TRANSPORTATION OF ALASKAN NATURAL GAS

Loeffler

JOINT HEARINGS

BEFORE THE

COMMITTEES ON COMMERCE

AND

INTERIOR AND INSULAR AFFAIRS
UNITED STATES SENATE

NINETY-FOURTH CONGRESS

SECOND SESSION

ON

S. 2510, S. 2778, S. 2950, and S. 3167

TO EXPEDITE A DECISION ON THE TRANSPORTATION OF ALASKAN NATURAL GAS TO OTHER STATES

MARCH 24 AND 25, 1976

Serial No. 94–72 (Commerce)
Serial No. 94–29 (92–119) (Interior)

PART 3

Printed for the use of the
Committees on Commerce and Interior and Insular Affairs

TRANSPORTATION OF ALASKAN NATURAL GAS

JOINT HEARINGS

BEFORE THE

COMMITTEES ON COMMERCE

AND

INTERIOR AND INSULAR AFFAIRS

UNITED STATES SENATE

NINETY-FOURTH CONGRESS

SECOND SESSION

ON

S. 2510, S. 2778, S. 2950, and S. 3167

TO EXPEDITE A DECISION ON THE TRANSPORTATION OF ALASKAN NATURAL GAS TO OTHER STATES

MARCH 24 AND 25, 1976

Serial No. 94–72 (Commerce)

Serial No. 94–29 (92–119) (Interior)

PART 3

Printed for the use of the
Committees on Commerce and Interior and Insular Affairs

U.S. GOVERNMENT PRINTING OFFICE

70-636 O WASHINGTON : 1976

COMMITTEE ON COMMERCE

WARREN G. MAGNUSON, Washington, *Chairman*

JOHN O. PASTORE, Rhode Island
VANCE HARTKE, Indiana
PHILIP A. HART, Michigan
HOWARD W. CANNON, Nevada
RUSSELL B. LONG, Louisiana
FRANK E. MOSS, Utah
ERNEST F. HOLLINGS, South Carolina
DANIEL K. INOUYE, Hawaii
JOHN V. TUNNEY, California
ADLAI E. STEVENSON, Illinois
WENDELL H. FORD, Kentucky
JOHN A. DURKIN, New Hampshire
JAMES B. PEARSON, Kansas
ROBERT P. GRIFFIN, Michigan
HOWARD H. BAKER, Jr., Tennessee
TED STEVENS, Alaska
J. GLENN BEALL, Jr., Maryland
LOWELL P. WEICKER, Jr., Connecticut
JAMES L. BUCKLEY, New York

MICHAEL PERTSCHUK, *Chief Counsel*
S. LYNN SUTCLIFFE, *General Counsel*
DAVID FREEMAN, *Professional Staff Member*
HENRY LIPPEK, *Staff Counsel*
LESLIE GOLDMAN, *Staff Counsel*
MALCOLM M. B. STERRETT, *Minority Counsel*
STEVE MCGREGOR, *Staff Counsel*

COMMITTEE ON INTERIOR AND INSULAR AFFAIRS

HENRY M. JACKSON, Washington, *Chairman*

FRANK CHURCH, Idaho
LEE METCALF, Montana
J. BENNETT JOHNSTON, Louisiana
JAMES ABOUREZK, South Dakota
FLOYD K. HASKELL, Colorado
JOHN GLENN, Ohio
RICHARD STONE, Florida
DALE BUMPERS, Arkansas
PAUL J. FANNIN, Arizona
CLIFFORD P. HANSEN, Wyoming
MARK O. HATFIELD, Oregon
JAMES A. McCLURE, Idaho
DEWEY F. BARTLETT, Oklahoma

GRENVILLE GARSIDE, *Special Counsel and Staff Director*
DANIEL A. DREYFUS, *Deputy Staff Director for Legislation*
WILLIAM J. VAN NESS, *Chief Counsel*
D. MICHAEL HARVEY, *Deputy Chief Counsel*
OWEN J. MALONE, *Senior Counsel*
HARRISON LOESCH, *Minority Counsel*

CONTENTS

TRANSPORTATION OF ALASKAN NATURAL GAS

WEDNESDAY, MARCH 24, 1976

U.S. Senate,
Committee on Commerce,
U. S. Senate,
Committee on Interior and Insular Affairs,
Washington, D.C.

The committee met at 9:30 a.m. in room 5110 of the Dirksen Senate Office Building; Hon. Adlai E. Stevenson, presiding.

OPENING STATEMENT BY SENATOR STEVENSON

Senator Stevenson. This morning the Committees on Commerce and Interior and Insular Affairs continue their joint consideration of systems for transporting Alaskan natural gas to markets in the lower 48 States.

On February 17 the committees held hearings to determine whether legislation to help bring such a transportation system into being was required. Today the committees are examining specific legislative approaches.

We have before us two general approaches to legislation on this subject. The first are those bills which would designate specific transportation systems. The bills in this category include S. 2778, introduced by Senator Stevens, to require the Federal Power Commission and other Federal agencies to approve only application for a transportation system that is located entirely in areas subject to U.S. or international jurisdiction.

S. 2950, introduced by Senator Mondale, would require the certification of the Arctic Gas project proposal. Other options are possible and will probably be considered in the course of these hearings.

The other general category of legislation would establish a decisionmaking process, a neutral process that would not designate a specific route.

S. 2510, introduced by Senator Gravel, and S. 3167, introduced at the request of the Federal Energy Administration take this approach.

It is my hope that we can develop a consensus that will lead to rapid consideration of all of these options and to congressional action in the near future in order to resolve this question of how the transport of natural gas from Alaska and perhaps also from Canada to the lower 48 States will be handled.

[The bills and agency comments follow:]

Staff members assigned to these hearings: David Freeman and Henry Lippek.

94TH CONGRESS
2D SESSION

S. 2510

IN THE SENATE OF THE UNITED STATES

OCTOBER 9 (legislative day, SEPTEMBER 11), 1975

Mr. GRAVEL introduced the following bill; which was read twice and referred to the Committee on Commerce

MAY 20, 1976

Referred to the Committees on Commerce and Interior and Insular Affairs jointly by unanimous consent

A BILL

Relating to construction of natural gas pipelines for transporting Alaskan north slope natural gas to the lower forty-eight States.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That, with respect to the application of the Alaska Arctic Gas Pipeline Company for a certificate of public convenience and necessity to construct and operate a natural gas pipeline on a Canadian route pending before the Federal Power Commission on the date of the enactment of this Act, and the application of the El Paso Alaska Company for a certificate of public convenience and necessity to construct and operate a natural gas pipeline on a competing Alaskan route so pending on such date, the Federal Power Commission shall make a final decision in the case of each such application on or before June 30, 1976. Any such decision shall become effective in accordance with the provisions of section 3 of this Act, but in no case shall any such decision be subject to judicial review under any law in any court, except that claims alleging the invalidity of this section may be brought within sixty days following its enactment, and claims alleging that an action will deny rights under the Constitution of the United States may be brought within sixty days following the date of such action. A claim shall be barred unless a complaint is filed within the time specified. Any such complaint shall be filed in a United States district court, and such court shall have exclusive jurisdiction to determine such proceeding in accordance with the procedures hereinafter provided, and no other court of the United States, of any State, territory, or possession of the United States, or of the District of Columbia, shall have jurisdiction of any such claim whether in a proceeding instituted prior to or on or after the date of the enactment of this Act. Any such proceeding shall be assigned for hearing at the earliest possible date, shall take precedence over all other matters pending on the docket of the district court at that time, and shall be expedited in every way by such court. Any review of an interlocutory or final judgment, decree, or order of such district court may be had only upon direct appeal to the Supreme Court of the United States.

SEC. 2. The Congress hereby authorizes and directs the Secretary of the Interior and other appropriate Federal officers and agencies to issue rights-of-way, permits, leases, and other authoriaztions that are necessary for or related to the construction, operation, and maintenance of a natural gas pipeline for the purpose of transporting Alaskan north slope natural gas to the forty-eight contiguous States on or before June 30, 1976. Any such actions shall become effective in accordance with the provisions of section 3 of this Act, but in no case shall any such actions be subject to judicial review under any law in any court, except that claims alleging the invalidity of this section may be brought within sixty days following its enactment, and claims alleging that an action will deny rights under the Constitution of the United States may be brought within sixty days following the date of such action. A claim shall be barred unless a complaint is filed within the time specified. Any such complaint shall be filed in a United States district court, and such court shall have exclusive jurisdiction to determine such proceeding in accordance with the procedures hereinafter provided, and no other court of the United States, of any State, territory, or possession of the United States, or of the District of Columbia, shall have jurisdiction of any such claim whether in a proceeding instituted prior to or on or after the date of the enactment of this Act. Any such proceeding shall be assigned for hearing at the earliest possible date, shall take precedence over all other matters pending on the docket of the district court at that time, and shall be expedited in every way by such court. Any review of an interlocutory or final judgment, decree, or order of such district court may be had only upon direct appeal to the Supreme Court of the United States.

SEC. 3. (a) No final decision of the Federal Power Commission referred to in the first section of this Act or any actions by the Secretary of the Interior and other appropriate Federal officers and agencies referred to in the second section the this Act shall take effect until the end of the sixty-day period (excluding Saturdays, Sundays, and holidays, and any day on which either House is not in session) beginning on the day such decision or such actions are transmitted by the Chairman of the Federal Power Commission or the Secretary of the Interior or other appropriate Federal officer to the Speaker of the House of Representatives and the President of the Senate and then only if during such sixty-day period both Houses of Congress do not adopt a concurrent resolution disapproving such decision or such actions.

(b) (1) This section is enacted by Congress—

(A) as an exercise of the rulemaking power of the Senate and the House of Representatives, respectively, and as such these provisions are deemed a part of the rules of each House, respectively, but applicable only with respect to the procedure to be followed in that House in the case of resolutions described by this section; and they supersede other rules only to the extent that they are inconsistent therewith; and

(B) with full recognition of the constitutional right of either House to change the rule (so far as relating to the procedure of that House) at any time, in the same manner and to the same extent as in the case of any other rule of that House.

(2) For the purpose of this section, "resolution" means only a concurrent resolution, the matter after the resolving clause of which is as follows: "That the disapproves of the decision of the Federal Power Commission described as follows: .", the blank spaces therein being appropriately filled; but does not include a resolution which specifies more than one action.

(c) A resolution with respect to such decision shall be referred to the appropriate committees of the House of Representatives and the Senate, by the President of the Senate or the Speaker of the House of Representatives, as the case may be.

(d) If the committee to which a resolution has been referred has not reported it at the end of twenty calendar days after its introduction, it is in order to move to discharge the committee from further consideration of any other resolution with respect to the same action which has been referred to the committee.

(e) A motion to discharge may be made only by an individual favoring the resolution, is highly privileged (except that it may not be made after the committee has reported a resolution with respect to the same action), and debate thereon shall be limited to not more than one hour, to be divided equally between those favoring and those opposing the resolution. An amendment to the motion is not in order, and it is not in order to move to reconsider the vote by which the motion is agreed to or disagreed to.

(f) If the motion to discharge is agreed to or disagreed to, the motion may not be renewed, nor may another motion to discharge the committee be made with respect to any other resolution with respect to the same action.

(g) When the committee has reported, or has been discharged from further consideration of, a resolution, it is at any time thereafter in order (even though a previous motion to the same effect has been disagreed to) to move to proceed to the consideration of the resolution. The motion is highly privileged and is not debatable. An amendment to the motion is not in order, and it is not in order to move to reconsider the vote by which the motion is agreed to or disagreed to.

(h) Debate on the resolution shall be limited to not more than ten hours, which shall be divided equally between those favoring and those opposing the resolution. A motion further to limit debate is not debatable. An amendment to, or motion to recommit, the resolution is not in order, and it is not in order to move to reconsider the vote by which the resolution is agreed to or disagreed to.

(i) Motions to postpone made with respect to the discharge from committee or the consideration of a resolution, and motions to proceed to the consideration of other business, shall be decided without debate.

(j) Appeals from the decisions of the Chair relating to the application of the rules of the Senate or the House of Representatives, as the case may be, to the procedure relating to a resolution shall be decided without debate.

94TH CONGRESS
1ST SESSION

S. 2778

IN THE SENATE OF THE UNITED STATES

DECEMBER 12, 1975

Mr. STEVENS (for himself and Mr. HANSEN) introduced the following bill; which was read twice and referred to the Committee on Commerce

A BILL

To require that any pipeline constructed to transport natural gas from Alaska's Prudhoe Bay area be entirely within such State and to require the Federal Power Commission to establish certain allocations and priorities with respect to the use of such gas.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Federal Power Commission, the Secretary of the Interior, and other officers and employees of any Federal department, agency, commission, independent establishment, or any other instrumentality, shall, with respect to any application or request for any right-of-way, including an easement, permit, or license, certificate of convenience and neces-

II

sity, or other document or paper, necessary to the construction, operation, or maintenance or a pipeline for the transportation of natural gas from Alaska's Prudhoe Bay area to markets in the other States of the United States, approve only such application or request which provides for such pipeline to be constructed or otherwise located in its entirety above, on, or under land areas in a State or States of the United States.

SEC. 2. (a) Due to the shortage of natural gas within the United States and for the purpose of protecting the public health, safety, and welfare and the national defense, the Federal Power Commission shall—

(1) allocate natural gas produced in the Prudhoe Bay area of Alaska and exported from Alaska among the regions of the United States to be established by the Federal Power Commission to carry out the purposes of the Natural Gas Act, particularly the public convenience and necessity standards of section 717(f) of title 15, United States Code, and the States within such regions, in such manner as will supply each such region and State with an equal per centum of the per centum decline in natural gas supplies from all sources to such region or State between the calendar year 1973 and the date transmission of Prudhoe Bay gas commences; and

(2) establish priority uses for such gas within such States on the basis of the Commission's order numbered 467, as modified by order numbered 467–B and such further orders as the Commission may issue.

(b) Allocations and priorities pursuant to subsection (a) shall (1) be in accordance with standards established by the Commission, and (2) include the authority to revise such allocations and priorities as necessary to best carry out the purpose of this section.

(c) For purposes of this Act the Commission shall have the authority to collect such data from whatever source they deem necessary and appropriate.

94TH CONGRESS
2D SESSION

S. 2950

IN THE SENATE OF THE UNITED STATES

FEBRUARY 6, 1976

Mr. MONDALE (for himself, Mr. ABOUREZK, Mr. CANNON, Mr. CASE, Mr. CLARK, Mr. CULVER, Mr. CURTIS, Mr. EAGLETON, Mr. FORD, Mr. GLENN, Mr. GRIFFIN, Mr. PHILIP A. HART, Mr. HARTKE, Mr. HRUSKA, Mr. HUMPHREY, Mr. McGOVERN, Mr. MANSFIELD, Mr. METCALF, Mr. MOSS, Mr. MUSKIE, Mr. PELL, Mr. RIBICOFF, Mr. HUGH SCOTT, Mr. STAFFORD, Mr. TAFT, Mr. WEICKER, and Mr. WILLIAMS) introduced the following bill; which was read twice and referred jointly to the Committees on Commerce, and Interior and Insular Affairs

A BILL

Relating to the construction and operation of a natural gas pipeline from the North Slope of Alaska across Canada to domestic markets, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SHORT TITLE

SECTION 1. This Act may be cited as the "Alaskan Natural Gas Pipeline Authorization Act of 1976".

II

CONGRESSIONAL FINDINGS

SEC. 2. The Congress finds and declares that:

(1) A natural gas supply shortage exists in the United States.

(2) Such natural gas supply shortage, unless corrected, threatens the economic and environmental well-being of the Nation through higher levels of unemployment, diminished economic activity, increasingly adverse effects upon the Nation's international balance of payments, increased reliance upon energy produced in other countries, and greater utilization of less environmentally desirable alternatives to this clean-burning energy source.

(3) There exists in the northern areas of the State of Alaska large proven and potential reserves of natural gas which can reduce significantly the Nation's natural gas shortage if a transportation system for delivery of such natural gas to the United States markets is constructed and placed into operation.

(4) A natural gas pipeline system from northern Alaska, across Canada, to the lower forty-eight States is the most efficient and economical method available for the transportation of northern Alaskan natural gas to domestic markets. Compared to alternative methods proposed for transporting such natural gas, such pipeline system will distribute this essential source of energy more directly to

70-636 O - 76 - 2

consumers, provide the lowest cost of transportation of the natural gas, consume less natural gas in the transportation process, and provide similar benefits to Canada, all of which effects are in the national interest of the United States.

(5) Immediate construction of a natural gas pipeline system to transport natural gas from northern Alaska across Canada to the contiguous United States is required by the national interest.

(6) A cooperative effort with the people and Government of Canada would advance the development of United States energy resources and could offer substantial return benefits to Canada; and the Congress clearly recognizes that it is the responsibility of the appropriate Canadian authorities to make their own determinations regarding Canada's interests in any cooperative project and this Act is in no way intended to interfere with the decisionmaking process of the Government of Canada.

(7) The procedures provided in the Natural Gas Act (15 U.S.C. 717 et seq.) and the Mineral Leasing Act of 1920 (30 U.S.C. 185), if complied with fully, will not allow the authorization and construction of a transportation system for natural gas from northern Alaska as promptly as is required by the public convenience and necessity, the national interest, and the requirements of international cooperation.

(8) It is appropriate and necessary for the Congress, in

the interest of furthering national energy policy, national economic and environmental well-being, and international relations, to authorize the expeditious construction of a transportation system for natural gas from northern Alaska.

DECLARATION OF PURPOSE

SEC. 3. The purpose of this Act is to insure that, in view of the extensive governmental and other studies already made of the Alaskan natural gas pipeline, as defined herein, and the national interest in the earliest feasible delivery of natural gas from northern Alaska to domestic markets, the Alaskan natural gas pipeline be constructed promptly, without further administrative or judicial delay or impediment. To accomplish this purpose, it is the intent of the Congress to exercise its constitutional powers to the fullest extent in the authorizations and directions herein made, and in limiting judicial review of this Act and of actions taken pursuant thereto.

DEFINITIONS

SEC. 4. As used in this Act:

(a) The term "Secretary" shall mean the Secretary of the Interior.

(b) The term "Commission" shall mean the Federal Power Commission.

(c) The term "Alaskan natural gas pipeline" shall mean that natural gas pipeline system described in the applications filed with the Federal Power Commission which are listed hereinbelow, identified by date of filing thereof and Federal Power Commission docket number assigned thereto, including any amendments thereto filed more than thirty days prior to the enactment of this Act, and shall include the facilities lying within the United States of the natural gas pipeline system across northern Alaska, to connect with a pipeline in northern Canada, and from border points between the United States and Canada to market areas in the contiguous United States, described therein, shall include the therein proposed natural gas pipeline facilities at such border points, shall include the export from the United States, at a point on the border between the State of Alaska and Canada, of natural gas to be transported by such natural gas pipeline system, and the import of such natural gas into the United States at points on the border between Canada and the States of Idaho and Montana, which has been proposed in docketed proceedings before the Federal Power Commission which have been consolidated with the docketed proceedings listed hereinbelow more than thirty days prior to the enactment of this Act, shall include the facilities, transportation, and sales proposed in applications, including amendments thereto filed more than thirty days prior to the enactment of this Act, by purchasers of gas to be transported by such pipeline system for authorization to construct and operate facilities to transport, and to sell, such gas and the sale of such gas to such purchasers by the owners thereof, and shall include such other facilities and activities as shall be necessary for the transport and sale of the natural gas to be transported by such pipeline system:

(1) Application for certificate of public convenience and necessity filed March 21, 1974, in docket numbered CP74-239;

(2) Application for certificate of public convenience and necessity filed March 21, 1974, in docket numbered CP74-241;

(3) Application for certificate of public convenience and necessity filed May 14, 1974, in docket numbered CP74-290;

(4) Application for certificate of public convenience and necessity filed May 14, 1974, in docket numbered CP74-292.

CERTIFICATION AND RELATED ACTIONS

SEC. 5. The Congress hereby authorizes and directs the Commission, within sixty days after the date of enactment of this Act, to issue to the applicants involved in the Alaska natural gas pipeline, and their successors, to take all necessary actions to administer and enforce, all certificates, permits, and other authorizations necessary for or related to the construction, operation, maintenance, and implementation of facilities and activities of and relating to the Alaskan natural gas pipeline. The holders of such certificates, permits, and other authorizations shall also have the powers of eminent domain provided by section 7(h) of the Natural Gas Act to holders of a certificate of public convenience and necessity issued pursuant to section 7(c) of such Act. Such provisions of the Natural Gas Act may be inconsistent with this Act shall not apply with respect to the Alaskan natural gas pipeline. In all other respects, including rate regulation, the provisions of the Natural Gas Act shall apply.

RIGHTS-OF-WAY

SEC. 6. The Congress hereby authorizes and directs the Secretary and other appropriate Federal officers and agencies not otherwise specified in section 5 herein, within sixty days after the date of the enactment of this Act, to issue and take all necessary actions to administer and enforce all rights-of-way, permits, leases, and other authorizations necessary for or related to the construction, operation, and maintenance of the Alaskan natural gas pipeline: *Provided, however,* That the rights-of-way, permits, leases, and other authorizations issued pursuant to this Act by the Secretary shall be subject to the provisions of section 28 of the Mineral Leasing Act of 1920, as amended, except subsections (h), (j), (k), (q), (s), (u), and (w) (2) thereof.

SUSPENSION OF ADMINISTRATIVE PROCEEDINGS

SEC. 7. (a) All authorizations issued by the Secretary, the Commission, and other Federal officers and agencies pursuant to this Act shall include the terms and conditions required by the provisions of law that would otherwise be applicable if this Act had not been enacted, and may include those terms and conditions, including those required for the protection of the environment, which are permitted by such provisions of law so long as such terms and conditions do not change the basic nature and route of the Alaskan natural gas pipeline and are not inconsistent with the purposes of this Act. The Secretary, the Commission, and such other Federal officers and agencies may waive any procedural requirements of law or regulation which they deem desirable to waive in order to accomplish the purposes of this Act, and may grant requests of any person which shall construct or operate any portion of the Alaskan natural gas pipeline for modifications of the route or facilities thereof which are not inconsistent with the purposes of this Act.

(b) The directions contained in section 5 and section 6 of this Act shall supersede the requirements and provisions of any law or regulation relating to or prerequisite to an administrative determination as to whether the authorizations for construction and operation of the Alaskan natural gas pipeline shall be issued.

JUDICIAL REVIEW

SEC. 8. The actions of Federal officers or agencies taken pursuant to this Act, and the legal or factual sufficiency of any environmental statement prepared relative to the Alaska natural gas pipeline pursuant to the National Environmental Protection Act (42 U.S.C. 4321 et seq.) shall not be subject to judicial review under any law, except that claims alleging the invalidity of this Act may be brought within sixty days following its enactment, and claims alleging that any such action will deny rights under the Constitution of the United States, or that any such action is beyond the scope of authority conferred by this Act, may be filed within sixty days following the date of such action. A claim shall be barred unless a complaint is filed within the time specified. Any such complaint shall be filed in a United States district court, and such court shall have exclusive jurisdiction to determine such proceeding in accordance with the procedures hereinafter provided, and no other court of the United States, or any State, territory, or possession of the United States, or of the District of Columbia, shall have jurisdiction of any claim raised in such complaint, whether in a proceeding instituted prior to, on or after the date of enactment of this Act. Any such proceeding shall be assigned for hearing at the earliest possible date, shall take precedence over all other matters pending on the docket of the district court at that time, and shall be expedited in every way by such court. Such court shall not have jurisdiction to grant any injunctive relief against the issuance of any certificate, right-of-way permit, lease, or other authorization pursuant to this Act except in conjunction with a final judgment entered in a case involving a complaint filed pursuant to this section. Any review of an interlocutory or final judgment, decree, or order of such district court may be had only upon direct appeal to the Supreme Court of the United States.

INTERNATIONAL COOPERATION

SEC. 9. This Act recognizes that approval by the Government of Canada, in addition to that of the Government of the United States, will be necessary in order to implement the Alaskan natural gas pipeline. It is therefore a purpose of this Act to declare it to be in the national interest of the United States to cooperate with the Government of Canada in authorizing the construction of the international pipeline system contemplated by this Act, in the event that the Government of Canada determines that it should approve, on a compatible basis, the construction and operation of that portion of such international pipeline system located in Canada.

ANTITRUST LAWS

SEC. 10. The grant of a certificate, right-of-way, permit, lease, or other authorization pursuant to this Act shall grant no immunity from the operations of the Federal antitrust laws.

SEPARABILITY

SEC. 11. If any provision of this Act, or the application thereof, is held invalid, the remainder of this Act shall not be affected thereby.

94TH CONGRESS
2D SESSION

S. 3167

IN THE SENATE OF THE UNITED STATES

MARCH 17, 1976

Mr. FANNIN (for Mr. JACKSON) (for himself, Mr. FANNIN, and Mr. PEARSON) (by request) introduced the following bill; which was read twice and referred to the Committees on Commerce and Interior and Insular Affairs jointly by unanimous consent

A BILL

To expedite the delivery of Alaskan natural gas to United States markets, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SHORT TITLE

SECTION 1. This Act may be cited as the "Alaskan Natural Gas Transportation Act of 1976".

CONGRESSIONAL FINDINGS

SEC. 2. The Congress finds and declares that—

(a) a natural gas supply shortage exists in the United States;

(b) large reserves of natural gas in the State of

Alaska can help significantly to alleviate this supply shortage;

(c) the construction of a natural gas pipeline system to transport natural gas from Alaska to the contiguous forty-eight States at the earliest practicable time, is essential to the national interest; and

(d) alternative delivery systems for transporting Alaskan natural gas to the contiguous forty-eight States are available, and the decision as to the selection of a system is one which involves critical questions of national energy policy, international relations, national defense, and economic and environmental considerations, and which therefore should appropriately be addressed by the Congress of the United States and the executive branch, in addition to the Federal Power Commission.

STATEMENT OF PURPOSE

SEC. 3. The purpose of this Act is to expedite the selection and construction of a natural gas transportation system for delivery of Alaska natural gas to the contiguous forty-eight States through establishment of new administrative and judicial procedures. To accomplish this purpose it is the intent of the Congress to exercise its constitutional powers to the fullest extent in the authorizations and directions herein made, and in limiting judicial review of the actions taken pursuant thereto.

DEFINITIONS

SEC. 4. As used in this Act—

(a) the term "Alaskan natural gas" means natural gas derived from the area of the State of Alaska generally known as the North Slope of Alaska, including the Continental Shelf thereof;

(b) the term "Commission" means the Federal Power Commission; and

(c) the term "Secretary" means the Secretary of the Interior.

FEDERAL POWER COMMISSION REVIEW

SEC. 5. (a) Notwithstanding the provisions of the Natural Gas Act (15 U.S.C. 717–717w), the procedures established by this Act shall govern actions by the Commission with respect to review and approvals of applications for a certificate of public convenience and necessity filed by any person with respect to proposals to transport Alaskan natural gas from the State of Alaska for use within other States in the continental United States. The provisions of the Natural Gas Act shall apply to the extent they are not inconsistent with this Act. Any certificate of public convenience and necessity related to the transportation of Alaskan natural gas from the State of Alaska shall be issued by the Commission in accordance with section 9 of this Act.

(b) The Commission is hereby directed to complete its proceedings with respect to proposals for the transportation of Alaskan natural gas from the State of Alaska, which proceedings are pending on the date of enactment of this Act, and to transmit a determination thereon to the President by January 1, 1977.

(c) The determination required by subsection (b) of this section may be in the form of a proposed certificate of public convenience and necessity, or such other form as the Commission deems appropriate, and should include such information as the Commission deems appropriate, including—

(i) estimated capital and operating costs, including analysis of any likely cost overruns;

(ii) analysis of construction schedules and possibilities for delay;

(iii) extent of reserves, both proven and probable, and their deliverability into a transportation system;

(iv) analysis of environmental considerations, including pipeline design criteria, and maintenance and construction procedures;

(v) financing capabilities;

(vi) safety in design and operation;

(vii) anticipated demand in, and deliverability to particular markets, including analysis of displacement questions and substitute fuels; and

(viii) anticipated transportation tariffs, both short term and long term.

OTHER AGENCY REPORTS

SEC. 6. By February 1, 1977, the President shall require from such agencies as he deems appropriate the submission of reports to him with respect to the alternative methods for delivering Alaskan natural gas to the other States in the continental United States. Such reports should include information with respect to—

(a) issues related to national energy policy;

(b) environmental considerations, including a detailed study of the air and water quality and noise impacts;

(c) issues related to pipeline safety and Liquefied Natural Gas transportation;

(d) foreign policy aspects, including evaluation of the status of Canadian approvals and plans;

(e) national defense, particularly questions of security of supply;

(f) issues relating to natural resources, use of Federal lands, and fish and wildlife resources; and

(g) issues relating to financing.

PRESIDENTIAL DECISION

SEC. 7. (a) As soon as possible after receipt of the reports required by section 6, but not later than August 1, 1977, the President shall issue a decision as to which system for transportation of Alaskan natural gas, if any, shall be issued the necessary approvals in accordance with sections 9 and 10 of this Act. The Presidential selection of the natural gas transportation system shall be based on the determination as to which system best serves the national interest in bringing Alaskan natural gas to the contiguous forty-eight States and shall include such terms and conditions as the President deems appropriate.

(b) The decision of the President made pursuant to subsection (a) of this section, along with a statement of the reasons therefor, shall be transmitted immediately to the Senate and the House of Representatives.

(c) The decision of the President shall become final as provided in section 8.

CONGRESSIONAL REVIEW

SEC. 8. (a) A Presidential decision issued pursuant to section 7 shall become final after the close of the sixty-day period beginning on the day on which such decision is transmitted to the Senate and to the House of Representatives.

(b) If, because of congressional action, the Presidential decision does not become final, the President may submit the same or a new decision to the Senate and the House of Representatives. Any such new submission may only become final in accordance with the procedures specified in subsection (a) in the same manner as a decision issued pursuant to section 7.

CERTIFICATION

SEC. 9. (a) The Congress hereby authorizes and directs the Commission, within thirty days after a Presidential decision has become final in accordance with section 8 of this Act, to issue all certificates, permits, and other authorizations necessary for or related to the construction, operation, and maintenance of the transportation system selected in accordance with sections 7 and 8 of this Act. The Commission, in issuing such certificates, permits or authorizations, shall include the terms and conditions set out by the President in his decision pursuant to section 7 of this Act.

(b) No action may be taken by any agency pursuant to this Act until any environmental impact statements considering a system for transportation of natural gas from Alaska to the contiguous forty-eight States, which statements are in draft form on the effective date of this Act, are completed in final form and filed with the Council on Environmental Quality. Section 102 (2) (C) of the National Environmental Policy Act of 1969 shall not be applicable to the Alaskan natural gas transportation system selected in accordance with this Act, except as provided in this subsection.

OTHER ADMINISTRATIVE AUTHORIZATIONS

SEC. 10. (a) The Congress hereby authorizes and directs the Secretary of the Interior, the Secretary of Transportation, and other appropriate Federal officers and agencies to issue and take all necessary action to administer and enforce rights-of-way, permits, leases, and other authorizations that are necessary for or related to the construction, operation, and maintenance of the Alaskan natural gas transportation system: *Provided*, That, nothing in this subsection shall be construed to require the granting of any authorization relating to Federal financial assistance.

(b) Rights-of-way, permits, leases, and other authorizations issued pursuant to this Act by the Secretary shall be subject to the provisions of section 28 of the Mineral Leasing Act of 1920 (30 U.S.C. 185) (except the provisions of subsections (h)(1), (j), (k), (q), and (w)(2)); all authorizations issued by the Secretary and other Federal officers and agencies shall include the terms and conditions required, and may include the terms and conditions permitted, by the provisions of law that would otherwise be applicable if this Act had not been enacted, and they may waive any procedural requirements of law or regulations which they deem desirable to waive in order to accomplish the purposes of this Act. The direction contained in subsection (a) of this section shall supersede the provisions of any law or regulations relating to an administrative determination as to whether the authorizations for construction of the Alaskan natural gas transportation system shall be issued.

(c) The Secretary of the Interior and the other Federal officers and agencies are authorized at any time when necessary to protect the public interest, pursuant to the authority of this section and in accordance with its provisions, to amend or modify any right-of-way, permit, lease, or other authorization issued under this Act.

JUDICIAL REVIEW

SEC. 11. The actions of the Federal officers concerning the issuance of the necessary rights-of-way, permits, leases, and other authorizations for construction, and initial operation at full capacity of the Alaskan natural gas transportation system, including the issuance of a certificate of public convenience and necessity by the Commission, shall not be subject to judicial review under any law, except that claims alleging the invalidity of this section may be brought within sixty days following the date of enactment, and claims alleging that an action will deny rights under the Constitution of the United States, or that the action is beyond the scope of authority conferred by this Act, may be brought within sixty days following the date of such action. A claim shall be barred unless a complaint is filed in the United States

District Court for the District of Columbia within such time limits, and such court shall have exclusive jurisdiction to determine such proceeding in accordance with the procedures hereinafter provided, and no other court of the United States, of any State, territory, or possession of the United States, or of the District of Columbia, shall have jurisdiction of any such claim whether in a proceeding instituted prior to or on or after the date of enactment of this Act. Any such proceeding shall be assigned for hearing at the earliest possible date, shall take precedence over all other matters pending on the docket of the district court at that time, and shall be expedited in every way by such court. Such court shall not have jurisdiction to grant any injunctive relief against the issuance of any right-of-way, permit, lease, or other authorization pursuant to this section except in conjunction with a final judgment entered in a case involving a claim filed pursuant to this section. There shall be no review of an interlocutory or final judgment, decree, or order of such district court except that any party may appeal directly to the Supreme Court of the United States.

SEPARABILITY

SEC. 12. If any provision of this Act, or the application thereof, is held invalid, the remainder of this Act shall not be affected thereby.

DEPARTMENT OF STATE,
Washington, D.C.

Hon. WARREN G. MAGNUSON,
U.S. Senate.

DEAR MR. CHAIRMAN: Thank you for your letter of January 12 forwarding for our consideration and comment S. 2778, a bill to require that any pipeline constructed to transport natural gas from Alaska's Prudhoe Bay be entirely within the State of Alaska and to require the Federal Power Commission to allocate Alaskan natural gas. We are also commenting in this report on S. 2950, a bill to authorize the construction of a pipeline through Canada for the transportation of Alaskan natural gas and S. 3167, a bill proposed by the Administration which would expedite a decision on the Alaskan natural gas pipeline route by authorizing the President, with the Congress' consent, to choose a route based on the Federal Power Commission's analysis and recommendation.

The State Department favors the Administration's bill. S. 2778 and S. 2950, bills intended to resolve the selection of a delivery system for Alaskan natural gas by legislating either a trans-Alaska, or a trans-Canada route respectively, appear deficient. These bills would sacrifice reasoned judgment and a decision based on a consideration of evidence being compiled by the Federal Power Commission for an expedient determination by the Congress. Ostensibly, these bills purport to serve the national interest by rendering certain a prompt decision in the vital matter of delivering Alaskan natural gas to the lower 48 states.

It is the State Department's view that as essential as early delivery of Alaskan natural gas is to the national interest, the need for a speedy decision should not outweigh careful consideration of the economic and environmental aspects of both routes which must be addressed if the national interest is to be served.

We believe that it is preferable to permit the Federal Power Commission to compile and evaluate its data and to recommend a route to the President for his final decision (with Congressional review) as proposed by the Administration in S. 3167. The Administration's bill would ensure that adequate attention is given to vital economic, environmental and other issues. By setting a firm date of January 1, 1977 for a determination by the FPC and a Presidential decision not later than August 1, 1977, the bill would increase the likelihood of prompt access to the Alaskan reserves. The timeframe suggested in the Administration's bill should offer sufficient opportunity to coordinate our decision making with Canada so as to give full consideration to the trans-Canadian option as requested by the Congress in the Alaska Pipeline Authorization Act of 1973 (P.L. 93–153). The accelerated regulatory and judicial actions would bring on-stream the Alaskan natural gas sooner than under an unaltered FPC proceeding and would serve to reduce our dependence on insecure foreign energy sources.

Sincerely Yours,

ROBERT J. MCCLOSKEY,
Assistant Secretary for
Congressional Relations.

Senator STEVENSON. Senator Mondale?

STATEMENT OF HON. WALTER F. MONDALE, U.S. SENATOR FROM MINNESOTA

Senator MONDALE. Thank you very much, Mr. Chairman, for holding these hearings and for permitting me to participate. I have a longer statement that I would ask be made a part of the record. But I would like to make a few brief remarks.

First, the United States is desperately in need of additional supplies of gas. Many regions are already suffering deep curtailments or will be within the next year or so, and these shortages grow each year.

The PFC recently estimated that by 1985 gas supplies will be more than 60 percent below requirements. We will be nearly 20 trillion cubic feet short of gas by that year. Unless new supplies are developed, prices will go up faster and further than they need rise.

As the members of these committees are aware, I am not an advocate of deregulation. But I think it is obvious that without added supplies, there will be no practical means of maintaining market or other restraints on the price of natural gas during the next few years.

Spreading shortages and escalating prices will add to our Nation's economic troubles, deepening unemployment, contributing to inflation and retarding necessary growth.

There is a way of bringing substantial new gas supplies to market. Alaska has proven reserves of 26 trillion cubic feet in Prudhoe Bay alone. Potential supplies in North Alaska are estimated at up to 100 trillion cubic feet, not counting the 78 trillion cubic feet the Navy estimates are located under Petroleum Reserve No. 4.

With respect to natural gas, Alaska is truly the Persian Gulf of North America. To capitalize on these vast resources, we must have a transportation system that can deliver the gas to markets in the lower 48 States.

For that reason I have introduced S. 2950, a bill to provide U.S. authorization for the Arctic Gas pipeline across Canada to the contiguous States. The competing proposal has been introduced to authorize the so-called El Paso proposal.

In my opinion, there are several clear and compelling reasons why the Arctic Gas proposal is preferable.

First: Consumers would be able to obtain gas from North Alaska at a significantly lower cost of transportation. From the Midwest and each alone these savings could amount too more than $500 million annually. Consumers on the west coast would save at least $150 to $160 million in transportation costs annually.

Second: The Arctic Gas project would be constructed at least a year ahead of the El Paso schedule.

Third: Both the Midwest and Pacific Northwest are dependents upon 1 trillion cubic feet a year of gas imported from Canada. Unless Canada can obtain access to its frontier gas reserves, there is a high probability of future export curtailments.

The Arctic Gas project would permit Canada to attach at least 6 trillion feet in reserves, thereby increasing the likelihood of continued exports to the United States.

Fourth: The Arctic Gas proposal would provide for a national distribution system, linking all major consuming regions, West, Northwest, Midwest, South and East.

Finally, for environmental reasons, the Trans-Canada pipeline is more desirable than the El Paso alternative. El Paso's liquefaction plant would be located in one of the most sensitive earthquake zones in the world. If Northern Alaska's reserves prove to be not 10, but up to 50 percent of America's present supply, as geologists now predict, it would be absolute folly to lock the Nation into a transportation system that can be destroyed by recurring earthquakes.

Furthermore, the west coast does not want to become the unloading dock for a large share of the gas supplies to our country. These tankers will be 50 percent larger than any now in operation and they will be highly explosive.

For all of these reasons, I believe the Trans-Canada pipeline is the best transportation system to bring natural gas to the lower 48 States.

The President recently introduced a bill to provide for at least another year of added study of this issue. His bill would provide for only a minimal congressional role in what may prove to be the most important energy decision of the coming year.

Even under the President's proposal, it could take up to 2 years before a final go ahead is given. That's why I hope the committee will give serious consideration to approval of the Arctic Gas pipeline as I have proposed it in S. 2950.

Mr. Chairman, I would like to insert my full statement, together with the resolution adopted by the Governors of Minnesota, Wisconsin, and Michigan, expressing their support for this proposal, and urging the present Congress to take all feasible action to expedite its authorization.

I would also like to include in the record a statement on behalf of Senators McGovern, Hart of Michigan, Humphrey, and Culver in support of this proposal.

Senator STEVENSON. Without objection, the three submissions will be entered into the record.

Senator Stevens, I am not entitled to equal time, however you are entitled to be heard.

Senator STEVENS. I will not ask for equal time, because I came to listen to these other gentlemen. But I would hope my friends from the northern tier would not discuss again or imply that LNG tankers are explosive.

We held hearings in this committee 2 years ago and we have the testimony of the Coast Guard. There is no explosion danger from LNG, and I would remind him that tanker after tanker comes to the east coast daily. If those are explosive, I think maybe we ought to hold some hearings and try to eliminate that hazard coming to our eastern shore.

The problem before us, Mr. Chairman, is a very unique one. Alaska has a very vital interest, because that is Alaska gas. It is gas to be produced from State-owned lands. Our State has the royalty interests which is an interest that can be taken either in cash or in kind. The area that would be served by one of these proposals is an area that currently has no natural gas supply, except for the very small barrel gas wells.

We believe that the Nation should learn a lesson from the battle we have had over the Alaska pipeline. And that lesson is that there is potential for delay here, if we are not careful we may get to the point where we have no pipeline to deliver the gas at the time when it is needed, which is no later than 1980, because of the limitation of the reinjection facilities on the North Slope, that are associated with that oil pipeline.

Now, Chairman Stevenson and I just returned from a session in Canada, and I think that our friends to the north have been very courteous in telling us their point of view. But the most significant thing that occurred in the trip we had last week to Canada, in my opinion, was when I asked one of the Government leaders if we had selected the Canadian route for the oil pipeline, would it be under construction yet, and the answer was no.

If we select the wrong route this time, and we have delay, caused by the failure of Canada to settle their native land claims, plus the delay that would be coming, I think, because of the procedural aspects of approval in Canada, we could well find the day coming when we would have to reduce the oil production on the North Slope because of the oil-gas reserve ratio.

Eventually I do believe that we will see the day when there will be pipelines that come through Canada to take a portion of our resources to what we call the south 48.

I only wish that my good friend who has just spoken had as much confidence in our reserves at the time of the oil pipeline battle that he has in terms of the battle over the gas pipeline, because I remember so well the feeling that there was a limitation to our reserves. I feel they are practically unlimited, and that we will be producing oil and gas for many, many years, and we should not be in the position now to battle between these pipeline systems as a one-time decision is not necessary. Because we have vast gas reserves, and we will be back, unfortunately, because of our location, we must be back to the Federal Government in regard to almost every Alaskan transmission system that we will be dealing with.

But throughout this hearing I hope my colleagues will keep in mind that while the area we are talking about of Alaska has gas much of the State is without this resource and, if the first pipeline is built solely to transport Alaska gas out of the State, it will deny a great portion of our State the advantages of our own resources, and I think, ultimately, it will lead to a very strained relation between our State government and the Federal Government.

And, Mr. Chairman, I would hope you would put in the record the statement that we have from the Indian Brotherhood of Northwest Territories, a statement of the Canada natives on their position on their native claims. It was presented to the chairman of the full committee.

I appreciate your courtesy. I think, Mr. Chairman, you are going to have to have great patience, you and your cochairman, through these hearings, because these are going to get, I think, to a little crescendo before my colleague and I are through, if I read the climate correctly.

Senator Stevenson. The statement will be entered in the record.

I would just add one word to what has been said by my distinguished colleagues and that is that the oil and gas resources in this area are not all located in the United States. There are, in addition, very substantial potential oil and gas resources in the delta along the MacKenzie River and the sedimentary basin in the Beaufort Sea, and further east in the Arctic Islands. To whatever extent a transportation system for gas and, perhaps for oil, brings down these Canadian resources, they enhance the possibilities of maintaining and even increasing exports of Canadian oil and gas to the United States.

So, I think there is more at stake in this decision than just the resources in the North Slope and petroleum reserve No. 4 in Alaska.

Senator MONDALE. Mr. Chairman, one of the facts to be borne in mind here is that many communities across the northern tier and down into the western part of the United States now depend heavily upon importation of Canadian gas which is running short.

And one of the arguments for the Arctic Gas proposal has been that if the Canadians are able to tap their reserves in the Mackenzie Delta and Beaufort area as a result of the Arctic Gas pipeline, which goes through that area, then they may be persuaded to be more liberal in their exportation policies with respect to the exportation of gas from existing reserves serving those communities than they would otherwise.

Senator STEVENSON. Well, I think the Senator is right. There is a possibility, at least indicated on this recent trip to Ottawa which Senator Stevens mentioned. To what extent it is a possibility depends largely on the results of exploration.

[The statements and resolution follow:]

STATEMENT OF HON. WALTER F. MONDALE, U.S. SENATOR FROM MINNESOTA

Mr. Chairman and Members of the Committees, I am pleased to have this opportunity to discuss the transportation of natural gas from the North Slope of Alaska to the contiguous United States.

As the author of S. 2950, the Alaskan Natural Gas Transportation Act of 1976, I would like to explain why the Congress should proceed as quickly as possible toward approval of the Arctic Gas pipeline system.

AMERICA'S NEED FOR NATURAL GAS

First, the United States is desperately in need of additional supplies of natural gas. Many firms that are under interruptible contracts for natural gas have already experienced curtailments. Additional curtailments are expected during the 1977–1978 heating season. Past supply cuts have not been uniform throughout the nation: some areas have suffered much deeper curtailments than others. But regions that have not yet been subject to major reductions in supply, including Minnesota, recognize that in a year or two they will be faced with serious shortages.

The magnitude of the potential shortfall can be seen in a comparison prepared by the Federal Power Commission of demand and available supply of natural gas for the years 1980–1985. During this period, demand for natural gas will increase from 32.4 to 37.2 trillion cubic feet (TCF), while supplies will decline from 19.1 to 17.7 TCF. This will leave supplies more than 60% below natural gas requirements by 1985.

Congress has recently been engaged in a major debate over deregulation of natural gas prices. I do not want to enter into a lengthy discussion of the arguments for or against deregulation at this time. I think controls should be retained. But I also believe that unless action is taken to dramatically increase America's supply of natural gas during the coming decade, there will be no practical way of maintaining meaningful market or other restraint on the price of natural gas. And the longer it takes to make new gas supplies available to consumers in the United States, the more intense the pressure will be for significantly higher prices not only for new but also for existing gas supplies.

Clearly, spreading shortages and escalating prices will add to our nation's current economic troubles. While some plants that use natural gas may be able to convert to alternative fuels, firms that are older or otherwise unable to convert will be forced to close, thereby swelling the unemployment rolls. Homeowners will similarly be faced with the choice of converting their heating systems at costs of $1,000. or more per unit, or paying greatly inflated prices to heat their houses in winter.

AMERICA'S GAS SUPPLIES IN THE ARCTIC

Fortunately, our nation has an alternative. Over 26 trillion cubic feet of gas have already been discovered in Prudhoe Bay, Alaska. The American Gas Association estimates that an additional 20 trillion cubic feet will be discovered on Alaska's North Slope between now and 1985. And the potential is even greater. According to a United States Geological Survey, Alaska contains possible reserves of 72–185 trillion cubic feet of gas. The firm DeGolyer and MacNaughton, petroleum engineers, estimates the potential of the North Slope at 114 TCF and that does not include Petroleum Reserve #4 where the Navy Department estimates an additional 78 TCF.

With respect to natural gas, Alaska is the Persian Gulf of North America. But in order to capitalize on these vast resources, we must build a system to transport the Northern Alaskan gas to markets in the lower 48 States. Since construction of a major delivery system for Alaskan gas will require substantial lead time, any delay in approvals at the federal level will mean ever increasing shortages and higher prices to consumers.

CONTROVERSY OVER ROUTING

For those of us who participated in the Alaska Oil Pipeline fight, it is unbelievable to find that we are now arguing about which route a gas transportation system should follow. When the Trans-Alaska Pipeline Act was under consideration in 1973, spokesmen from the Midwest argued that the oil was being sent to the wrong place. We emphasized that the West Coast could not possibly use all of the oil that would be shipped south from Alaska. And advocates of the TAPs pipeline told us that this time the oil would go to the West Coast, but the next pipeline—a gas pipeline—should be built through Canada to distribute supplies to the Midwest and to other parts of the United States.

I would like to call to the Committee's attention an article by Roberta Hornig, in the March 17th edition of the Evening Star. This article points out that the Federal Energy Administration (FEA) now admits what we knew would happen all along—that the West Coast is heading for a major oil surplus. We do not have any system to bring oil into the mid-continent where additional supplies are urgently needed. This is not a regional issue. An independent study by the Rand Corporation prepared for the California State Legislature shows that even California could receive gas at a lower cost under the Arctic Gas pipeline than under the rival system. And California would not be placed in the position of having to serve as the unloading dock for up to a third of the gas consumed throughout the United States.

There is an added irony in that El Paso is premising much of the argument in favor of the Alaska-LNG system on the grounds that a pipeline through Canada might not be "secure". This question of security did not seem to trouble El Paso when it decided to participate in the construction of a massive LNG plant in Algeria. Nor did security seem to enter into El Paso's consideration when that company sought long-term agreements to purchase gas from the Soviet Union and Iran. In none of these cases am I aware of a prolonged history of friendship and cooperation with the United States such as the relationship we have enjoyed with Canada. Nor are there treaties comparable to the *ad referendum* agreement initialed in Washington last January to guarantee throughput of gas, no taxation of gas, non-discriminatory taxation of facilities, and continued access in the event of emergencies.

COMPARISON OF ARCTIC GAS AND EL PASO SYSTEMS

Let's review these proposals in detail. The Arctic Gas Study Group has proposed a pipeline from Northern Alaska to markets in the lower 48 States. This pipeline would traverse the gas-bearing Mackenzie Delta, enabling Canadians to develop their gas supplies in the Arctic. The American gas would then be delivered directly to major markets in the United States: West, Northwest, Midwest, East and Southeast. Canada would, of course, determine the appropriate destination of its reserves, but pipeline connections would provide access to both eastern and western Canadian markets.

The El Paso proposal contemplates an 800 mile pipeline from Prudhoe Bay to Gravina Point in Prince William Sound. There, the largest liquefaction plant yet to be constructed, would process the gas for transportation by tanker to Southern California. Some of this natural gas would be consumed directly in Southern California, and the rest would be transported inland by reversing and enlarging existing pipelines and building new lines as necessary. The entire El

Paso project rests upon the concept of displacement, one which is without doubt physically possible given sufficient pipeline investment, but one which would surely create a legal and contractual nightmare.

COST

Of primary concern to consumers is how much the two systems will cost, not in the aggregate, but in the actual charges for delivery of energy to homes and factories. In this respect, a cost comparison of the El Paso and Arctic Gas projects shows minimum costs savings for gas delivered to consumers in the East by the Trans-Canada pipeline of 70 cents per million BTU. In the Midwest and Mountain States, the savings would be at least 60–80 cents, in the South more than 60 cents, in the West over 50 cents and in the Pacific Northwest more than 70 cents per million BTU. For the Midwest and East alone these savings amount to more than $500 million annually and additional savings of at least $150–60 million per year would be achieved in the West.

TIMING

Secondly, our country has an obvious interest in the system that would permit most rapid delivery of gas to markets. In this connection, the El Paso application contemplates a period of 70–80 months from formal approval to final completion while Arctic Gas has proposed a schedule calling for completion within 54 months of approval. Beyond El Paso's longer construction schedule, there is greater probability of delay with the El Paso system because reorganization of the present Arctic Gas consortium would be necessary in order to permit financing of the Alaska-LNG alternative. Furthermore, El Paso has not yet applied to the Department of Interior for a right-of-way permit, a step taken more than two years ago by the Arctic Gas Study Group.

TOTAL ENERGY AVAILABILITY

Thirdly, a great many States, particularly in the Northwest and Midwest, currently depend on Canada for more than 1 trillion cubic feet of natural gas each year. Official Canadian studies show that unless Canada is able to increase its supplies of natural gas during the next 5–10 years, there is a high probability that natural gas exports will be curtailed. Under the Arctic Gas proposal Canada could look forward to attachment of at least 6 trillion cubic feet of reserves and production of a minimum of 1 trillion cubic feet of new gas per year to meet the needs of its domestic consumers. This system would offer greatest hope that current export levels could be maintained.

ENVIRONMENTAL AND OTHER RISKS

Finally, environmental and other risks must also be considered. National environmental groups have expressed concern about the effects of the Arctic Gas pipeline on the Arctic National Wildlife Range in northern Alaska. Several steps have been proposed by the Arctic Gas Study Group to meet these concerns. First, it has been proposed that the pipeline be built in the winter, when no wildlife is present. Second, the pipeline would be chilled so that it would not melt the permafrost and buried so that it would leave no permanent scar across the coastal plain. Third, while some continuing monitoring activities and compressor stations would be needed, the stations would be widely spaced (50 miles apart) and a satellite communications system would be used to minimize towers and lights.

In my judgment, these problems are far less serious than those that would be posed by the El Paso alternative. El Paso is proposing to build a liquefaction plant, several times the size of any that is now in operation, in the heart of what the National Academy of Sciences described as "one of the world's most active seismic regions." In its study of the great Alaska earthquake of 1964, the NAS reported that vertical movement of the earth in some areas reached as much as 50 feet, with crustal deformation extending throughout an area of more than 100,000 square miles. Tidal effects from this earthquake were felt as far away as Antartica, and the estimated release of energy during this disaster was judged by the NAS to be twice that of the San Francisco disaster of 1906.

El Paso contends that its LNG plant will include the latest techniques to protect against earthquake damages. Nevertheless, no engineering method has yet been found to withstand a 50 foot vertical movement of the earth, and with a material as explosive as liquified natural gas, it would not take a 50 foot separation to blow the entire plant sky high.

Even at a production level permitted by today's proven 26 trillion cubic feet of gas, the Point Gravina facility would be handling up to 10 percent of America's entire natural gas supply. If, as expected, these reserves are doubled or tripled with new drilling generated by the pipeline system, a third of our entire gas supply could be cut off by a natural catastrophe like those which occurred in 1964, 1958, and at regular intervals dating back to the first recorded settlements in Alaska.

A second danger is presented by the El Paso scheme. It will require a fleet of massive tankers to handle the gas volumes that have already been proven with potential for doubling or tripling of traffic as new gas reserves are developed in Alaska. These tankers will be operating in waters that are already heavily used by oil carriers. They will require docking facilities which the State of California has shown no disposition to approve. In fact, environmental challenges to docking facilities on the West Coast have already greatly limited America's ability to land crude oil carriers from Alaska. Given the extremely hazardous character of the cargo carried by LNG tankers, the probability of successful challenges with natural gas will surely increase.

NEED FOR LEGISLATION

Thus, from every standpoint—consumer cost, environmental risks, timing, distribution and total energy availability—the Trans-Canada pipeline is preferable to the Alaska-LNG route. Nevertheless, our existing regulatory and judicial review processes could prevent a final decision for from three-to-five years. In the interim, inflation in construction costs will add up to $1 billion a year to final construction costs, an additional $2 billion annually must be added to our nation's oil import costs, and the price of gas for supplies produced in the lower 48 will undoubtedly climb.

Despite the wealth of evidence now available, the President has recently proposed that this entire question be studied for another year. Within 16 months, he would offer his recommendations to the Congress. Only by a majority vote of both Houses of Congress could the President's choice be overturned, and if that were done, additional time would be required for submission of a new alternative and Congressional review.

A proposal not disapproved by Congress would then fact court review.

For a number of reasons, I believe that the President's proposal is a poor method for resolution of this issue. First, it provides for minimal Congressional involvement in what could well prove to be the most important energy policy issue to be decided in the coming year. We must bear in mind that we are talking of potential gas reserves not of 26 trillion cubic feet but probably more in the order of 100 trillion cubic feet, a very large proportion of the nation's total supply. Secondly, there is serious question as to the need for another 12–to–16 months of study before a recommended solution is put before the Congress for action. Over 95 percent of the information at issue has already been presented and cross examined on the public record before the Federal Power Commission. The remaining details and cross examination will be completed during the next five weeks. Within the next month, two final environmental impact statements will also be released on the Arctic Gas pipeline by the reviewing agencies.

Those issues that are still unresolved such as gas purchase, or Alaskan tax and conservation policies, will not be in any way clarified as a result of the Administration bill. But final answers on these questions are not necessary for Congress to make a judgment on which transportation method is desirable. We do not, for example, need to know what Alaska plans to do with its royalty gas, since the Trans-Canada pipeline can be constructed without these supplies. We do not need to know what the precise Alaskan tax policies will be, only that the potential for excessive taxation is far greater with the El Paso system, since the bulk of its facilities would be located in Alaska. Final contracts need not be signed in advance for purchase of the gas, since it can be determined now which transportation system will be best for every part of the nation.

Finally, it is likely that Canada will have reached its decision on the pipeline within the time frame set forth in the President's bill, but the Canadian schedule would permit a decision well before then; in fact, it will probably be reached before Congress could take final action on a pipeline authorization bill and any court appeal could be concluded.

There is no advantage to either Canada or the United States in a delayed decision by this country. Each nation must make a choice. Does this project serve the needs of our citizens? For the United States—from East to West and North to South—I believe the answer is a clear yes. Therefore, we should make that decision, signaling to our neighbors in Canada that we are willing and able to proceed should they decide that this project is also in their national interest.

In reviewing the evidence from this hearing and the one held in February, I am hopeful that the members of the Senate Commerce and Interior Committees will agree with me that time is of utmost importance and that we must move with all possible speed to approve S. 2950.

Statements of Senators McGovern, Philip Hart, Humphrey and Culver

Mr. Chairman: As members of the Midwest Caucus we are pleased to have this chance to submit a statement concerning the transportation of gas from Alaska to the lower 48 States.

Although the States we represent are located in the Midwest, we would like to make clear our belief that the vast majority of Americans from all regions would benefit from the gas delivery system proposed in S. 2950, the Alaskan Natural Gas Pipeline Authorization Act of 1976, introduced by Senator Mondale. The national interest in this approach is reflected in the broad cosponsorship of S. 2950 including 29 members from States as far east as Maine and as far west as Nevada.

We would like to begin by reviewing the projected national need for natural gas. The Federal Power Commission recently predicted that by 1980 demand for natural gas will reach a level of 32.4 trillion cubic feet. Anticipated domestic supplies, exclusive of gas from Alaska, are estimated to be 19.1 trillion cubic feet, leaving a shortfall of 13.3 trillion cubic feet at the beginning of the next decade. By 1985, the FPC projects that the shortfall will increase to nearly 20 trillion cubic feet.

The best hope of increasing America's domestic supplies of natural gas lies in the development of our reserves in the Arctic. Deposits in Prudhoe Bay alone exceed 24 trillion cubic feet. Potentially recoverable reserves in Northern Alaska total at least 76 trillion cubic feet.

At stake in the selection of alternative delivery systems is thus a major share of America's future energy supply. Congress has a clear interest in the cost and efficiency with which supplies will be made available to citizens throughout the nation.

S. 2950 proposes a pipeline system involving the construction of new pipelines for gas transmission across the northern portion of Alaska and through Canada, and the construction of new pipelines and the expansion of existing pipelines in the contiguous United States. Through this system gas would be delivered to citizens in each part of the Nation: Northwest, West, Midwest, Northeast and Southeast.

An alternative system has been proposed to transport Alaskan natural gas by pipeline across Alaska, liquefy the gas and transport it to the West Coast by oceangoing tanker, with subsequent regasification and distribution by pipeline.

Analyses show that natural gas could be delivered to consumers through the trans-Canada pipeline at an annual cost that is several hundred million dollars less than the Alaska-LNG alternative. A standard underground pipeline would avoid unnecessary waste of gas in the liquefaction and tanker-transportation stages of the system. Furthermore, a trans-Canada route would avoid the enormous risks presented by the construction of the largest liquefaction plant ever constructed in what was described by a National Academy of Sciences report as one of the most sensitive earthquake zones in North America.

Proponents of the Alaskan-LNG alternative argue that the trans-Canada route should be rejected by the United States because it would require US cooperation with Canada. We are told that Canadians are "unreliable" and that they would unfairly tax or otherwise interfere with the delivery of American gas to American consumers. We believe that these charges are totally unfounded. While the government and provinces of Canada have taken certain steps regarding pricing and distribution of Canadian energy resources that have not been entirely welcome in the United States, it is foolish to charge that they would interrupt the flow of American energy supplies to American consumers. To underscore this point, officials of both the United States and Canada recently initialed an *ad referendum* treaty that would prevent any interference with, or direct taxation of, pipeline throughput or discrimination in indirect taxes levied by the provinces.

We would like to put the issue of U.S. cooperation with Canada in some perspective. First, both the Midwest and Northwest regions of the United States depend upon Canada for 1 trillion cubic feet a year of natural gas. Unless Canada can develop its Frontier gas reserves, there is a high likelihood that future exports to the United States will be curtailed.

Secondly, to gain access to its gas reserves in the Mackenzie Delta, Canada is now seriously considering an application by a consortium of Canadian and six U.S. long line natural gas companies for construction of the joint US—Canadian pipeline. Even with the recent Supreme Court ruling, Canadian officials point out that a final verdict can be reached before the end of this year.

The Administration has proposed a bill to "expedite" U.S. approval of an Alaskan natural gas transportation system. Nevertheless, this bill would require 12 to 18 months of continuing analysis. It would not provide for a final judgment until the fall of 1977, as much as a year behind the probable Canadian schedule. Moreover, this proposal would provide for only token Congressional involvement in what certainly will be the most important energy policy decision to be made during the coming year.

We see no compelling need for further study. There is already an extensive body of evidence concerning the merits of the two proposals. We feel this evidence clearly demonstrates that a trans-Canada pipeline would benefit the vast majority of consumers in all regions of the United States. Rather, we would urge that the Committee act favorably on S. 2950, thereby expressing the ability and willingness of the United States to proceed with this important project as soon as a Canadian judgment has been made.

RESOLUTION

Be it *Resolved* by the Governors of Minnesota, Wisconsin, and Michigan:

Whereas, the United States suffers economically and environmentally from a severe shortage of natural gas, whose consequences are being felt especially in the Midwest, and, if continued, would be felt particularly the Upper Great Lakes States, and

Whereas, it is therefore in the national interest that a transportation system be promptly approved and constructed to transport the huge supplies of naural gas from northern Alaska and the Canadian Arctic to markets across North America, and

Whereas, the proposed transportation system for such purpose which would appear to deliver such gas most directly to markets; to be most energy efficient; to ultimately deliver the most natural gas; to transport such gas at materially lower cost to all parts of the nation; to best support the level of imports of natural gas from Canada by providing access for Canada to its supplies of gas in the Canadian Arctic; to be most environmentally acceptable; to be capable of being put into operation most promptly; and to be of the greatest economic benefit to this country is the all-land pipeline system across Alaska, Canada, and the contiguous United States proposed by the Arctic Gas Project;

Now therefore be it *Resolved:*

1. That the Governors of Minnesota, Wisconsin, and Michigan hereby express their support for the Arctic Gas Project, and

2. That they hereby urge the President and the Congress of the United States to take all feasible action to expedite the authorization of the construction and operation of said Arctic Gas Project.

WENDELL R. ANDERSON,
Governor of Minnesota.
PATRICK J. LUCEY,
Governor of Wisconsin.
WILLIAM G. MILLIKEN
Governor of Michigan.

Senator STEVENSON. Now, I think we better move on.

The first witnesses will comprise a panel, and they are Howard Boyd, chairman of the board of El Paso Alaska Co.; William Brackett, vice chairman of Arctic Gas; and Robert Blair, president of Alberta Gas Trunkline.

Now, why don't we proceed with Mr. Boyd?

STATEMENTS OF HOWARD BOYD, CHAIRMAN OF THE BOARD, EL PASO ALASKA CO., WASHINGTON, D.C.; AND WILLIAM BRACKETT, VICE CHAIRMAN, ARCTIC GAS, WASHINGTON, D.C.; VERNON HOLTE; AND ROBERT BLAIR, PRESIDENT, ALBERTA GAS TRUNKLINE, CANADA

I would ask all of you, if you can, to condense your statements, summarize them, and the full statements will be entered into the record.

Senator STEVENS. Mr. Chairman, I think we should welcome not only the people from El Paso and Arctic, but a distinguished Canadian, who is the president of the Alberta Gas Trunkline system, who has come here at his own expense to add his own comments to the information that is available to this committee.

And Mr. Blair has assisted in the interparliamentary efforts between our two countries on at least one occasion. And I think it is very courteous of him to take his time to come here and be with us.

Senator STEVENSON. I certainly concur. We are very grateful to Mr. Blair.

Mr. Boyd.

Mr. BOYD. Mr. Chairman and members of the committee, as indicated, I am Howard Boyd, chairman of the El Paso Co. I am here with a number of my associates for the purpose of addressing ourselves to what we consider to be a matter of major national importance.

We welcome the opportunity to document how we view the best method of bringing these vast supplies of badly needed natural gas from the Prudhoe Bay area to the hungry markets in the lower 48. There are presently before the Federal Power Commission, the agency set up by Congress to consider matters of this sort, two competitive applications: One we refer to either as the Trans-Alaska project or the El Paso project, and the other that which we refer to as the Arctic Gas project.

For reasons that I will develop within the constraints of time that have been imposed upon us of necessity, I think we can demonstrate to the satisfaction of an impartial group that the Trans-Alaskan project has benefits of economic advantage, environmental advantage, security advantage, that the gas can be made available to the lower 48 in a shorter period of time and, with respect to the points that the chairman mentioned of the desirability of having as much Canadian gas flow as possible because it does enhance the prospect, however remote it may be, of increasing the quantities of Canadian gas that will come into the United States.

I think it follows that certification of the El Paso project will achieve the important objective that the chairman mentioned in his statement.

I would like very briefly to describe the differences between, basic differences between these two systems, and it might be helpful if I could allude very briefly to a map that we have prepared.

These gas reserves, large in size, up here at Prudhoe Bay, can be moved physically in either one of two methods. What the El Paso plan contemplates is that within the corridor in which the oil line is presently being built, the gasline will be laid through a distance of some 809 miles using the haul road, its work pads, its campsites, and some of the equipment that is presently available in the construction of the oil line.

At the south central shore of Alaska, this gas would be liquefied, put aboard cryogenic tankers, floated to the west coast of California, where it would be regasified and then distributed to such points in the Lower 48 as were entitled to it.

You will observe immediately that this concept puts the movements of gas at all times exclusively within the control of the United States, a point that I will stress later on.

I would like to just touch upon references to the liquefaction plant. It will be a large liquefaction plant, but liquefaction plants are made in trains, and you add a train as the volume of gas requires additional liquefaction.

Liquefaction is not a complex technology. It is simply an elaboration of your refrigerator that you have at home. There is nothing complex about it.

Liquefied gas is presently being taken into Spain, Italy, France, England, Japan, and the United States.

With respect to the reference to the explosive character of the tankers, let me just say that the head of the Coast Guard has testified that this is among the safest maritime transportation known to his agency. There have been some 2,000 ship movements without a single incident of damage or injury. The testimony is elaborate on that point before the Federal Power Commission, and I won't stress it any further.

On the west coast of the United States, this gas would be regasified and, as I said, then distributed to such points in the lower 48 to which it may be destined. This is done by a method called "displacement," an accepted procedure in the industry, understood by everybody that has had the slightest exposure to it.

As a matter of fact, in the forum 2 reports which the pipeline companies are required to file with the Federal Power Commission, it is shown that in 1974 the average displacements between the pipeline companies was some 9.4 billion cubic feet a day, which is roughly four times the quantity that is anticipated out of Prudhoe Bay.

It may be of interest to the committee for me to explain that for over 20 years a large percentage of the supply of gas that is sent into Minnesota by Northern Natural Gas Company comes from wells in the Permian Basin area dedicated to El Paso.

And the wells dedicated to Northern Natural in the Permian Basin area supply gas to El Paso that goes to California. And that, gentlemen, has been a procedure in effect for approximately 20 years.

The very concept of displacement is extremely simple. There are huge gas deposits in west Texas and New Mexico, in this area to which I am referring. We pick up gas there, and we move it west, serving the western States as we go. California is our largest market.

Obviously, as soon as you offload gas on the west coast of Californit, there is no longer a need to move this gas a thousand miles from west Texas to California. And thus, as soon as you offload the gas on the west coast of California, you have the supply in west Texas that is available to go to other points in the United States.

And, as you will observe from the system map that we have here, and perhaps it would be well to exhibit it right now, you see that once you get into west Texas, you are moving into the area where the large pipeline companies move to the Midwest and to the East. And thus you are approaching the point where gas that is offloaded on the west coast by displacement is now available to go to the Midwest or to the East.

This system that we refer to as the Trans-Alaskan El Paso system would require an estimated capital expenditure of approximately $7.9 billion. We recognize, of course, that that is a staggering figure, but we are assured, and we have the expert witnesses here available in this hearing room, to give their opinion, that that can be financed within the private sector of the U.S. economy.

Now, as contrasted with the El Paso system, there is the competitive proposal that I refer to as Arctic Gas. That would pick up the gas at Prudhoe Bay, move it eastward through the most remote area of Alaska, totally unpopulated, traversing as it goes through the wildlife refuge that is indicated on this map, all virgin territory, then enter Canada and proceed 2,400 miles across Canada, also virgin territory, encompassing some 1,200 miles of permafrost, entering the United States at the two points indicated here, and then building an additional 2,400 miles inside of the United States of new pipeline.

That project is estimated to require capital expenditures of about $9 billion, and the spokesmen for Arctic Gas have indicated that the financing would in all probability require Government guarantees.

Now, we felt that, for reasons that I would like to tick off, that the El Paso project could be built sooner, and for these reasons: It requires only U.S. authorization. It does not require Canadian authorization as well, which, as Senator Stevens indicated, as applied to the oil line would probably have resulted in the fact that, indeed, it would still not be under construction.

Let's just take a look at what Arctic Gas faces in Canada. There is the Berger hearing that is in progress, considering the environmental impact upon the Arctic Gas line in the northern regions of Canada. Efforts are being made to prod Justice Berger to accelerate his hearing. He has indicated he is thoroughly going to consider the environmental impact, and he considers it to be in the interest of his country that that be fully evaluated.

As mentioned, the Canadian native claims matters have never been settled, and there is no reason to believe that they will have any less importance to Canada than the native claim situation was to the United States.

Of necessity, there has to be a favorable decision by the NEB, and it is significant to allude to what just happened recently in connection with those proceedings. They had been in hearing for approximately 5 months when the judicial machinery in Canada concluded that the chairman of that hearing was disqualified and could not proceed further, as a consequence of which the entire panel of three members withdrew.

A new panel has been selected. Its hearings must commence anew, and they are scheduled to start on April 8, with the consequence that all that has gone forward to date has been lost and the proceedings must start again.

In that proceeding before the NEB, there is presently one competitive project which must be weighed, obviously, by that agency. And I will not describe that for the reason that it is one being sponsored by Mr. Blair, who sits on my left and can deal with it far more adequately than can I.

But if the National Energy Board should find that in Canada's interest, the competitive project sponsored by Mr. Blair, that is referred to as the foothills project, then, of necessity, Arctic Gas would be disqualified, and the United States would be left in the embarrassing position of having no project for its movements to the lower 48 of the Prudhoe Bay gas.

In addition to the one project that is already competitive against Arctic Gas before the NEB, there is the Polar Gas project, which proposes, as soon as additional quantities of gas have been discovered —and they have already proven up some 13 trillion—they propose to make application to the NEB for certification to move their gas. And those who are knowledgeable about matters in Canada concede that the Canadian economy cannot tolerate simultaneously both the Arctic Gas project and the Polar Gas project.

With respect to the points the chairman made about the desirability of having as much Canadian gas produced as possible, recognizing the more such gas that is produced, the better is the opportunity that some of it may come into the United States, let me just point out that the proven quantities of gas at Mackenzie Delta are in the range of 3.7 trillion cubic feet.

The proven quantities of gas in the polar region are now in excess of 12 trillion and were recently announced to be 13-plus trillion.

Now, the certification of Arctic Gas, as mentioned by those that are knowledgeable in financial matters relating to Canada, indicate that Arctic Gas and Polar Gas cannot both be built at the same time, or even in the same decade. Thus, certification of Arctic Gas seriously postpones Polar Gas, which has the far greater quantity of gas.

I will leave to Mr. Blair to answer the question whether, in his opinion, it would be possible for Foothills to be financed substantially concurrently with Polar Gas, in which event there would be production from both Mackenzie Delta and these much larger regions of the Polar Gas project.

In addition to the necessity of securing approval by the NEB, Arctic Gas must also face the test of a parliamentary approval. The Parliament of Canada is, obviously, going to decide this issue in consideration of what it considers to be the best interest of Canada. That is, obviously, a political body, and let me point out that one of the participants in Foothills is West Coast Transmission, which, in effect, is a government agency of the Province of British Columbia, and the

Polar Gas project which I alluded to is partly owned by the Federal Government of Canada and the Provincial Government of Ontario.

I suggest to you that those obvious government interests will have a voice in the parliamentary decision.

We suggest, gentlemen, that from a construction standpoint, the El Paso project can be completed sooner. As mentioned, we would expect to use the haul road, the work pads, the campsites, some of the equipment, that is presently there, having been put there by Alyeska.

As against this, Arctic Gas must build some 1,200 miles through permafrost, it must move 3½ million tons of equipment into Canada, and it expects to handle this on snow roads, snow pads and on barges during the period when the water will permit movements of such barges, which, as you will recall, was a serious threat to Alyeska.

You will recall the daily newspaper accounts about the hostility of the weather that prevented the movement of those barges, up to the Prudhoe Bay area, many of which had to be turned back.

If that window Arctic Gas expects to enter during the construction period should be closed for a matter of a few weeks, the net result would be that the project would be delayed a year.

There have been many studies made with respect to those two projects, but there is one study that was made by a totally disinterested agency. And it was made at the direction of Congress. That was the study made by the Interior Department, the report of which has been submitted to Congress.

That study weighed the risk of delay and concluded that the risk of slippage in the Arctic Gas proposal was twice that inherent in the El Paso proposal. The Interior Department said the danger of slippage with respect to Arctic Gas was 12 to 36 months, whereas that of El Paso was 6 to 18 months.

As I mentioned, we will build in the corridor through which the oil line is now being built. And I mention that because of the differences in the environmental impact of these two projects.

Those facilities that will need to be built in the lower 48 will, for the most part, parallel existing pipeline systems. Arctic Gas, as I mentioned, must go through the wildlife refuge; it must be built in this permafrost.

They expect to do it off snow roads and snow pads, and I think when the reference is made, if we ever come to that, it will be demonstrated that that cannot be accomplished, that winter construction is not engineeringly feasible, with the result that in the midst of construction, it may well be necessary to haul in huge quantities of gravel to do what Alyeska did, namely build a gravel all-weather haul road.

With respect to transportation costs, I suggest to you, gentlemen, that whatever assumptions you make, you can get virtually any answer that you are looking for. As my associates mentioned with respect to Arctic Gas, when you try to grasp what it is that they propose, it is like trying to pick up quicksilver. The project changes in complexion almost weekly.

The most recent radical change having been filed as recently as March 11, in which, much to our happy surprise, Arctic Gas now embraces what was heretofore characterized as a vague, untried, ill-defined concept of displacement. They propose to terminate their line in mid-Illinois, and those markets that are to be served east of that point, by virtue of their most recent filing, will be served by this vague, ill-defined method of displacement.

Balance of payments is obviously an economic consideration to which those responsible for the national interest of the Unietd States cannot close their eyes. The El Paso project, being all-American in character, using exclusively, 100 percent American machinery, pipe, compressors, will have zero impact upon the balance of payments.

However, the Arctic Gas project, according to an exhibit filed by them with the Federal Power Commission, a copy of which I have in my hand, although in need of updating to reflect the impact of inflation, indicates that the costs which they visualize would be required in Canada of $5,898,000,000 would entail purchases from the United States directly of only $357 million.

And even the direct and indirect purchases from the United States, according to their own exhibit, would entail benefits to the United States of only $1,020,000,000.

With respect to jobs, obviously a matter of economic importance to the United States, particularly at a time when there is undesirable unemployment. The evidence undeniably shows that the El Paso project would provide in the range of 750,000 man-years of U.S. employment, as contrasted with 400,000 man years of U.S. employment for the Arctic Gas project.

The impact of that, readily recognized by labor, is illustrated by the support of the maritime trade unions that represent 43 international unions having 8 million members. They have strongly endorsed the El Paso project.

I wanted, if I may, Mr. Chairman, to touch upon what I think is probably the most important point, and that is the matter of security. I have dealt with this in the opening statement that I have left with you, but there is one aspect of it I would like to close on, and that is, what is the attitude of the Canadians toward matters of this sort?

I cannot express it better than did the Prime Minister of Canada in 1966, and I would like simply to read his words, at a time when Canada was proposing a gas line to be built by Trans-Canada, whcih would drop down into the United States and return into eastern Canada for service there. And this had been approved by the NEB but was overturned by the Parliament.

The Prime Minister made this statement:

> The government does not believe it to be in Canada's best interest that the future development of facilities for bringing western Canadian gas to its eastern Canadian markets should be located outside of Canadian jurisdiction and subject to detailed regulation under laws of the United States which are naturally designed to protect the interests of U.S. citizens.

And he concluded with this:

> This has been a difficult decision in a very complex matter. However, the gas transmission industry is a public utility on a vast scale, and is important to Canadian national well-being. The development of its main links between west and east should, we believe, remain wholly under Canadian jurisdiction.

That was in 1966. Has their attitude changed to the present?

Let me just read to you one sentence from a resolution adopted by the ruling party of Canada at its convention in November 1975, and I quote:

The Federal Government should give first priority to northern Canadian pipeline schemes that are all-Canadian in ownership and which are designed to serve adequately the Canadian public first.

I close, gentlemen, with the rhetorical inquiry: Should we have less regard for the security of the citizens of the United States than that displayed by Canada for the well-being of its citizens?

[The statement follows:]

STATEMENT BY HOWARD BOYD, CHAIRMAN, EL PASO CO.

Messrs. Chairmen and Members of the Committee: I welcome the opportunity to testify before you today on a matter of vital importance to the entire nation—how can U.S. consumers obtain the vast and urgently needed gas supplies located on Alaska's North Slope? These supplies offer one of the quickest methods of helping to alleviate the natural gas shortage now confronting the Lower 48 States.

Two plans to bring this Alaskan gas to market in the Lower 48 States are now under study in comparative hearings before the Federal Power Commission. Our plan offers security of supply, economic benefits, less environmental impact and what is probably of most importance, the ability to bring the gas quicker to markets throughout the Lower 48 States.

I will first give you a brief description of the projects and then discuss in detail the four issues which we believe are basic to any decision as to which project is in this nation's interest.

DESCRIPTION OF THE TRANS-ALASKA PROJECT AND THE TRANS-CANADIAN PROJECT

The project proposed by The El Paso Company to move Alaskan gas to the Lower 48 States is totally under American control. The Alaskan portion of the line will be 809 miles long and will substantially parallel the oil line built in the "utility corridor" established by the U.S. Department of the Interior.

The gas will be liquefied at Point Gravina in South Central Alasks. It will then be transported in eleven 165,000 cubic meter LNG carriers to receiving and regasification facilities in California. From that point, gas will be made available to all areas in the Lower 48 States entitled to receive it, including the Midwest and East, by displacement and the utilization of idle capacity in existing interstate pipeline systems. Not more than 800 miles of additional pipe, much of which will parallel existing systems, will be needed in the Lower 48.

The total estimated cost of El Paso's project, including the necessary facilities to be built by an unaffiliated company, is $7.9 billion calculated in mid-1975 dollars.

The opposing project, referred to interchangeably in this statement as the Arctic Gas Project or Trans-Canadian project, would transport the Alaskan gas through Canada in order to reach U.S. markets. The line would run from Alaska's North Slope via the most remote area in Northeast Alaska, traversing a wildlife range, and then would move across some 2,400 miles of Canadian territory. At a point near Calgary, Alberta, two entirely new pipeline legs extending into the United States would be constructed, one through the Western portion of the United States and the other into the Midwestern part of the United States. About 5,000 miles of new pipeline,[1] much of it in new corridors in Canada and the United States, would have to be constructed. Total capital cost of the Arctic Gas Project in mid-1975 dollars is about $9.0 billion.

THP TRANS-AASKA PROJECT CAN BRING ALASKAN GAS TO THE LOWER 48 STATES SOONER THAN THE ARCTIC GAS PROJECT

Any delay in bringing North Slope gas to market will increase the economic hardship throughout the country brought on by the energy shortage. The Trans-Alaska Project will be completed sooner than the Arctic Gas Project for several major reasons

---

[1] On March 11, 1976, it was announced that a portion of the Northern Border Pipeline extending from south of Chicago to Pittsburgh had been eliminated. The mileage and capital costs stated do not take into account this latest change. As a result of such elimination, service would be accomplished by displacement, thus utilizing the concept proposed in the trans-Alaska plan.

(1) The Availability of Alyeska's Haul Road, Work Pads, Campsites and Equipment

The El Paso Project, paralleling the Alyeska oil line now under construction, will utilize the same haul roads, work pads and various campsides, etc.

The Arctic Gas Project faces great delays because of construction problems inherent in its proposal. The Arctic Gas Project will have to devise means of obtaining facilities and equipment (an essential part of which is currently non-existent) and of transporting this equipment into some of the most remote and inhospitable regions of the North American continent. For example, the Arctic Gas Project calls for extensive construction and utilization of snow roads and snow pads over the frozen tundra which may be infeasible or unacceptable. The use of gravel is the only alternative to these snow roads and snow pads. It took Alyeska two years to build a gravel haul road covering 400 miles with associated campsites—about one-third of the frozen tundra Arctic Gas must cross.

That project also requires the movement of almost 3.5 million tons of pipe and equipment, much of it by land to various staging areas in Canada, and the barging of a good deal of this equipment via the Beaufort Sea and the Mackenzie River. Successful barging requires favorable ice conditions. If the time period or "window" during which weather and ice conditions are favorable for the barging as scheduled by Arctic Gas should shorten even by a few weeks, this slippage—because of tight construction scheduling—could add an additional year's construction time. Because of abnormal weather conditions and the consequent short "window," many of the barges, destined for the use of Alyeska, which were scheduled to dock at Prudhoe Bay during the summer of 1975 were turned back.

El Paso proposes to use as its principal means of transportation in Alaska the gravel haul roads and work pads already in place.

The Department of Interior in its report to Congress dated December, 1975, on the transportation of Alaskan gas, made an assessment of the time uncertainties involved in the construction of the two transportation systems. The study concluded that the trans-Canadian system would be more risky to construct and would have a greater potential for schedule slip and cost overrun when compared to the trans-Alaska system. It was estimated that a schedule slippage of from 12 to 36 months and a cost overrun from $1 billion to $3 billion is not unlikely for the trans-Canadian route as compared to 6–18 months and $500 million to $1.5 billion for the Trans-Alaska route.

(2) Only American Approvals Are Required to Launch the El Paso Project

Not quantified in the Interior study, but recognized as nevertheless present, is the fact that the Arctic Gas Project must secure a multitude of Canadian approvals and find solutions for a number of existing problems before a system could be constructed across Canada. These include authorizations from the Canadian National Energy Board and recommendations from the Department of Indian Affairs and Northern Development [2] and disposition of native claims.

In Canada, Arctic Gas is opposed by an "all-Canadian" project commonly referred to as "Foothills" or "Maple Leaf." The Foothills Project proposes the movement of Canadian gas from the Mackenzie Delta area to connect with the existing pipeline systems in British Columbia and Alberta—no Alaskan gas is to be transported through these facilities.

The Canadian National Energy Board commenced hearings in October, 1975, on the competing applications of Arctic Gas and Foothills. However, on March 11, 1976, the Canadian Supreme Court disqualified the Chairman of the panel considering these competing applications. An entirely new panel has been selected and hearings are to begin anew on April 8.

Whatever may be the NEB's decision, that decision cannot become effective unless it is adopted by the Cabinet (Governor-In-Council); and in a matter of such far-reaching importance, a "political review" could well involve a debate in

---

[2] Hearings are now being held by Mr. Justice Berger—a Canadian jurist—to assess the social, economic and environmental impact of a pipeline project upon the Canadian North. Recent expressions in the Canadian news media indicate these hearings will be completed in the Fall of 1976 and recommendations issued by the end of 1976.

Parliament.[3] And, even if the Arctic Gas proposal were so approved, that decision would be subject to review by the Canadian courts. Obviously, if the "all-Canadian" project is approved, Arctic Gas' present proposal before the U.S. authorities would be rendered moot.

There is also the possibility that the province of Alberta may hold hearings to consider the environmental aspects of these two competing projects.

There is also the possibility that the "Polar Gas Project"—which envisions bringing gas from the Canadian Arctic Islands to Eastern Canada with some possible exports to the Eastern U.S.—will during early 1977 ask for authorizations from the Canadian National Energy Board. If this should occur, the Polar Gas Project could be consolidated with the other two projects before the NEB in order that Canada could reassess its energy priorities with respect to its Arctic regions.[4]

(3) Canadian Native Claims Are Still Unsettled

A problem which has been resolved in the U.S. but not in Canada is the settlement of native claims. This problem could seriously delay the construction of the Arctic Gas pipeline. Native claim settlements in the U.S. took years of intensive negotiation to resolve. The claims of natives in Canada are just as complex and could be just as time-consuming as were the settlements in the U.S. In deference to these Canadian natives, the sponsors of the Foothills Project have stated they would defer construction of their line until substantial progress is made in settlement of these claims. In view of the fact that the Canadian natives have expressed hostility to a pipeline crossing their lands prior to the settlement of their claims, pipeline integrity under the Arctic Gas Project cannot be assured.

(4) Cooperation Relative to Construction

The State of Alaska, which has endorsed the trans-Alaska concept, has given assurances that it will cooperate fully with respect to the haul roads, work pads, campsites, etc., when they become available.

TRANS-ALASKA GAS PROJECT WILL BENEFIT THE U.S. ECONOMY

If the Trans-Alaska Gas Project is authorized, the United States will gain economically. Likewise, if a Canadian route is approved, Canada will gain economically, at the expense of the United States:

(1) Balance of Payments

Unlike the Arctic Gas proposal which would increase this nation's international monetary difficulties, the El Paso proposal will have no effect on the U.S. balance of payments. U.S. dollars will be spent in this country for the goods and services required to construct the Alaskan gas pipeline, LNG facilities, the LNG carrier fleet and other related facilities in the Lower 48 States. To the extent possible, all facilities will be U.S.-built and U.S.-owned and operated. In addition, all transportation charges for the movement of Alaskan gas throughout the life of the project will remain in the U.S. economy.

Robert R. Nathan, one of the nation's leading independent consulting economists, has testified that El Paso's project would provide almost double the U.S. governmental revenues and an estimated 85 percent more man-years of employment than would the Arctic Gas proposal. And, he said in a period of disturbing unemployment which may recur from time-to-time, preference should be afforded to that system which promises the best opportunity for the employment of Americans.

If the Canadian proposal were to be approved, billions of dollars would be invested in that country for construction and operation of their pipeline and huge additional amounts would go from U.S. consumers to Canada as transportation charges and taxes.

The Arctic Gas consortium announced it is seeking bids from Japanese and

---

[3] It should be noted that the ruling National Party of Canada at its Annual Convention held in November, 1975, adopted the following resolution: "[that the federal government] give first priority to Northern Canadian pipeline schemes that are all-Canadian in ownership and which are designed to serve adequately the Canadian public first."

[4] The Ontario government and the Canadian federal government (through Petro-Canada, the national oil company) are participants in the Polar Gas Project.

German pipe mills for the pipe to be strung across Canada. Further, of the total capital expenditures required to be made in Canada, only 17 percent would be spent either directly or indirectly for American goods and services. This is consistent with official Canadian government policy on this matter.[5]

The total adverse effect on the U.S. balance of payments over the life of the project for the Arctic Gas proposal is estimated to be about $10 billion.

(2) The El Paso Project Will Result in Huge Tax Benefits to the United States

All tax benefits generated by the Trans-Alaska Project will accrue to U.S. federal and state governments. Under the Arctic Gas proposal, the largest part of taxes paid would go to Canada.

The El Paso project will generate an estimated $19.8 billion in tax revenues for federal and state entities, almost twice as much as the Arctic Gas proposal. In contrast, it has been estimated the Arctic Gas proposal would generate —at present Canadian tax rates—$7.0 billion to Canadian taxing authorities, most of whichh would be paid by the U.S. consumer.

(3) The El Paso Project Will Provide More Jobs for Americans

In round numbers, about three-quarters of a million man-years of employment for U.S. citizens will be generated by the Trans-Alaska Project as compared to slightly over 400,000 man-years under the trans-Canadian proposal. After completion of the project, the Trans-Alaskan route will provide permanent employment for three-and-a-half times as many U.S. workers as would be permanently employed if the trans-Canadian route is approved.

The Trans-Alaska Project already has strong labor support. As an example, the Maritime Trades Department of the AFL-CIO—which is comprised of 43 international unions and 8 million American workers—has strongly endorsed by convention action the El Paso proposal.

(4) The El Paso Proposal Would Utilize Existing Facilities

Interstate pipeline systems have not been able to add new supplies of gas sufficient to offset the decline in existing sources. The Trans-Alaska Project will utilize the idle capacity in these existing systems—presently being paid for by the American consumers—in bringing Alaskan gas to markets served by these systems.

Backers of the trans-Canadian route have described as "complex" or as being "under some vague and ill-defined theory of displacement" El Paso's proposal that natural gas delivered to the West Coast be made available throughout the country by the utilization of idle capacity in presently existing pipeline systems. They have suggested that their proposal, involving the construction of extensive new pipeline systems, could somehow be more beneficial to the United States since these new pipeline systems would be physically constructed in the Western and Central parts of the United States.

Displacement is not a "new" theory—it has been employed in the gas industry for decades. El Paso has been engaged in displacement and exchange agreements for years in the Permian Basin and Panhandle areas with several members of the Arctic Gas consortium. In fact, both the Department of Interior in its December, 1975 report to Congress and the FPC Staff in its draft environmental statement have separately concluded that if the Arctic Gas Project were to be approved, the transportation system should be changed so that only one pipeline, which would terminate just south of Chicago, should be built into the U.S. This would replace the present proposal of having two new lines built into the U.S., one entering California and the other terminating at Pittsburgh.[6] From the one entry into the U.S.—just south of Chicago—the gas would then be made

[5] The Honorable Allan J. MacEachen, Canada's Secretary of State for External Affairs, recently stated:

"It is plain that Canada and the United States have entered upon a new period in their bilateral relations . . . Each government will have to make hard decisions in line with its perception of the national interest, decisions with which the other may find it difficult to concur."

And, the Honorable Donald S. Macdonald, when Minister of Mines, Energy and Resources, underscored this point:

"In addition to the lead role which we insist on for Canadians in designing, constructing and operating the pipeline, we also insist that Canadians should be given a prior opportunity to acquire majority ownership of the pipeline which will be operating in Canada and carrying a substantial amount of Canadian gas to Canadian markets."

[6] On March 11, 1976, the Arctic Gas consortium did exactly that with respect to one of these pipeline legs—the so-called Northern Border pipeline. The portion which would have been built from just south of Chicago to Pittsburgh has been eliminated.

available throughout the country by the same technique heretofore advocated by El Paso—displacement.[7]

In testimony before the Federal Power Commission, U.S. members of the Arctic Gas consortium have acknowledged that Alaskan gas could be delivered to them under the El Paso proposal—through existing facilities and by displacement.

(5) Comparative Costs

Although there have been scores of calculations by El Paso and Arctic Gas of the comparative transportation costs of the two projects—always resulting in wide divergencies—it is perhaps helpful to this Committee to refer to the only study made by a disinterested party. It will be recalled that Congress directed such a study by the Department of Interior. This study, dated December, 1975, was filed with Congress pursuant to Public Law 93–153 and compares the transportation of Alaskan gas to the Lower 48 at two different volume levels. At both levels, the Trans-Alaska Project is shown to enjoy a cost advantage after giving credit to U.S. taxes paid under both projects. It is significant that in this calculation the Department of Interior did not undertake to quantify the obvious advantages of the Trans-Alaska Project from the standpoint of balance of payments, political and security risks, employment opportunities to American workers and environmental impact. Moreover, the Interior study further concluded that the risk of construction slippage and resultant cost over-run under the Arctic Gas Project was twice that of the Trans-Alaska Project.

(6) Utilization of Energy Consumed in the Movement of Natural Gas

The very movement of gas from one point to another requires the expenditure of energy. Pipeline transportation of gas requires huge compressors which are normally operated by natural gas—the fuel being transported. The amount of gas used in pipeline transportation is a function of distance. Consequently, the Canadian project, which involves the use of substantial quantities of new pipe, would use more energy in pipeline movement than that required under El Paso's proposal. However, at the terminus of El Paso's pipeline system in Alaska, energy is utilized under El Paso's proposal to convert the natural gas to liquid and then to move this liquid by ship. Energy used in the movement of gas is normally referred to as "shrinkage."

The Department of Interior study also considered the question of shrinkage. At the 2.5 billion cubic feet per day level of transporting Alaskan gas, the study concludes that under the El Paso Project, 8.5 percent of the gas would be utilized as compared to 6.4 percent under the Arctic Gas Project. However, at the 3.5 billion cubic feet per day level of transporting Alaskan gas, the El Paso Project would consume 9.9 percent of the gas while the Arctic Gas Project would consume 10.4 percent.

It should be noted, however, that in the Trans-Alaska Project, the "shrinkage" attributable to the transformation of gas into a mass of "super cold" will be available for future use in the making of industrial gases and in food processing, as now employed in connection with LNG projects in France and Japan, and for other uses.

THE EL PASO PROJECT WILL HAVE MINIMAL EFFECT ON THE ENVIRONMENT

Several basic facts highlight the superiority, from an environmental view, of the Trans-Alaska Project over the Arctic Gas Project.

(1) The Pipeline in Alaska will be Built Within the Utility Corridor Established by the U.S. Department of Interior

The Alaskan oil pipeline is already under construction in this corridor. The gas pipeline to be built across Alaska will use many of the essential construction facilities already in place, thus minimizing disturbances in this area.

---

[7] "Displacement or exchange agreements are common in the natural gas industry. The two displacement plans described here (the El Paso Project and Arctic Gas Project) would be much larger than any previous examples . . . If all of the companies involved have an interest in seeing Alaskan natural gas reach its final destination, they should be able to agree upon a displacement plan without much difficulty . . . *Displacement avoids both the cost and the environmental impact of new pipeline construction and makes a more efficient use of existing facilities.*" [Emphasis added.] (U.S. Department of the Interior, A Report to Congress Pursuant to Public Law 93–153, December, 1975, pp. 8, 9.)

Studies conducted prior to the authorization of the Alaskan oil pipeline provide a reservoir of knowledge which can be used in construction of the trans-Alaska gas pipeline. These include information on (1) wildlife movements and breeding areas, including fish and stream data, (2) environmental and engineering matters relating to pipeline design and construction, and (3) sensitive permafrost areas. Further, the experience gained in building the Alyeska Project will contribute to minimizing any environmental impact when the trans-Alaska gas pipeline is built.

(2) New Pipelines in the Lower 48

Under the El Paso proposal, at most only 800 miles of new connecting pipeline, much of which will parallel existing facilities, will need to be constructed to transport the Alaskan gas after it is delivered on the West Coast.

Under the Arctic Gas proposal, construction of some 5,000 miles of new pipeline would be required in Canada and the U.S. This construction would be across permafrost areas which never before have been disturbed, across the Arctic Wildlife Range in Northeastern Alaska and much of which would be along other new rights-of-way.

(3) LNG Technology

With respect ot LNG technology, the U.S. Coast Guard has reported that LNG is among the safest seagoing operations being carried on today. LNG has been shipped for more than twelve years—covering more than 2,000 deliveries without a cargo release. Most of the U.S. members of the Arctic Gas consortium are involved in LNG operation or shipment in one form or another. Details of extensive studies of LNG technology and safety have previously been furnished to the Committees.

SECURITY INHERENT IN AN ALL-AMERICAN PROJECT

The question of security is important—not in the sense of a threat of war, but with respect to peacetime requirements for pipeline security and the need for future expansion as other supplies of gas and oil in Alaska are produced. A determination made now that a trans-Canadian pipeline is to transport Alaskan gas will commit this country's present and future Northern Alaskan gas and oil reserves irretrievably to Canadian control.

(1) Approval of a Trans-Canadian System Would Unnecessarily Subordinate to Canadian National Interests Not Only Presently Available Supply of Prudhoe Bay Gas, but More Importantly, Future Discoveries of Both Gas and Oil in the Northern Reaches of Alaska

It is highly improbable that Canada would make any effort to divert Alaskan gas to its own markets. Viewed in today's light, it would seem unlikely that over the decades of expected life of the pipeline, Canada would undertake to preempt the capacity built into the line to move the quantities of gas presently attributable to Prudhoe Bay. But no such comfort is justified in regard to the movement of future discoveries of gas in the Alaskan Arctic. The inability to move such gas also seriously impacts the movement of associated oil. This risk should be understood in the evaluation of the available alternative.

Much of the North Slope gas is associated with oil and the two are necessarily produced together. Such gas can be dealt with in only one of three ways: (a) It can be flared to the atmosphere, which is unthinkable in this period of energy crisis, as well as unlawful. (b) It can be compressed and reinjected into the reservoir with the consequence that it will be denied to the market and will be wasted in the ever-increasing quantities consumed in the reinjection effort. There would be a huge loss of revenue which otherwise would be available for further exploration. (c) It can be marketed to the great advantage of all concerned.

In view of the high probability that additional quantities of gas will become available in the Alaskan Arctic,[8] it will be possible to move them through the proposed Canadian facilities, but only if they are expanded for that purpose. What assurance can be given now that in the future the Canadians will find it

[8] It has been announced that two deep exploratory wells will be drilled during the 1975–1976 winter season in Naval Petroleum Reserve No. 4, located just west of Prudhoe Bay.

in their interest to expand the pipeline in their country under circumstances which will benefit only the United States? The initial expandability of a pipeline is usually the cheapest expandability. Additional quantities of gas are anticipated at Mackenzie Delta. In fact, the quantities already proven are admittedly only a small percentage of the area's potential. Thus, if Arctic Gas finds favor wih Canadian authorities it will be because it provides a method by which Canadian gas can "piggyback" to Canadian markets on the large line required to move Alaskan gas. Once built, however, it will be in Canadian interest to reserve the expandability for increased Canadian production.

Various Canadian approvals will be required for future expansion. What guarantees can be offered at this time that the Canadians will find it to be in their economic, social and environmental interest to provide the expansion which would in no way serve the interest of Canada?

Of course, new discoveries of gas in Alaska could then be moved through a new line built across the state for that purpose, but this prospect ignores human experience. Something in the range of a minimum quantity of 20 trillion cubic feet in required to make such a pipeline economically feasible. A discovery of that magnitude in all probability would represent an exploration effort of ten to twenty years, or perhaps longer. It must therefore be recognized that if such gas could not be marketed, the oil associated with it would also be denied to the United States. Thus, the line across Canada not only impacts the present supply of gas, but imperils the marketing of future discoveries of both oil and gas from the Alaskan Arctic.

(2) A Treaty Is Not the Complete Answer

The recently initialled ad referendum agreement with Canada provides no answer to American concern regarding the expansion of a pipeline built through Canada. Neither does it provide guarantees against increased provincial ad valorem taxes, etc. As to this latter aspect, the State Department is on record that "the impact of State and Provincial taxes on an Arctic pipeline and other issues relating to a specific pipeline can most effectively be addressed in the context of a protocol negotiated after the approval of the treaty." (Emphasis added.)

CONCLUSION

I wish to thank you again for this opportunity to contribute to the record of your deliberations. Decisions made in the immediate future with respect to the disposition of Alaska's natural gas will affect every American citizen. The El Paso Project will bring Prudhoe Bay natural gas to the American people as quickly, economically and securely as possible with an absolute minimum of adverse environmental effects.

Senator STEVENSON. Thank you, Mr. Boyd.

We will complete the balance of the statements and then proceed to the questions. I will have to urge you all once again to be just as concise as you can or we will never complete the hearing.

Mr. Blair.

Mr. BLAIR. Mr. Chairman, I am Robert Blair, appearing in response to the invitation letter of the chairmen of the committees.

My principal job and responsibility is president of the Alberta Gas Trunk Line Co., which has transmission systems in the Province of Alberta and gathers and transmits about 70 percent of the gas produced in Canada, including substantial quantities of the gas I will describe today as exported from Canada presently into the United States.

I serve also as president and chief executive officer of Foothills Pipe Lines Ltd., an applicant company incorporated by special act of the Parliament of Canada which is proceeding, sponsored by Alberta Gas Trunk and Westcoast Transmission Co., through regulatory procedures and parliamentary review in Canada.

Westcoast performs a similar role in the Province of British Columbia and so handles about another 20 percent of the gas produced in Canada.

Westcoast is not exactly an agency of the government of British Columbia, for the record. It is a shareholder company, and British Columbia owns the significant minority share position, and it does act as the agent of the gas commission in moving all of the gas across the province.

The two companies, Westcoast and Alberta Gas Trunk, through ownership of shares in Foothills and participation in the top management of Foothills, are both committed to the application which has been mentioned as proceeding in the Canadian jurisdiction and which has been described, Mr. Chairman, in response to the questionnaire from your committee dated January 1976 and filed on February 11.

Since this material is in your record, I will not burden the committee this morning with detail, but try to summarize the situation for you.

Foothills' application is to construct an entirely Canadian-owned and operated gas system of 42-inch diameter through the Mackenzie Valley with emphasis on the employment of the existing pipeline systems in Canada, to use their existing extra capacity in increments to deliver additional natural gas in the future.

The applications of Foothills are before the National Energy Board, and will be considered, along with that of Arctic Gas, when the hearing recommences on April 12 under a new panel.

Foothills is similarly an applicant and a party in the hearings before Mr. Berger's judicial inquiry into the environmental and social impact of gas lines through the Northwest Territories.

In our third arena of governmental review in Canada, we are much involved with the various political groups, native and others, which are concerned with the definition in Canada of the political rights and citizenship rights of persons resident in the Northwest Territories in Canada, which is a matter still requiring definition and resolution.

In terms of engineering and construction management, the Foothills project is ready to proceed at whatever time a gas pipeline service is required. But in terms of the obvious and necessary needs of regulatory and other governmental review, we recognize that some time remains ahead before a project will be authorized.

At the moment, the earliest date of gas production scheduled in the Mackenzie Delta is 1981, and while that nominal date has been submitted publicly by the producers, those of us watching the situation closely are inclined to believe that 1982 is a more practical expectation.

There are many pronounced differences between the Foothills' application and that of Arctic Gas.

The detailed comparison is occurring on the record in Canada and is available to your staffs.

If I might, Mr. Chairman, just briefly summarize the many areas of difference, I would be prepared to leave it at that in your forum.

First: Rather than construct an entirely new express system across western Canada as Arctic Gas would do, as is shown on a map that has been put up on the wall, Foothills would build in every respect possible on the existing Canadian pipeline facilities, none of which are shown on that map. The map characterizes an express system from Alaska and the Mackenzie Delta into the United States, and doesn't show anything of the substantial existing plant that exists in Canada and the good-sized markets across all of that virgin territory.

Second: We have necessarily designed the proposal to hold our initial capital requirements down as far as can possibly occur while still preserving good unit cost advantage in the long-term.

Third: Since the initial capital requirements are held down and are spread over several operations, financing can be achieved with less difficulty.

Fourth: We do provide for complete share ownership by Canadians.

Fifth: The Maple Leaf project offers Canada a project which will be subject to present and future regulation only by one sovereign jurisdiction.

The Maple Leaf project can be financed without Government funds. Our project relies upon pipe produced in Canada and is more cautious in its construction plan and operating pressures.

There is contention about the sufficiency of the Mackenzie reserves to be a basis for a separate project in Canada. Within our jurisdiction and also before the Federal Power Commission we have entered evidence that we believe that the reserves there now, even only that which has been demonstrated so far, is in fact sufficient for the proper cinduct of the application and that with only the small and normal growth of reserve to be expected by the time of financing does make the project feasible.

Mr. Chairman, one thing I want to emphasize is that we are pipeline operators, this is our business, and our stock in trade; our professional management reputation in Alberta Gas Trunk and Westcoast rests on the kinds of projects that we participate in and we are a success, and we do not speak about a project being feasible carelessly or in any exaggeration.

We are convinced that the suggestions that Canada needs to piggyback on Alaskan gas in order to have access to its own new source area are wrong, and incorrect, and have been, we are convinced, well refuted in the proceedings in Canada.

We are also convinced that the unit costs to Canadians of moving gas from the Delta through a separate system such as Foothills proposes will overall be no greater than the corresponding costs of moving that Canadian gas jointly with gas from United States sources.

The submissions as filed by Arctic Gas and by Foothills actually show a modest advantage to the Foothills scheme in terms of it producing a lower unit cost, an advantage of the order of 10 percent or a little more.

I don't mean in this proceeding to suggest detailed and thorough comparison of the costs that will occur in the proven jurisdiction, but I want to get it well into your mind, if I may, that large and responsible Canadian pipeline companies are denying and we believe refuting the proposition that there is a Canadian benefit in terms of cost and time from the international project of the sort advanced by Arctic Gas.

Mr. Chairman, the letter of invitation particularly asked for our comment on two other matters besides a description of the concurrent project advanced by Foothills.

The other matters are the two alternative suggestions for the movement of gas from the north slope of Alaska, being the Fairbanks corridor-Alcan Highway alternative and the alternative of conversion of all of the gas to methanol and the remainder of my remarks are in response to that letter of invitation from the committees.

While we have given our main attention to the project which is the obviously appropriate one in our view for the Mackenzie Delta gas, we have been considering from time to time the possibility and prospects for the movement of United States gas from the north slope of Alaska by any route.

In Alberta Gas Trunk and Westcoast we had not been presuming any responsibility for performing that function. Our interest has occurred in part because we have business friends and other friends in the United States who have raised the question with us on occasion of whether there is not something more than our companies might contribute to the difficult choice and selection that will occur in the United States in that respect to obtain and connect the Alaska gas supply, if there is not something we could do over and above our present day-to-day operations of maintaining the present export deliveries of Canada into the United States.

Another part of our interest, Mr. Chairman, has occurred through our realization that the scale of any of those projects is so large that if there is any development of this sort coming our way as a matter of regional self-protection we have just got to keep our heads up and be realistic about what the possibilities may be.

One thing plain to any of us seeing this situation is that each and any one of these pipeline projects has the potential, because of their scale, to absolutely rock our whole gas pipeline and gas distribution industry and to shake up even our regional industrial economy and even our Canadian economy by requirement of capital, materials and construction forces; and could quite possibly rock our political environment through focusing of international, provincial and territorial government issues. In light of Canada's history, we know enough about pipeline projects and their potential political and economic effects to see that we have to keep all of the possibilities under continuing review as a matter of management responsibility.

Whichever choices of routes and specific service objects may exist, we do believe consistently in the practices of identifying a manageable project design, keeping the initial capital cost as modest as we can correlate with long-term unit cost advantages and above all in watching out for public and political concerns at all levels. Our companies are large in western Canada, but they are not large enough to afford to share in any serious international investment or utility mistake.

In this atmosphere, we have not been surprised to receive inquiry from businss and government people in the United States in a direction very similar to that which we expound within Canada.

It has been suggested to us that compared to the present applications there may occur a somewhat smaller initial production of the oil-associated natural gas from Prudhoe Bay than advertised, a more gradual or at least a less certain build-up of those production quantities in the early years of operation, more accommodation of the State of Alaska's positions on gas routing and more utilization of existing transportation installations. We have been given their positions on gas routing and on utilization of both the existing transportation installation, the highway and gravel pad of Alyeska, and the utilization of gas in the State, and we have given consideration to what we could contribute to minimizing and spreading out the initial capital cost over a number of companies by participating with our Canadian companies in the movement of the Alaska gas with the lowest capital cost and in the most economical way possible.

We have some immediate cautions about Canadian participation in such a scheme and I will come back to that a little later.

However, we have also completed estimates of the capital cost and the transmission service charges for a pipeline connection from Prudhoe Bay across Alaska to western Canada to the existing systems in western Canada, using those systems to delivery points along the 49th parallel. The total capital investment required to place this system in operation for 1981 is just under $4 billion in escalated dollars, that is the total system in Alaska and Canada.

The system as so estimated would employ 42-inch diameter pipe for the whole route of the new connection, to carry about 1 billion cubic feet per day initially, increasing to about 2½ billion cubic feet per day with progressive expansion of capacity by adding compressor stations.

May I refer, Mr. Chairman, in giving these figures which are the first time that these estimates have been made publicly, may I refer please to a map which is attached to the back of the written testimony filed with the committee.

I use this map as my reference in reporting these estimates as they were requested.

Of the initial $4 billion, about $1.9 billion would be invested in the State of Alaska along the route of the pipeline shown in yellow on the attached map. That is the route from the North Slope down past Fairbanks, still in the Alyeska Pad, to a point named Delta Junction, and thence down the Alaskan Highway to Yukon boundary.

As shown in green along the Alaskan Highway, $1.6 billion would be invested in the new mainline connection within Canada; and $0.5 billion would be invested in expansion of the existing systems of Westcoast Transmission and the Province of British Columbia, and Alberta Gas Trunk in the Province of Alberta.

When this system becomes later expanded to full capacity, the cumulative capital investment in escalated dollars, and we use all of the same factors and cost units in this as have been used by the other applicants, and by foothills in its own project, the total cumulative capital investment would be about $5.4 billion, and the total cost of service to move the Alaskan gas to points along the international boundary, the existing points of delivery on the south of the Provinces of British Columbia and Alberta, would run $1.12 cents per million Btu.

Incidentally a lower transmission charge than that which has been submitted in evidence by Arctic Gas.

We have confidence in the accuracy of those estimates within Canada, our own construction, management, and engineering people in Alberta Gas Trunk and Westcoast have gone over the design and routing thoroughly, and these are the people who added several hundred miles this year, over a thousand miles of new pipeline connections in our two provinces in the northern areas.

We also believe that our approximation of the costs in Alaska is reasonably indicative, although we have less qualification to speak to pipelines in that area.

We conclude that as far as engineering and construction factors are concerned, such a system is manageable and even rather superior and if approved by all concerned, it could apparently provide the capacity to move the Alaskan gas to the lower 48 States on a unit cost favorably comparable with any other proposals.

In these estimates, our engineering and construction management staff assume 30 percent of the Alaskan gas would go to the State of Washington through the Westcoast Transmission system, and the remaining 70 percent would go to U.S. companies taking delivery either at the south end of Alberta and British Columbia, or through trans-Canada pipelines for further transmission to the Western and Northeastern States.

In these estimates we have covered the cost of all of the systems shown on the map except only that early or eventual gas pipeline from the Fairbanks area, shown in yellow on the map.

That leg of the line has not been included in the figures I gave you, but I would like to comment and explain why.

We believe that the study invited by Senators Magnuson and Jackson of Fairbanks-Alaskan Highway corridor is probably worthy, because besides the assumptions I mentioned, attention has been called to the relatively low environmental sensitivity, to the good construction logistics, good operations access, prompt land claims settlement and other favorable factors.

But I must emphasize that a real business response to this kind of arrangement could only occur if there was an initiative from the United States to seek such a service, and also if the Government authorities in Canada let us know it was their choice that we endeavor to work out such an alternative.

I just mean to underline from my own limited base of authority in Alberta Gas Trunk that while we are far from "isolationist" and do act energetically to market commodities or services to the United States, whenever we can develop new business at arm's length and obtain a satisfactory return and value added in Canada, for this Alaska situation we are not ourselves sponsoring or proposing a new project. We are just explaining our reaction now to a future possibility which has been raised. We could only go further if there were an American request and the Canadian Government request and sanction and also if there were the express endorsement of our close partner, Westcoast.

It is a fact of life, speaking more generally, that pipelines do a great deal more for the highly populated areas than they do for the country through which they pass.

For the large capital investment needed, the region traversed gets relatively small benefits in cases in which the transmission operation is strictly an express-through job. This is a matter requiring the greatest of attention by the State of Alaska. This is also the reason foothills proposes certain accommodations to the Northwest Territories through which our pipeline will pass. And it is a weighty factor my company has to consider in agreeing to carry any foreign gas across the Province of Alberta.

For instance, for under $50 million of capital investment, Alberta Gas trunk and a partner have installed enough methanol manufacturing capacity in this province to change Canada from being a 90-percent importer of methanol into being self-sufficient in this supply plus having about 75 percent more than Canadian requirements available for export sales until the Canadian market grows to need it all.

As to the kind of priorities I have, I feel more interested in investing $50 million that way than in investing $250 million to express Alaskan gas through Alberta, frankly.

So while it is a utility operation, we do not refuse to consider any help to a neighbor with a problem. I want to emphasize my judgment is that any such help should be partial and supplementary and that in no way are we out selling ourselves into seeking the whole job and responsibility.

We have given some thought to the kind of cautionary provisions which we should point out early in any such discussion and in our view they are as follows:

One: That in any application by a pipeline company in Canada to provide transmission services for some of the gas to be produced from Alaska, there be particular recognition, expressed in the application and any forms of contract, that besides the commercial undertakings for transmission there needs to be also a future decision of principle by the Government of Canada. The principle is whether to confer a long-term transmission service access for Alaskan gas to U.S. markets through routes crossing western Canada by 150 miles or more, subject to Canadian regulatory authority.

Two: Similarly, that there be particular recognition that there must be decisions by the provinces of Alberta and British Columbia and the National Energy Board that the gas pipeline companies providing service for gas produced in those provinces may integrate through their systems a further service for the transmission of Alaskan gas to U.S. markets.

Three: That the arrangements for transmission of some Alaskan gas across western Canada be accompanied with other long-term arrangements to move other Alaskan gas interstate and also intrastate as by liquefaction and ocean transport within the U.S. jurisdiction, so that Canadian companies shall not inherit complete responsibility for all future investment in providing and expanding transmission capacity for future gas production from the North Slope of Alaska.

70-636—76——5

Also that the design of the new 800-mile pipeline connection in Canada not exceed the size and specification of pipe available, tried, and true from Canadian and other North American pipe mills nor exceed the project scale capable of orderly financing without financial contribution or guarantees by governments in Canada.

Four: That transmission services to move Alaskan gas a further 700 miles, or 800 miles through British Columbia or Alberta, to delivery points from those Provinces across the 49th parallel or through trans-Canada to points of delivery eastward, be provided on terms to U.S. shippers of Alaska gas which are not more favorable to such shippers than to concurrent terms of services to Canadian users.

Five: That Canadian pipeline operators transmitting Alaska gas shall exercise similar rights and responsibilities in the operational use and handling of the gas as for Canadian gas in their possession.

After having pointed out all these serious conditions which must be considered, I would like to point out that in our opinion this overall scheme could have some definite advantages.

It does remove several uncertainties about construction, recognizing that the pipeline in Alaska can be placed on the gravel pad of Alyeska and from Fairbanks to Fort Nelson it follows the Alaska Highway which provides excellent access for material and construction. From Fort Nelson south, it is merely expansion of existing systems. Along the whole route of the pipeline there are excellent airstrips providing quick access. If such a project were started shortly after completion of the Alyeska line, all the equipment, camps, and all the manpower mobilization and administration associated with that project could be utilized for the gasline project, thus affecting substantial savings. So as far as that alternative, I will leave it at that.

We have replied with a statement of our own policy position with respect to such developments, and our own best figures on cost.

The other alternative we were asked to respond to today was that because of our recent installation of two world-scale methanol manufacturing plants in Alberta, which is that quantities of natural gas be converted to methanol and moved to market as a liquid energy source.

We have had a brief look at that alternative and have two immediate reactions. The first is that some of the factors which have caused us to move aggressively in Alberta in the manufacture of chemical grade methanol probably exist in Alaska, too. The merits of developing industrial benefits for the producing State or Province by adding value through processing locally, using some of the raw hydrocarbon for locally based and owned industry, are bound to come up in Alaska, too, and personally I cannot do anything but enthuse about those purposes.

It doesn't take much gas to make methanol or ammonia-based petrochemicals and we maintain that while exporting all those jobs to other more populated areas, through a pipeline, it is just plain right to keep a bit of the supply at home and give the local economy a share of the action.

However, as to converting all of the natural gas produced into methanol, as an energy transportation mode, our people are very negative. I admit, of course, that because we have become one of the larger producers and makers of chemical-grade methanol in North America, we would have a clear conflict with the sudden appearance on the market of new methanol in quantities which, for each 1 billion cubic feet per day converted, would be equal to three times the U.S. requirement in 1973–74, even if its cost base were much higher than ours. So please don't consider us to be detached as to business interest.

My methanol expert colleagues have been asked about the possible feasibility of this alternative and judge that it would be both too expensive and too inefficient in terms of energy conversion to stand comparison with pipeline transmission as the means of moving the main gas stream from Prudhoe Bay.

My expert colleagues have reviewed carefully the report of the Institute for Energy Analysis as submitted to this committee and perhaps I can most effectively summarize their conclusions by a brief comparison with the conclusions of the institute report.

We believe the conversion efficiency of methanol synthesis on the North Slope would be somewhat lower, it would be more like 49 percent than the 63 percent the institute estimated.

We believe that the capital cost would actually be about double those estimated by the institute. And we represent that on the basis of our most recent cost experience in installing plants of large scale in Alberta, and then by adding our own calculations of additional costs in the arctic areas. We believe also that compared to the 50 cents a million Btu's field price assumed by the institute, that the real value of gas in the North Slope will be substantially higher, perhaps as high as approaching $2 a thousand cubic feet, by the time that gas is delivered and that should be taken into account.

Using such calculations, and a somewhat faster depreciation rate and a different assumption on tariffs than the institute used, our own best estimate of the actual laid-down cost of methanol in Los Angeles would be about 66 cents per gallon or $10.91 per million Btu's, as compared to 25 cents a gallon, or $3.69 a million Btu's, as estimated by the institute.

Mr. Chairman, the report on this was prepared by a department of my company, our Planning and Development Department, and expressly for this appearance, in response to the committee's letter. It also had the particpation of the president of the affiliate company that makes the methanol, and if it is proper or of any use to the committee or the staff, I would be pleased to submit this for the record for whatever use you may like to make of it.

Senator STEVENSON. Thank you, Mr. Blair. It will be received by the committee.

Mr. Blair, as I understand it, the Canadian National Energy Board cannot act except on applications before it, which it either approves or disapproves, is that right?

Mr. BLAIR. Yes.

Senator STEVENSON. And is the Alaska Highway proposal which you have described embodied in an application before the NEB now?

Mr. BLAIR. No, sir, it is not. All I have done this morning is submit information about our prospective participation in such a project if we have a United States initiative.

So it is a job for the United States and our participation would only be cooperative.

Senator STEVENSON. But will it be embodied in an application that can be considered in what has been described as a lengthy regulatory process in Canada?

Otherwise what relevance is it to us, assuming we want to move ahead?

Mr. BLAIR. Mr. Chairman, I could only surmise what relevance appears to the committee and to Senators Magnuson and Jackson when they invited our response to this possibility.

I would say this, in Canada we are seeing something happen which is also obviously happening in the U.S. jurisdiction, and that is a public conjecture as to whether the regulatory process should result in only the consideration of projects for which corporate sponsors have committed their financial suuport. It is said in Canada, it has been said in our Parliament, that perhaps all of these good companies have enough self-interest, case by case, that none of them nor any combination of them will necessarily produce the project which is best for Canada, and one result of that kind of discussion in Parliament has been a broadening of the instruction to the National Energy Board as to what it should investigate, to go beyond the two applications presently before it.

And that has resulted in, for instance, the Energy Board's addressing the applicants, and instructing them to reply on other alternatives that the Energy Board staff thought of, including different permeations and combinations of designs proposed by various applicants.

I have seen the Federal Power Commission staff act similarly in the United States, and it has expressly recommended consideration of the project we are speaking of today.

So my comments to you are only or are nothing more than a part of the response to that kind of thing. We are not applicants, we don't purport to be, because this is not a primarily high-priority objective of ours.

We have other things we want to do in these years, but we don't like to block the well when a neighbor is thirsty, and we have got to have some kind of a constructive response and that is all this is.

Senator STEVENSON. It is a constructive response, thank you.

[The statement follows:]

STATEMENT OF S. ROBERT BLAIR, PRESIDENT AND CHIEF EXECUTIVE OFFICER, ALBERTA GAS TRUNK LINE COMPANY LIMITED

My name is Robert Blair and I reside in Alberta, Canada. I am here today through invitation of a letter from Senators Magnuson and Jackson and offer to describe to you as background information, the Maple Leaf Project for connection of Canadian gas from the Mackenzie Delta/Beaufort Sea area. Also I agree to respond to the request of the Joint Committee for information with my views with respect to the transportation of Alaska gas across Canada via a Fairbanks Corridor—Alcan Highway system or its marketing through a methanol conversion system.

My principal job is President and Chief Executive Officer of The Alberta Gas Trunk Line Company Limited (Alberta Gas Trunk). That Company was formed in 1954, by special act of the Alberta Legislature, to provide the residents of Canada's principal petroleum-producing province with a medium for direct investment as shareholders in the petroleum industry then emerging.

Alberta Gas Trunk gathers and transmits about 70% of the natural gas produced in Canada and is also engaged in other natural gas business and in petrochemicals and manufacturing.

I serve also as President and Chief Executive Officer of Foothills Pipe Lines Ltd. (Foothills), an applicant Company incorporated by special act of the Parliament of Canada which is proceeding, sponsored by Alberta Gas Trunk and Westcoast Transmission Company Limited (Westcoast), through regulatory procedures and parliamentary review in Canada. Westcoast gathers and transmits the gas produced in the province of British Columbia and so handles another 20% of the natural gas produced in Canada. The Chairman and Chief Executive Officer of Westcoast is also the Chairman of the Board of Foothills and the President of Westcoast is also a Vice President and Director of Foothills and so these two of the three major gas pipeline companies in Canada are joined in sponsorship of Foothills. Westcoast, Alberta Gas Trunk and Foothills propose to constitute the gas transmission service arrangement called the "Maple Leaf Project".

Foothills' one and only application is to install a pipeline for the new frontier gas being developed in the Mackenzie Delta and Beaufort Basin in Canada, to connect to the main existing systems in Canada and provide gas to the communities in the Mackenzie Valley and Great Slave Lake areas.

The pipeline design proposed by Foothills represents the best assessment of Westcoast and Alberta Gas Trunk of the most orderly, economic and manageable route and sizing for connection of the Mackenzie Delta gas.

In response to the Committee's Questionnaire dated January, 1976, Foothills, and its sponsors filed a submission with your Committee on February 11, 1976. My remarks today will first summarize the material contained in that submission, if you approve, Mr. Chairman.

The application by Foothills is to construct an entirely Canadian-owned and operated natural gas pipeline of 42 inch diameter from the Mackenzie Delta/Beaufort Sea area south through the Mackenzie Valley to a delivery point near the 60th parallel (northern boundary of the Provinces of Alberta and British Columbia). From this point, interconnections will be made with the mainline facilities of Westcoast and of Alberta Gas Trunk. The gas will then be transported through the present western Canadian transmission companies facilities, much of it to a point of interconnection near the Alberta/Saskatchewan border with TransCanada PipeLines Limited (Trans-Canada). The gas will then be transported by TransCanada to the markets east of Alberta. A map is attached at the end of this testimony.

Presently, the applications of Foothills and Canadian Arctic Gas Pipeline Ltd. (Arctic Gas) for construction of their respective pipelines are pending before the National Energy Board. A hearing of those applications, which commenced on October 27, 1975, has been effectively terminated by a decision of the Supreme Court of Canada which held that the Chairman of the Panel hearing those applications should not hear the applications.

At the date of the preparation of these remarks, the National Energy Board had appointed a new panel to hear the applications but had not fixed a new date to commence a new hearing, although I expect such a hearing might commence during the latter part of April. The hearing will have to start from the beginning and it is my view that they will continue well into 1977. The report to be made by the National Energy Board as a result of the hearing will then be forwarded to the Canadian Cabinet, which has committed to referring the entire matter to the Canadian Parliament for debate.

In addition to the proceedings before the National Energy Board, there is a concurrent hearing being held by Mr. Justice Thomas Berger to inquire into and report to the Canadian Government upon the terms and conditions that should be imposed in respect of any right of way that might be granted by the Canadian Government for the purposes of a Mackenzie Valley pipeline. It is my expectation that this hearing will not conclude until late in 1976, at which time Mr. Justice Berger's recommendations will go forward to the Government for its consideration. In addition to these proceedings, there are transactions involving definition of the future lands entitlements and political rights of the native and other residents of the entire Northwest Territories which must also proceed before construction of any main pipeline there.

Therefore, while Foothills' requirements for authorizations are simple, and its engineering and construction plan is completed, it is acknowledged that considerable time is still needed for regulatory and government decisions. The first production of gas in the Mackenzie Delta is presently scheduled nominally for 1981 by the producers. It is not known yet whether the overall development will achieve that schedule. Foothills itself is ready to proceed at whatever time a gas pipeline service is in fact required.

In this forum today I am supposing that you will not want a review of every reason for the difference between the Maple Leaf and Arctic Gas projects. That comparison is occurring on record in Canada and is available to your staffs. May I just present to you in that respect that we know the situation in Canada, are natural gas pipeline operators by trade, and are committed very earnestly and optimistically to Foothills' project. I will just summarize some major differences between the Maple Leaf project and the Arctic Gas project, insofar as the Canadian public interest is concerned. First, rather than construct an entirely new express system through Canada as Arctic Gas would do, Foothills proposes to utilize existing Canadian pipeline facilities to the fullest extent possible with resulting benefit to other users. Secondly, by this same approach, we are able to hold our initial capital requirements down so as to avoid a depletion of financial resources needed for other worthy projects. Third, since the initial capital requirements are minimized and spread over several operations, financing can be achieved with less difficulty. Fourth, our project provides for complete share ownership by Canadians. Fifth, the Maple Leaf project offers Canada a project which will be subject to present and future regulation by only one sovereign jurisdiction. Sixth, the Maple Leaf project can be financed without government funds. Seventh, our project relies upon pipe produced in Canada and is more cautious in its construction plan and operating pressures.

Another major point of contention is sufficiency of Mackenzie reserves. The latest estimate of reserves in the Mackenzie Delta/Beaufort Sea area on a most likely basis, made by Foothills, was 6.2 trillion cubic feet (Tcf). The designation "likely", or "most likely", refers to that quantity of gas which, on an engineering basis, will ultimately be produced from a reservoir. This is the nomenclature gaining preference for frontier sources by other organizations, including the Geological Survey of Canada. Foothills' consultants believe that it is still unrealistic to use conventional designations such as "proved, probable, and possible" insofar as reserves in the Mackenzie Delta are concerned, since delineation drilling, which is required to make a final evaluation of reserves on this basis, will not be sufficiently advanced until after a pipeline is certificated.

Drilling activity during the 1975/76 drilling season has resulted in a significant gas find by Sun Oil Canada Ltd. at their Sun Gary location, and delineation drilling by Gulf Oil Canada Ltd. at Parsons Lake has resulted in increased reserves for that reservoir. Foothills expects that once the well information on these successes is made available, reserves in the Mackenzie Delta area will be approximately 7.7 Tcf on a most likely basis at this date, excluding gas which may be added as a result of other exploratory wells now being drilled.

Foothills' consultants have estimated the ultimate potential for the Mackenzie Delta area, including the offshore to a water depth of 600 feet, to be 39.1 Tcf. This is the most conservative estimate of ultimate potential made to the National Energy Board (NEB) of Canada during its 1974/75 supply-requirements hearings. Estimates ranged from 39.1 Tcf by Foothills to 110 Tcf by the Canadian Petroleum Association.

Representatives of the Arctic Gas consortium have frequently asserted that Canadians have no choice other than to "piggy-back" their Mackenzie Delta reserves on top of Alaskan gas being transported through Canada. Mackenzie Delta reserves alone, it is argued, are not sufficient to finance and economically justify an all-Canadian pipeline. Foothills, Alberta Gas Trunk, and Westcoast strongly disagree with this claim. The construction of the Foothills pipeline to deliver 1.2 billion cubic feet of gas per day requires only 2 billion dollars. This provides a complete 42-inch line with four compressor stations. Later expansion from that level to a capacity of 2.4 billion cubic feet per day is accomplished by the addition of more compressor stations and the money for this expansion can come from internal cash flow and normal financing by the established companies. Therefore, at the time the project is financed—and it looks now as if this will be not earlier than late 1978 for equity and late 1979 for debt—it will only be necessary to show that there are enough reserves to sustain a flow of 1.2

billion cubic feet per day, or less, for sufficient years to pay out the line. This is calculated to require from 7 to 8 trillion cubic feet.

Threshold volumes to build the pipeline are, therefore, not 15 to 18 trillion cubic feet as some people have publicly claimed; they are more like 7 to 8 trillion cubic feet.

With regard to cost of service, or unit cost of transportation, the claim has been made that the unit cost of delivering Mackenzie Delta gas to Canadian markets through the Maple Leaf project will be too high, and that for this reason, also, Delta gas must be "piggy-backed" on top of Alaskan gas in a 48 inch line to obtain acceptable unit costs. This is not so. We are completely familiar with normal economies of scale which make unit costs somewhat lower as line sizes get larger but, in this case, there are some offsetting factors. Main among these is that the Maple Leaf project makes use of conventional materials and present organizations and facilities to transport the gas south through Alberta and British Columbia instead of having a wholly new organization and new facilities for this section. This Alberta section amounts to about half the total distance between the Mackenzie Delta and the delivery point to TransCanada at the Alberta-Saskatchewan border.

When the Arctic Gas project was originally conceived, it was anticipated that substantial quantities of natural gas from the Mackenzie Delta would be reclared "surplus" to Canadian requirements, and, therefore, would be made available for additional export to the United States. It is now generally recognized, however, that Canada will need the Delta reserves to satisfy its own growing demand. In fact, the National Energy Board of Canada has recently issued a report finding that:

"Without substantial supplies from Canada's Frontier areas, growing domestic requirements could not be satisfied beyond 1985 even if all exports were diverted to domestic markets as required. Without substantial further development of the conventional producing areas they could not be satisfied beyond 1979 even with exports diverted to domestic markets as required to meet domestic deficiencies."

Another topic closely associated with the northern pipeline project is the native land claims issue. Foothills is sympathetic to native land claims and would prefer to have them settled before construction of a pipeline begins. Because of regulatory requirements, Foothills believes there is time for this to happen. Foothills is also aware of the growing need in eastern Canada for the energy from the north. This need must be weighed against the need for time to settle northern affairs. The Maple Leaf group is actively attempting to find a solution to these divergent requirements by working diligently on a program to increase the supplies of gas from Alberta over the interim period until the northern pipeline can be completed. There is definite probability of this being accomplished.

Foothills' construction schedule can be tailored to suit Canadian needs for thorough regulatory proceedings and settlement of native land claims. Arctic Gas's construction schedule cannot be tailored to meet Canadian requirements because of the urgent need of the United States for the Alaska gas.

Foothills and its sponsor companies, Alberta Gas Trunk and Westcoast, fundamentally believe that United States—Canadian relations will be strengthened through the construction of separate and distinct Arctic transmission systems. Accordingly, we are differing from the joint project which has been proposed by the Arctic Gas consortium.

Above all, the Congress should not labor under the impression that Canada needs the Arctic Gas project in order to gain access to its Mackenzie Delta reserves. The Maple Leaf project offers Canadians an opportunity to own, operate, and manage their own Arctic transmission systems for their own total benefit.

In Canada we are therefore considering some of the same problems which you are considering for United States gas. Your invitation asked for our views on alternative approaches for the delivery of Alaskan gas to its intended markets.

In Alberta Gas Trunk and with Westcoast, we have made some assessment of such alternatives. We are certainly not presuming any responsibility or initiative. Our interest occurs so far partly because we have business friends and other contacts in the United States who have raised the question with us of whether there is not something more that we could contribute to a difficult situation over and above our present actions to maintain the present export deliveries from Canada to the United States. Another interest is from our realization that if there is any main development coming our way as a matter of natural self protection we had better keep our heads up and size it up and see what is might do to us. One thing plain to all of us is that each and any arctic gas pipeline project has the potential to really rock our whole natural gas service industry and shake up regional industrial economy and even our Canadian economy by requirement of capital, materials and construction forces; and could quite possibly rock our political environment through focusing of international, provincial and territorial government issues. In light of past Canadian pipeline experience we would be foolish not to see that such impacts are there potentially so we do try to keep all of the main possibilities under continuing review.

Whichever choices of routes and specific service objects may exist, we do believe consistently in the practices of identifying a manageable project design, keeping the initial capital cost as modest as we can correlate with long-term unit cost advantages and above all in watching out for public and political concerns at all levels. Our companies are large in western Canada but they are not large enough to afford to share in any serious international investment or utility mistake.

In this atmosphere, we have not been surprised to receive inquiry from business and government people in the United States in a direction very similar to that which we expound within Canada. It has been suggested to us that compared to the present applications there may occur a somewhat smaller initial production of the oil-associated natural gas from Prudhoe Bay than advertised, a more gradual or at least a less certain build-up of those production quantities in the early years of operation, more accommodation of the State of Alaska's positions on gas routing and more utilization of existing transportation installations. We have considered what our views would be about a deliverate plan to minimize and also spread out the initial capital cost of transmission facilities for Alaska gas until more information becomes available. We would have some immediate cautions about Canadian participation that I'll note shortly. However we have made an estimate of the cost of carrying Alaska gas from the Alaska-Yukon Border near Northway Junction along the Alaska highway to Fort Nelson and thence through Westcoast's and Alberta Gas Trunk's systems to the 49th parallel in southern B.C. and Alberta; the gas destined for the western United States to go through Westcoast's system and that destined for the eastern United States to go through Alberta Gas Trunk's system. Our estimate was based on a 42 inch diameter pipeline being built along the Alaska highway from Northway Junction to Fort Nelson to carry an initial volume of 1 billion cubic feet per day, rising over 4 years to 2.4 billion cubic feet per day. At Fort Nelson the gas was assumed to split approximately 30% through Westcoast's system and 70% through Alberta Gas Trunk's system by gradual expansion of these systems as required. I should point out that our estimates are of a preliminary nature but have been done with enough care so that we are confident they give reasonably accurate results.

In addition, in order to be able to get an idea of the total cost of delivering Prudhoe Bay gas to the 49th parallel we have made an estimate of the costs of a 42 inch pipeline across Alaska from the North Slope along the route of the Alyeska pipeline to Delta Junction and thence from Delta Junction along the Alaska highway to Northway Junction. This estimate must be considered less reliable than the estimate we have made for Canada.

The Joint Committee's invitation to fine testimony in advance has developed on brief notice to us and my colleagues are using the days before my appearance on March 24 to work up our most current figures which I will be able to give at the time of the appearance. I will provide the information we have.

Such study of a Fairbanks-Alaskan Highway Corridor is probably worthy because, besides the assumptions mentioned above, attention has been called by others to its relatively low environmental sensitivity, good construction logistics, good operations access, prompt lands claims settlement and other favourable factors. However, I emphasize that a real business response to this kind of arrangement could only occur if there was an initiative from the United States to seek such a service and also if the governmental authorities in Canada let us know that it was their choice that we endeavour to work out such an alternative. I just mean to underline from my own limited base of authority in Alberta Gas Trunk that while we are far from "isolationalist" and do act energetically to market commodities or services to the United States, whenever we can develop new business at arm's length and obtain a satisfactory return and value added in Canada, for this Alaska situation we are not ourselves sponsoring or proposing a new project. We are just explaining our reaction now to a future possibility which has been raised. We could only go further if there were an American request and Canadian government request and sanction and also if there were the express endorsement of our close partner Westcoast.

It is a fact of life that pipelines do a great deal more for the highly populated areas that they go to than for the country through which they pass. For the large capital investment needed the region traversed gets relatively small benefits in cases in which the transmission operation is strictly an express-through job. This is a matter requiring the greatest of attention by the State of Alaska. This is also the reason Foothills proposes certain accommodations to the Northwest Territories through which our pipeline will pass. And it is a weighty factor my Company has to consider in agreeing to carry any foreign gas across the Province of Alberta.

For under $50 million of capital investment Alberta Gas Trunk and a partner have installed enough methanol manufacturing capacity in this province to change Canada from being a 90% importer of methanol into being self-sufficient in this supply plus having about 75% more than Canadian requirements available for export sales until the Canadian market grows to need it all.

In the matter of priorities I would have, I feel more interested in investing $50 million that way than in investing $250 million to express Alaskan gas through Alberta, frankly. The demands of capital investment as well as management and engineering-construction would quite outweigh the commercial gain in transmission business. So while as a utility operation it is not in our policy to refuse any help to a neighbour with a problem I have wanted to emphasize that my own judgment is that any such help should be partial and supplementary and that in no way are we out selling ourselves into seeking the whole job and responsibility.

We have given some thought to the kind of cautionary provisions which we should point out early in any such discussion and in our view they are as follows:

1. That in any application by a pipeline company in Canada to provide transmission services for some of the gas to be produced from Alaska there be particular recognition, expressed in the application and any forms of contract, that besides the commercial undertakings for transmission there needs to be also a future decision of principle by the Government of Canada. The principle is whether to confer a long-term transmission service access for Alaskan gas to U.S. markets through routes crossing western Canada by 1500 miles or more, subject to Canadian regulatory authority.

2. Similarly, that there be particular recognition that there must be decisions by the provinces of Alberta and British Columbia and the National Energy Board that the gas pipeline companies providing service for gas produced in those provinces may integrate through their systems a further service for the transmission of Alaskan gas to U.S. markets.

3(a). That the arrangements for transmission of some Alaskan gas across western Canada be accompanied with other long-term arrangements to move other Alaskan gas intrastate and also interstate as by liquefaction and ocean transport within the U.S. jurisdiction, so that Canadian companies shall not inherit complete responsibility for all future investment in providing and expanding transmission capacity for future gas production from the North Slope of Alaska.

(b) That the design of the new 800-mile pipeline connection in Canada not exceed the size and specification of pipe available tried and true from Canadian and other North American pipe mills nor exceed the project scale capable of orderly financing without financial contribution or guarantee by governments in Canada.

4. That transmission services to move Alaskan gas a further 700 miles to 800 miles through British Columbia or Alberta to delivery points from those

provinces across the 49th parallel or through TransCanada to points of delivery eastward, be provided on terms to United States shippers of Alaska gas which are not more favourable to such shippers than to concurrent terms of service to Canadian users.

5. That Canadian pipeline operators transmitting Alaska gas shall exercise similar rights and responsibilities in the operational use and handling of the gas as for Canadian gas in their possession.

After having pointed out all these serious conditions which must be considered I would like to point out that in our opinion this overall scheme could have some definite advantages.

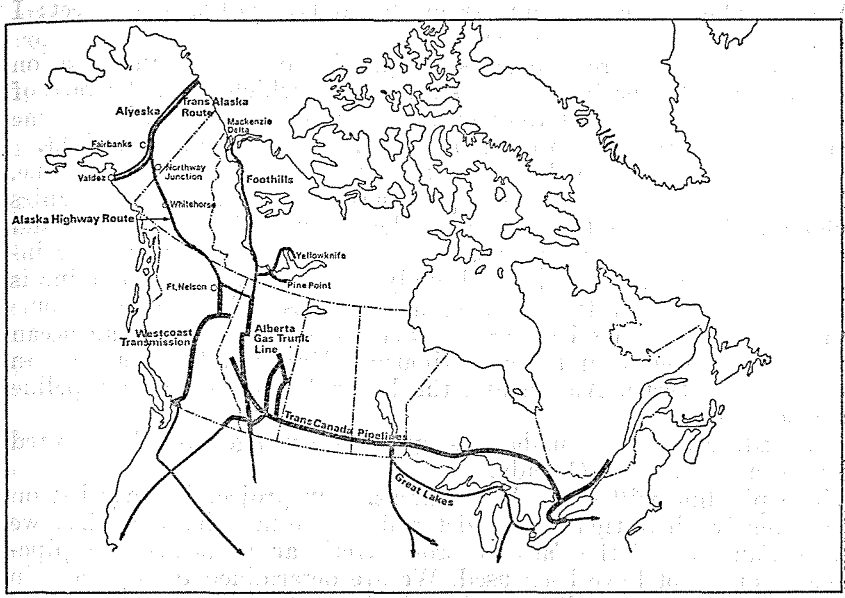
One extremely important point is that it removes several uncertainties about construction. The construction in Alaska can take place along the route of the Alyeska oil line, it can be built off the same gravel pad. From Fairbanks to Fort Nelson it follows the Alaska highway which provides excellent access for materials and construction. From Fort Nelson south, it is merely expansion of existing systems. Along the whole route of the pipeline there are excellent airstrips providing quick access. Construction of all sections of the line would therefore be by conventional methods and this should not only reduce the initial capital costs but substantially reduce the possibility of cost overruns. The fact that there would be excellent all-year access to all sections of the line would eliminate the possibility of lengthy interruptions of service and could eliminate the need for an all events tariff.

If this project could be started shortly after the completion of the Alyeska line all the equipment, and camps, and all the manpower mobilization and administration associated with that project could be utilized for the gas line project, thus effecting substantial savings.

There is the other alternative which we have been asked about because of our recent installation of two world-scale methanol manufacturing plants in Alberta, which is that quantities of natural gas be converted to methanol and moved to market as a liquid energy source. We have had a brief look at that alternative and have two immediate reactions. The first is that some of the factors which have caused us to move aggressively in Alberta in the manufacture of chemical grade methanol probably exist in Alaska too. The merits of developing industrial benefits for the producing state or province by adding value through processing locally, using some of the raw hydrocarbon for locally based and owned industry, are bound to come up in Alaska too and personally I cannot do anything but enthuse about those purposes. It doesn't take much gas to make methanol or ammonia-based petrochemicals and we maintain that while exporting all those jobs to other more populated areas through a pipeline, it is just plain right to keep a bit of a supply at home and give the local economy a share of the action.

However, as to converting all of the natural gas produced into methanol, as an energy transportation mode, our people are very negative. I admit of course that because we have become one of the larger producers and marketers of chemical-grade methanol in North America, we would have a clear conflict with the sudden appearance on the market of new methanol in quantities which, for each 1 BCFD converted, would be equal to three times the United States requirement in 1973–74, even if its cost-base were much higher than ours. So please don't consider us to be detached as to business interest.

My methanol-expert colleagues have been asked about the possible feasibility of this alternative and judge that it would be both too expensive and too inefficient in terms of energy conversion to stand comparison with pipeline transmission as the means of moving the main gas stream from Prudhoe Bay. I have asked them for their latest figures and estimates and for their appraisal of the Institute for Energy Analysis Report dated November 1975 and will report our information and views when I appear as a witness.



Senator STEVENSON. Mr. Brackett, will you proceed, please?

Mr. BRACKETT. Mr. Chairman and members of the committees, my name is William W. Brackett. I am vice chairman of the Alaskan Arctic Gas Pipeline Co., which has its home office in Anchorage, Alaska. My office is in Washington, D.C. Accompanying me on my left is Mr. Vernon Horte, president, Canadian Arctic Gas Pipeline Ltd., the Canadian portion of the Arctic Gas project.

Some of my other colleagues are listed on the first page of my written testimony and are with me today and can respond to detailed questions. I would ask that my rather extended written testimoney be introduced into the record and I will not, of course, attempt to read it today.

Senator BUMPERS. It will be received, Mr. Brackett. Is it your intention to present this testimony?

Mr. BRACKETT. No, sir, I think I will speak extemporaneously.

Senator BUMPERS. I would appreciate that very much. We are using a little more time than anticipated.

Mr. BRACKETT. I will attempt to conserve time. Like Senator Stevens, I shall not request equal time.

The extended remarks in writing which we have introduced are built upon the premise that the Congress may decide to make a decision in this matter and indeed can be competent to make a decision, and we have attempted to furnish detailed information.

We appreciate the opportunity to appear. The subject is obviously a topic of great importance. You have heard today, mainly from the El Paso project, arguments that the Arctic Gas project cannot be built. I shall respond. But first, I would like to talk briefly about why it should indeed be built, in the national interest. The need for gas in the United States, I think, is clear. It is a priority fuel; a unique fuel, pollution free. There are large supplies in northern

Alaska. The estimates range from 100 to 175 trillion cubic feet; I need not dwell on that subject.

I think we are here to discuss the question of what transportation method is in the national interest. The map which is on the face of some materials which I distributed to the committee will give the route of the Arctic Gas project, as does the relief map on my right.

We propose to build the facilities marked in red, green, and blue. The blue facilities are existing pipelines of western area companies which will be expanded as part of the system, whereas the red and green are new pipelines proposed to be constructed. I think the initial starting point is that in all analyses possible, a land pipeline is the best method of transporting natural gas unless there is some reason why it cannot be utilized, such as the existence of an ocean between the source and the destination. Happily, Canada, not an ocean, lies between Alaska and the lower 48 States and a pipeline can be used.

Indeed, crossing Canada has great advantages to the United States, as well as to Canada.

The pipeline will cross Arctic areas. Our project has carried on an extensive investigation to determine whether the fact that we cross Canada and the fact we cross Arctic areas means that pipelines should not have been used. We are determined to construct in the most environmentally sound method possible.

We have made what we believe to be a thoroughly researched proposal, dating back to 1968, encompassing studies, experiments, and tests which have involved expenditures in excess of $100 million, only in the preparatory stage. This is quite a contrast to some of the other projects.

It has involved field tests, research, experimentation. We have developed new machinery, new techniques, new seed methods. We have published 34 volumes of biological reports which our investigators have complied in the process of determining the best possible, and the most environmentally sound, method of constructing a pipeline.

Our proposal is based, we think, on knowledge, not on theories. We have spent millions of dollars in environmental studies and environmentally related studies. And we believe that this is a sound and thoroughly conceived method.

On the second page of the packet, following the map, you will see a chart which lists the various alternative systems for transporting natural gas which we studied. You will see use of the liquefaction process, with transportation by tanker, rail, even airplane and monorail and submarine. It also included the possibility of conversion of gas to electricity, or to methanol with transmission, in our case, by a methanol pipeline.

I won't dwell very long on the methanol proposal. Most of the comments Mr. Blair made, I agree with. Basically, it would involve the usage of natural gas, a high-priority fuel used for high-priority use, as, either a chemical feedstock or an additive for gasoline. To my mind, that reverses the priorities in our Nation. In addition, it involves a huge energy loss, approximately 50 percent of the Btu's, and the cost is extremely high. I believe you will hear from other witnesses later on this situation. We believe that this is not a reasonable and feasible proposal; there are other technological problems involved.

We believe that, and we hope the attention of the Congress will not be diverted by that type of untried proposal, but will concentrate on the methods of getting natural gas to the markets that need it so much.

We have studied a variety of routes. The third page of the packet gives a relief map of the Alaskan and Canadian portions of our proposal, and on it are marked the proliferation of routes we studied before finally choosing the route marked in white, which I will call the Arctic Gas prime route.

As you see, it is a relatively direct route to the southern portion of Alberta, where it splits, in order to deliver gas to two border points as well as a delivery point for eastern Canada. And those are marked on the large map to your left.

I will return to the so-called Fairbanks Corridor in a few moments. First, I would like to describe the route marked in white; the Arctic Gas proposal.

It crosses the coastal plain of the North Slope of Alaska and Canada both. And the North Slope—I think some of you are familiar with this—but the following page following the map gives an indication of the flat topography of the slope. Caribou are grazing there, and we find they are remarkably phlegmatic animals. Nevertheless, we have taken extreme protective measures to be sure they are not interferred with.

The following page is a winter photograph of the Arctic North Slope, and its flat terrain, and three contrasting shots of the Brooks Range to the south; the difficult terrain that would need to be crossed by either the El Paso route or the Fairbanks corridor.

With those in front of you, I would like to mention briefly that the environments advantages of the Arctic Gas proposal are many. There are also construction advantages.

The environmental safeguards which have been built into the Arctic Gas project include the refrigeration of the gas, so it will not melt the permafrost soil and, therefore, can be totally buried and thus limit drastically the environmental impact.

We will construct in the northern areas in the winter, when the animals have migrated, thus avoiding environmental impact. We will operate on the basis of snow and ice roads to avoid a permanent road across the North Slope, and, contrary to the aspersions cast, these techniques have been tested in field experiments. They are not theories; they are workable.

Snow can be available either by harvesting natural snow or by manufacturing, or a combination of both, so that the technique is solid; it is proven. It can be done, and it will be done.

The environmental consultants that we have retained include some of the most prestigious people in North America, and their representatives are here today. They have participated fully.

This cooperation and participation by the environmental consultants has been on a day-to-day basis, because it was a goal, and now I think it is an achievement, to provide the most environmentally sound pipeline possible to bring energy to the United States; energy in a form that has environmental advantages, since it is natural gas.

We have concluded that the route proposed in white on the relief map in front of you, the Arctic Gas route, is by far the most desirable route environmentally, despite the fact that it is proposed to cross the coastal area of the Arctic National Wildlife Range. That range is not, in law or in fact, a wilderness area.

The coastal plain contains the village of Kaktovik, operative and inoperative DEW line stations, airstrips, and substantial airplane traffic. It is obviously not a congested metropolitan area, but it is also not a wilderness area and it is not the portion of the wildlife range which is most productive for wildlife.

Our consultants, after extensive study, have determined it would have far more impact to proceed south to the mountainous areas, and we have, accordingly, for environmental reasons, as well as economy and construction ease, chosen the coastal route, which we believe is most desirable on all counts.

We will have controlled operations. We will have only four compressor stations in Alaska, separated by 50 miles each, so that the impact will be minimal.

The Fairbanks route, marked on the relief map in blue, has recently been proposed by some environmental organizations and now by the Foothills project.

Let me point out that we have investigated that route rather thoroughly before choosing ours. Our environmental——

Senator BUMPERS. Are you talking about the Alaskan Highway route?

Mr. BRACKETT. Yes, sir. We refer to it as the Fairbanks or Fairbanks-Alaskan Highway route, sir.

The route was investigated. It was found by our consultants, environmental consultants, most of whom follow academic pursuits, to be environmentally inferior on balance.

Also, if it has the spur pipelines to connect both the Mackenzie Delta Canadian gas and the Prudhoe Bay gas, it is over 1,000 miles longer. It must be constructed mainly in the summer, because of the mountainous areas, when more wildlife are present——

Senator BUMPERS. I am sorry to interrupt, but I want to be sure I am following this testimony.

Does this 2,860 miles your map shows include the juncture with the Mackenzie Delta line, which is 735 miles long?

Mr. BRACKETT. Yes, sir; it does. Those are mileages down to the Caroline junction, and there would be additional mileages south of there.

Since it is so much longer, it would necessarily have more environmental impact, would cross more prolific wildlife areas, and would not cross expected areas of gas developments. It would run south directly from the delta and Prudhoe Bay areas.

In addition, that routing is far more costly. We costed it, contrary to the figures given by Mr. Blair, at approximately $3 billion more than the Arctic Gas route, in 1975 costs. That information is in detail in the written testimony which we have submitted.

Senator STEVENS. Are you saying it would cost us $3 billion more to build the gas transmission system in the oil pipeline corridor than if we chose the arctic gas route?

Mr. BRACKETT. What I am saying, Senator, is, taking into account the fact that a portion of the Fairbanks route would be in the oil corridor, the total cost of the Fairbanks Corridor and Alaskan Highway, including the leg to the Mackenzie Delta, would be $3 billion more.

Senator BUMPERS. How much would it cost without the Mackenzie Delta line—Blair is not going to let you have that anyway.

Mr. BRACKETT. Approximately three-quarters of $1 billion more without the leg, if it was 48-inch pipe.

Senator BUMPERS. 735 miles would only cost three-quarters of $1 billion?

Mr. BRACKETT. No, sir; it would eliminate $2¼ billion.

Senator BUMPERS. It cuts the $3 billion down to $750 million?

Mr. BRACKETT. Yes, sir.

What we have done to look at that possiblity is to also price out the corridor with reduced-size piping and without the Mackenzie Delta line. That is still 300 miles longer than the proposed Arctic Gas route, and it would not carry Canadian volumes.

Therefore, the per unit cost of carrying gas for the American consumer would be not $250 million more a year, as the full line would be, but $340 million a year more expensive to American consumers.

On either account, there is no economic advantage; indeed there is a huge economic disadvantage to use the Fairbanks Alcan Highway, whether or not Canadian gas is connected.

In addition, however, if there were no line to the delta, then we would not have the advantages which were mentioned by the chairman, and by Senator Mondale, at the opening of the hearing; there would not be the support of the Mackenzie Delta gas to support continued exports to the United States.

An alternative would be to carry that gas by the Foothills project. It has at least three problems. Number 1, the combined cost of the Foothills project and a Fairbanks project would be huge in relation to the Arctic Gas project. It would be at least $4 billion more.

Secondly, an independent line to carry only Delta gas cannot be constructed in the time frame we are looking at, because there is insufficient Canada Delta reserves to support an indepedent line. We differ directly with Mr. Blair in that regard. Please note that he said at the present time there are enough reserves to prosecute an application, not to build a line. Accordingly, it is necessary, if the Canadians are to have timely access to their Delta gas, that a combined project be made.

Furthermore, a combined project has the economies of scale which a larger diameter high pressure line can provide. Those economies of scale provide benefits for both Canadians and the United States.

That brings me to the point that crossing Canada is highly beneficial to the United States in this instance. The reason is that it allows the use of an all-land pipeline. That is very prosaic, but it is the bedrock of this matter. And all-land pipeline has massive advantages. In terms of cost, the Arctice Gas project, again supported by material in the filed testimony, will save American consumers, on the basis of the lower volumes from Prudhoe Bay which we posit initially, approximately $700 million per year in transportation costs.

That is simply because, as compared to a liquefaction process, a natural gas pipeline is hugely efficient, both in dollar terms and in energy terms.

The liquefaction process is expensive, and it uses up a substantial portion of the energy as fuel in the liquefaction process.

I might note in that context that the decision to carry Alaskan oil by tanker was quite different. They do not have to change the form of oil in order to transport it by tanker. So whatever the merits of the trans-Alaska pipeline decision, pro or con, we are not dealing with that decision; we are dealing with natural gas that must be changed in form to put it in tankers, and also dealing with a fully formed proposal for the trans-Canadian project which will not delay the United States if it is utilized and will produce the savings I alluded to.

These cost savings will inure to all parts of the Nation, not just the upper Midwest, although they use a large amount of gas and will be aided. But it will produce savings of equivalent size to the eastern areas, and indeed the Arctic Gas project will deliver, even to California, at 50 to 65 cents per million Btu's cheaper than the liquefaction process, even though the liquefaction process will land liquefied gas in California.

Indeed, that is the reason why the sponsors of the Arctic Gas project include companies from coast to coast and in both nations. The two principal distribution companies of California are members of the Arctic Gas project, favoring this process. The Northwest Pipeline Co., serving the intermountain area and the Pacific Northwest, is a cooperating participant with this project and will cooperate in the transportation of the gas to the Western and Northwestern United States.

The companies that serve the upper Midwest, ranging from the Dakotas to Ohio, are all members of this consortium and propose the all-land pipeline. So do two companies that serve Pennsylvania, New Jersey, New York, New England, and the Atlantic coast region, including Washington, D.C.

It is a nationwide project backed by the bulk of the pipeline companies and distribution companies of the country, because a land pipeline is superior.

In Canada, Trans-Canada Pipeline Ltd., which serves eastern Canada, of which Mr. Horte was the former president before he took on the responsibilities in this project, is a member of this project, a charter member, as are the three major distribution companies of eastern Canada and so is the Alberta Natural Gas Company and the Canada Development Corp., the new business development crown corporation, which has recently been made public by stock issues.

The energy savings and benefits of a gas pipeline are also massive. From 6 to 7 percent of the gas will be saved in fuel by using an all-land pipeline system, and that is equal to or exceeds the residential usage of each of 30 of our States. Simply the savings of energy from the use of an all-land pipeline will exceed the residential usage of that many of our States.

The displacement system proposed by El Paso rests upon exchanging Permian Basin gas in part for Alaskan reserves and that is not an equivalent exchange. Therefore, the costs mount for that type of displacement, and, indeed, even initially, some of the gas must be transported from California to the east to begin with.

The displacement proposal that we have recently adopted involves, instead, exchanging Louisiana gas, where the reserve ratios are much different, and we have determined that that limited exchange is feasible and will indeed save funds, so we have adopted that limited displacement exchange.

But these costs have all been factored into the proposals and into the figures which we have furnished you, to produce the over $700 million savings.

In addition, an all-land pipeline is a more reliable method of transportation. It has a long history of reliability. It does not suffer from the seismic problems to which Senator Mondale alluded. We do not concentrate the large liquefaction plant in one location, where a disruption could cause at least 2 years' interruption of the gas supply.

In addition, the Arctic Gas project, the all-land pipeline, can be put into operation faster. Our schedule calls for over a year earlier introduction of the gas to the market, on the basis of the technological ability to construct a gas pipeline, as opposed to construction of a large liquefaction plant and tankers, which have a long time schedule.

Senator STEVENS. I am constrained to interrupt and ask you, don't you represent the same companies that just built the oil pipeline through the same area?

Mr. BRACKETT. No, sir, we do not. None of the oil pipeline companies are members of our project. They have, of course, sold gas to members of our consortium. We represent natural gas pipelines companies that are experienced in building hundred of thousands of miles in the lower 48 States as well as Canada.

Senator STEVENS. But you tell us it is more dangerous to construct a gas pipeline through that area than going across Canada.

Mr. BRACKETT. My comment went to the question of construction of a liquefaction plant, through which all of the northern Alaska gas would be required to go in an area which experienced, about 10 years ago, a seismic event of the nature of about 8.5 on the Richter scale, with which you are much more familiar than I, of course.

In addition, the Arctic Gas project offers very substantial benefits in terms of economic advantage to the United States, and in terms of balance of payments benefits. Because of the effects of Canadian activities, and Canadian purchases in the United States resulting from increased Canadian activities, our studies have demonstrated a plus balance of payments benefit from the project itself, in addition to the huge balance-of-payments benefits from offsetting importation of OPEC oil, which both projects would share.

The pipeline also crosses an area of future gas supply. The question then becomes if all of these benefits inure to the United States from use of a pipeline, why not use it? The answer is there is no reason why we should not. There is no danger from crossing Canada, we are convinced after long exploration. The companies which must make the investment to build these lines do not undertake these kinds of matters lightly. They believe that the project can be financed in the capital markets of the United States and Canada, and the international capital markets, and indeed, it should be easier to finance than a tanker project, both because it will tap the markets of Canada, in addition to the United States, and the markets of Europe, and also because of the greater economic feasibility of the method.

Turning to the Canadian matter, at times it has been suggested that Canada would interrupt the flow of gas, and yet the St. Lawrence Seaway is an example of uninterrupted flow of U.S. goods across Canada for many years. A similar situation exists with regard to Montana gas that goes through Canada. The trade between the United States and Canada is huge and has been amicable and has been to the benefit of both nations.

In addition, there is a very large self-interest in Canada to approve this project, to achieve a pipeline which will allow them access to their Arctic reserves more promptly and at lower cost. Contrary to the statement made by Mr. Boyd, Canada has not refused to put pipelines through the United States when it was to their economic benefit. Roughly, forty-five percent of the gas consumed in eastern Canada and produced in wetsern Canada flows through the United States, through the Great Lakes Pipeline Co., crossing the upper peninsula of Michigan. Canada chooses to do that as an expansion of the same Trans-Canada pipeline that Mr. Boyd alluded to.

In addition, even though all of the oil consumed in eastern Canada and produced in western Canada flows through the United States and back into eastern Canada for consumption, Canada chooses to make that decision in reliance upon the good faith of the United States. And indeed when they chose recently to expand that pipeline to extend it to Montreal, the decision was made not to bring the extra oil east by way of a Canadian line, but instead to expand the system in the United States.

I feel the United States should have no less confidence in our neighbor. But in case any more assurance is needed, the negotiators of the Department of External Affairs of Canada, and the State Department of the United States recently initialed the ad referendum text of a treaty that would guarantee that hydrocarbons would pass through the other nation's territory, once approved, without being interfered with, without being taxed, and without being discriminated against in the regulation and taxation of the pipeline in the domestic nation. We feel this settles the problem; it simply memorializes the good faith between the nations in the past.

With regard to the Canadian provinces, it has sometimes been noted a treaty would not bind the provinces. However, Canadian constitutional law does. If there are questions on the subject, I have with me a distinguished Canadian lawyer who can respond to those in detail today. But basically, the status of the Canadian law is that a Provincial Government, in respect to a pipeline which carries gas in interprovincial or international commerce, and the Arctic Gas project will do both, cannot tax the product, cannot interefere with the product, cannot regulate even the Canadian pipeline which carries it, and with respect to any taxation, income or ad valorem, on the Canadian pipeline, cannot discriminate against that pipeline or against the international flow.

We think that status of Canadian law also justifies confidence that there will be fair treatment of this joint international project. Indeed, it is a classic example of mutual benefits by international trade.

With regard to timely approval by Canada, I obviously cannot tell you with certitude what will happen any more than I can tell you what will happen in the United States. I can tell you what the factual situation indicates.

The Berger inquiry, formed not for approvals but for recommendations on the terms and conditions to be imposed on a right of way for the Arctic Gas project, has been reported to be on the way to ending the hearings by June 1976, and to be aiming for a report to the Minister of Indian Affairs and Development in the third quarter of 1976, a schedule well in advance of the normal U.S. regulatory process, I might note.

The National Energy Board, after a false start, will begin hearings on April 12 and the new chairman of the panel has recently announced to Parliament a need for, and a feeling of, great urgency to move promptly ahead on an accelerated schedule, and the indications are, and I believe that the new chairman has indicated he believes' that the hearings can be completed in 1976, again a schedule that I believe is ahead of the U.S. normal process.

Those two decisions will come together before the Canadian Cabinet, the Governor in Council, for a decision which is subject essentially to no appeal. There have been essentially no appeals in gas cases in Canada.

The matter of native claims represents a position by negotiating bodies of the native brotherhoods, but there have been announcements by the Minister of Indian Affairs and Northern Development that there are methods, which is indeed true, under Canadian law, by which native claims can be safeguarded while at the same time granting right of way permits to a pipeline project judged to be in the national interest, and indeed that Canada would be willing to take that action on a basis which will safeguard the rights of the native claimants.

We are confident the Government of Canada, upon evaluation of this project, will perceive the benefits, indeed does now perceive the benefits, of a joint project and will proceed promptly to approval.

U.S. approval processes are slower. Without legislation, I do not foresee a decision until late 1978 to late 1979, and later if the Supreme Court were to grant review. Senate bill 2950, introduced by Senator Mondale and 29 of your colleagues, could secure approval this year if passage of that bill could be approved this year.

But appeals might thereafter push the approval date to early or mid-1977. Senate bill 3167, introduced by request of the Administration, would bring a decision at least a year later than S. 2950 and more if Congress were to disapprove the decision ultimately made by the President by August, 1977 under that bill.

Delay is costly to the consumers. Hundred of millions of dollars of capital cost each year are added to any project by inflation. And the continued dependence on greater quantities of OPEC oil would continue for a longer period.

S. 2950 does not violate the spirit or the letter of the National Environmental Protection Act. It is expected that this month and next month, environmental impact statements about the Arctic Gas project, final statements, will be filed by the Department of Interior and the Federal Power Commission staff.

Accordingly, information is available to the Congress and will be very shortly on a final basis, of the environmental impact of the project in the view of those agencies.

The comments that have been filed, voluminous comments by Arctic Gas, are also available, and so are the economic considerations.

We hope favorable consideration will be given by the committee to S. 2950. We firmly believe the Arctic Gas project is totally in the national interest of the U.S., as well as Canada. We hope the two governments will proceed promptly to approve that project in the interests of both nations.

Thank you very much for the opportunity of appearing, Mr. Chairman. My colleagues and I stand ready to answer any questions you may have.

Senator STEVENSON. Thank you.

Unless there is objection, the members will limit their initial questioning to 10 minutes each.

Mr. Brackett, what assurance can you and this treaty give against unreasonable burdensome provincial taxation, not the product, but the property itself, the pipeline?

Mr. BRACKETT. The basic protection, Mr. Chairman, lies in the nondiscrimination provisions of Canada law, constitutional law, which would prohibit discrimination against the pipeline carrying Alaskan gas with respect to any pipelines in each of the provinces, and there are other pipelines in each of these provinces which will carry only Canadian gas and oil, and the Arctic Gas pipeline itself would carry the Canadian product, as well as the United States product, so that the burdensome taxes would fall on Canadians also.

I have with me, Mr. Chairman, today, Mr. John Robinette, a distinguished constitutional lawyer of Canada, if you would care to hear from him on that subject, I would be happy to have him come up.

Senator STEVENSON. If it is possible to respond briefly.

It was my impression that adequate assurances would require protocols or agreements between the Federal Government and the Provincial Government. Otherwise, yes, we have assurances against discriminatory taxation, but not assurances against unreasonable taxation.

Mr. BRACKETT. Mr. Chairman, we do not believe that a protocol would be required, because we believe the nondiscrimination provisions will preclude the matter of burdensome and unfair taxation.

Senator MONDALE. I think it might be well to hear this witness, because that has been raised as an issue before.

Senator STEVENS. Mr. Chairman, I object to going to this witness unless we also have some other witnesses here, because you and I were just in Canada and heard frequently to the contrary from the Canadian Government itself.

Now, I have respect for a lawyer, but I am an advocate, too, we are all advocates. He is here to represent his clients, so I want a lawyer from the other side. If we are going to become a court, I don't think it is proper to bring in one legal witness and not hear another.

Senator MONDALE. The only reason I say is, in all deference to my friends from Alaska, I have never heard any Canadian official, in a responsible position, argue that the position asserted by the Senator from Alaska is correct. All of them have said it is inaccurate, and I have gone out of my way to check and that point was raised in the last hearing, we checked it again, it is not correct. There is no basis for the argument and I thought it might be well to hear a lawyer.

Senator STEVENSON. You are welcome to have your crescendo on your own time. I think the way to resolve this question is not now, but with an opinion from your counsel and we will help phrase the question off the record. Senator Stevens can then get similar opinions from other lawyers. I do not want to take up the time now with a detailed question.

I think we can take it up and enter it in the record later.

Mr. BRACKETT. Mr. Chairman, I might note that the legal opinion of Mr. Robinette and also of another firm, Campbell, Godfrey and Lewtas, on this subject are in the appendix to the submitted testimony. But we will be pleased to respond to your inquiry further.

Senator STEVENSON. On the question of delay, it has been suggested that the resolution of native claims, deliberations of the Berger Commission, and the deliberations of the National Energy Board, which must be followed by a Cabinet-level decision, will cause an unacceptable delay.

The question has two parts. What is your response to that suggestion? And second, what happens if those Canadian deliberations produce an unfavorable decision to the Arctic Gas project? Have we then by waiting lost a year?

Mr. BRACKETT. I will try to respond to that in two parts, Mr. Chairman. With respect to the first part of your question, will there be a delay, I mentioned the schedule that the Canadian Government has announced for the National Energy Board and the Berger hearings, the latter aiming towards a report by the third quarter of 1976, the former aiming for a decision by the end of 1976, coming together for a Canadian Government decision we would hope in early 1977.

Under existing law, the United States would not make a decision within probably 1 or 2 years after that. Under Senate bill 2950 a decision could be taken before that time, but might be delayed until that time if there were an appeal under the provisions of that bill.

I cannot in any event see the likelihood of the United States making a decision before Canada. However, if that did occur, we would simply have a reflection of the fact that someone has to go first, but I am confident that the national interest of Canada will indicate, particularly if the United States indicates a willingness to utilize an international cooperative route, the public interest of Canada will dictate a prompt and favorable decision.

I would submit time would not be lost. There would be at least two alternative procedures. One would be to continue the examination by the FPC of the alternative system, so in the unlikely event that an alternative choice would be necessary, it would be ready to be utilized.

Second, I do not think there is a real likelihood of Canada either disapproving the project or of delaying unconscionably. I suppose a similar question could be posed to Canada with respect to the U.S. procedures.

Canada is proceeding ahead promptly to at least consider the project and we think approve it.

Senator STEVENSON. First of all, we were assured in Ottawa and your testimony reflects this, that notwithstanding Mr. Crowe's disqualifications, the National Energy Board process would run its course by the end of the year.

We are also assured that the Berger Commission would have its inputs within that framework and would not protract it, and also that the resolution of the native claims were entirely separate. The decision and instruction could proceed without resolution of the native claims question.

Assuming that to be the case, you still have, it seems to me, a problem of who goes first. Neither side is going to want to go first at the risk of being embarrassed by the other side, and neither is going to want to appear to be acting in response to pressure from the other side, and neither can predict with certainty, at least, the outcome of the deliberations on the other side. All of that being unarguable, I think—argue with me if you can—why wouldn't it make more sense for the United States and the Congress to defer making a decision now or dictating a decision before some early date, and instead, establish a process which could be synchronized with the Canadian process and permit consultation at every point along the way. This could lead to a simultaneous decision, with more confidence in its rightness than, with all due respect to my colleagues, we nonexperts can be confident of producing here in the Congress.

And I draw your attention to the administration proposal which originated in this committee. Why doesn't that make the most sense, bearing in mind all of those considerations, including the danger of one side going ahead and making a decision only to be embarrassed by the other?

I address that question to all of you. Let's start with you, Mr. Brackett.

Mr. BRACKETT. The answer, I think, lies in two parts. The first is that I am uncertain that the factor of embarrassment should be a large consideration in dealing with matters of this importance between these two nations. It seems to me——

Senator STEVENSON. Let me interrupt at this point. Maybe embarrassment is bad word. But what I meant was the delay, the possibility that one side makes a decision only to have it followed by a contrary decision on the other side and then the process has to start all over again. That's the embarrassment, the delay.

Mr. BRACKETT. The delay at that point, it seems to me, if the event you posit took place, would be relatively small. By that time under the premise, Mr. Chairman, that you have given, the Arctic Gas project will have been made impossible by Canadian decision, to take that example, leaving only the liquefaction process in the field, and it would seem to me the approvals of that project at that time, if that were the will, could be made very promptly, either by the regulatory authorities or by the Congress.

What is the case, however, is that under the administration bill, the time schedules proposed would bring a decision by the President by August of 1977, and there would be 60 days more for the Congress to act, 30 days more for an administrative decision, and a court appeal following that.

Accordingly, if there were the synchronization to which you alluded, Mr. Chairman, in early 1977 or say the first quarter of 1977, and the U.S. decision were made after that, after a Canadian decision, we would therefore have after that time, 9 to 12 months, at least, of further delay while the further process of decision, congressional review, administrative determination, and appeal takes place.

It seems to me that that is an extension of time which is neither productive for United States nor necessary. I believe that the information is available on which this Congress is competent to make a decision.

Senator STEVENSON. Mr. Blair, do you have a response to that?

Mr. BLAIR. Yes, I do.

Mr. Chairman, I think the fundamental point to recognize is the great urgency that exists for U.S. purposes. In Canada, we added more gas reserves in the Province of Alberta last year in 1 year than the cumulative reserve that has been identified to date in the Mackenzie Delta.

I am speaking to you from the company that gathers and transmits 70 percent of the gas produced in the country. And we have a general growing interest in connecting with the Mackenzie Delta.

But, in perspective, it is one of several prospective sources of supply for the Canadian markets. In perspective, all of Canada's main source of supply through the remainder of this century will be the Province of Alberta.

What we have to do is to see how we can fit in an orderly project to achieve that connection as soon as a project can be accomplished, but not on a crash basis. We need to spend several years to get ready to get into place what has to be done.

I differ totally with Mr. Brackett and his comments about the Canadian perceptiveness of that scheme shown on that map. In Canada the scheme well characterizes itself by showing a huge new express system across Canada, going to U.S. markets and native land positions. We know these people; we know them well, personally, directly, intimately. Week by week we are dealing with the heads of these native associations, with other residents of the Northwest Territories, and there is just no way that one can conceive as a practical matter of putting through that sort of thing in a very short time period. It is going to take time.

Now, that was the important thing to me in my answer, was to get that out. Specifically in answer to your question, I would agree that setting up a framework in which there could be consultation and continuing review between the two jurisdictions makes more sense than approving a project in one jurisdiction, hoping the other will do the same, particularly when there is such great contention about this.

This is the biggest civil engineering project ever undertaken in Canada, whoever does it; even ours. And we have already had one government in Canada, the Federal Government, defeated over issues of a pipeline project and the native land claims issue in the North Territories is recognized as one of the hottest political issues of social impact in the country, and it is just going to take time.

There is in Canada, among Canadians, a completely different assessment of the situation than what Mr. Brackett said.

Senator STEVENSON. Mr. Boyd.

Mr. BOYD. I would like to emphasize the point Mr. Blair just made, that the urgency is greater in the United States than in Canada. I would like to give a short demonstration of that.

There are 40 million homes in the United States dependent upon natural gas. They provided housing to over one-half of this country's total populations, and its gas supply is declining at an alarming rate. In 1974, we consumed 21 trillion cubic feet of natural gas, and we added only 7 trillion. In other words, we are using it three times faster.

What is the available gas supply?

The Canadians have enough that they are even exporting some to the United States. But how do they deal with the situation when there is need in both countries?

For example, in the Western portion of the United States, Washington, Oregon, Idaho, there were contracts providing for the purchase of 800 million cubic feet of Canadian gas a day. But when the Canadians did not have that amount to serve 100 percent of their markets, the Pacific Northwest got what was left, which was just one-half of 800 million, 400 million.

The point I am making is, we can't hold our breath as long as they can hold theirs. And as Mr. Blair was suggesting to you, therefore, they are not faced with the need for expeditious action.

Now, coming to the point that the chairman posed, working out some kind of procedure whereby we work to a result that both countries make the announcement simultaneously. First of all, that assumes that the trans-Alaskan project has already been rejected, because the only need for working with the Canadians so that you come out with a simultaneous response is that you have already decided the gut question of which of the two projects is going to be certificated.

Senator STEVENSON. No, the procedure that is contemplated is neutral to all of the possibilities, but it could include consultations with the Canadian authorities.

Mr. BOYD. Assuming we are not going to stand still, awaiting the decision of the Canadians, then, obviously, when our case is ripe for decision, the decision ought to be forthcoming, whether or not the Canadians are then prepared to speak or not.

Now, I suggest that since we can't hold our breath as long as they can, it would be contrary to the interests of this country to tie the decision to a time when both can speak at once.

Let me address myself to the prospect that the chairman has properly recognized, that the Canadians, for the reasons voiced by the Prime Minister in 1966 and repeated as recently as November of 1975, decide that it is not in the Canadian interest to have this American gas flowing through their country, and, therefore, they deny the Arctic Gas project.

Mr. Brackett, who is very generous with El Paso's money, suggests in the meantime El Paso will be going forward. But if the decision is indicated that the Trans-Canadian project has been mandated, subject only to authorization from Canada, we have no justification for staying in this battle.

El Paso has paid three times the amount of anyone of the participants in Arctic Gas. We have already spent $15 million bringing this project up to this point. Those expenses aggregate about $500,000 a month in pressing it before the FPC.

Once there is an indication that the Canadian route has been mandated, we just can't justify staying in the fight. And, thus, if you wait for the Canadians to speak, and then, as is strongly suggested here, they may turn it down, then you are back to square one.

So what I am suggesting is that if anything is to be mandated, since this Congress can only speak for the United States, it cannot mandate a line across Canada, but it can mandate a line across the United States, then either let the Congress mandate the only line that it can deal with and get on with this thing as quickly as possible, or, certainly, don't tie yourself to waiting for the action of Canada.

Let me point out one other very serious objection to mandating at this time a trans-Canadian line. The suggestion is made, contrary to the testimony of legal experts from Canada before the FPC, that the protocol relating to the treaty is going to take care of everything. The testimony before the FPC suggests that is just not so.

But let us assume that that be true, and this Congress mandates now, as Mr. Brackett suggests, the Canadian line. What bargaining position is the United States then left in in preparing its protocol, dealing with the very difficult regulatory questions that have to be resolved before this project can go forward?

And then, since they are not in the need that we are, they can wait us out. I suggest that simply from the standpoint of negotiations, it would be extremely ill advised for the United States to indicate now that it had already decided on a trans-Canadian project.

Senator STEVENSON. You will have another chance, Mr. Brackett.

My question had to do with the procedural proposition. It would be an accelerated procedure, a neutral procedure, which would consider all of the options.

My time has expired.

Senator STEVENS. Thank you very much. Mr. Blair, the Arctic islands activity according to the information we received from Canada last week, should lead to an application before the NEB in 1978. I have a note on that that I made at the time. Is that consistent with your feeling as to their activity in the Arctic islands?

Mr. BLAIR. I think it will proceed a little earlier, if anything, than that. There has been well over 10 trillion cubic feet, I forget the exact number, of gas identified in the Arctic Islands and the latest information I have, Senator Stevens, is that they are hoping to have their first application before the National Energy Board in the first months of 1977. But I don't really argue with your date, because after 6 years ourselves as a participant and sponsor and applicant of Arctic pipe lines, which my company began in December 1969, we know that one of the fact of life is that everything takes a little longer than you expect.

Senator STEVENS. They have already proved up in the Arctic Islands, I am informed, several times the amount of reserves proved in the Mackenzie River delta. Is that correct?

Mr. BLAIR. It is certainly more. I think several times goes a bit too far. The latest figure I have heard in the Arctic Islands is they have proved up 12 or 13 trillion cubic feet or they have identified as reasonably assured some quantity, perhaps the word "proved" goes too far. The corresponding figure in the Mackenzie delta has been about 8. There are various estimates, but the figure that is represented as the most likely figure for the real reserves in the Mackenzie delta is 8. So the relationship is 1.6 to 1.

Senator STEVENS. They weren't talking about the proved reserves in comparison, then?

Mr. BLAIR. There are so many estimates it is hard to be completely accurate and generalize. Some estimators made estimates last year that showed as little as 3 or 4 proven.

Senator STEVENS. I want to get to my point, and that is, it was my understanding that the Canadian native claims settlement procedure was going forward, but the Government is anxious to get the matter resolved. We were told the James Bay settlement took several years, but with the Berger inquiry, it was plain they would not get a decision before sometime in 1977, at the earliest. Assuming that is correct, if the NEB says and has every expectation that Pan-Arctic will make an application in 1977 or 1978, how can we be assured that the National Energy Board of your country would act on the applications that are before it now, your application and the Arctic application before the NEB, when right over the horizon is the largest project in Canadian history, the Polar Gas route to come down to Winnipeg? Don't you believe, and I am really asking you, do you believe in your experience, that the NEB, knowing that application is coming, will wait to make a determination as to what is in the best interests of Canada in terms of the relationship between Polar and Arctic and the Maple Leaf or Foothill Line, rather than deciding in the first instance between Arctic and Foothills and waiting to decide the Polar matter a year later on its own.

Mr. BLAIR. I believe it may occur as you describe. I believe the National Energy Board or the Government of Canada may decide not to approve any project until it has heard the project, no one can assure you that may not occur. I don't predict it necessarily.

Senator STEVENS. It is a reasonable possibility.

Mr. BLAIR. Yes, I think so.

Senator STEVENS. In terms of your procedures before the NEB, my impression is—I don't want to get you cross-wise to your own Government up there—but the urgency is no more of a factor in their process than it is before the FPC? As an applicant before the NEB, have you ever seen them dictated to by urgency from another nation?

Mr. BLAIR. I would say this, that I would expect the process will be deliberate and thorough and will use such time as they believe is appropriate for this purpose, and that in Canada there will be a continual weighing of the desirability of connecting the Mackenzie

Delta, which generally is recognized as a desirable objective for early accomplishment, and that wil lhave to be weighted with the availability of additional natural gas in Alberta and political matters, including the settlements of the lands and entitlement of individual political rights in the Northwest Territories. I do not believe that any project, even for Canadian purposes only, will carry enough weight to cause a sudden abrupt, urgent acceleration by the National Energy Board or by Parliament. I would think a project which is basically a United States project will have, just as a matter of self-interest, that much less weight, because we have our own priorities.

Senator STEVENS. Thank you very much.

Mr. Brackett, it is my understanding that Exxon is a substantial participant in the Arctic Consortium, is that correct.

Mr. BRACKETT. No, sir.

Senator STEVENS. Imperial?

Mr. BRACKETT. Imperial Oil, the Canadian affiliate is a participant, yes, sir. Exxon was a participant and dropped out sometime ago. They are, of course, one of the holders of gas on the North Slope.

Senator STEVENS. Their subsidiary, Imperial, is definitely involved.

Mr. BRACKETT. Yes, sir.

Senator STEVENS. I must express great umbrage at your position in trying to over-emphasize the problems of seismic activity in my state, in view of Exxon's and Imperial's, and the whole international industry's presentation to the Congress on the oil pipe line and their expressed confidence in being able to meet those risks through engineering. I am quite alarmed that you would present to this committee the impression that a gas pipe line and a gas liquefaction plant would be more risky in terms of our geographical location as far as seismic activity is concerned than the oil pipeline being built. We do have a LNG plant in Alaska, it is built right in the area where there was seismic activity. We had a gas pipe line that went under the Cook Inlet at the time of the 1964 earthquake and it did not sheer. I can understand the opponents of this route developing such an issue, but I really can't understand a group that is comprised of major oil industry representatives that argued before this Congress for the oil pipe line, saying the gas line cannot be built safety.

That is not a question. My question to you is what volume of Mackenzie River delta gas is your pipe line predicated on?

Mr. BRACKETT. The basic planning and exhibits which we have shown for illustrative purposes shows an initial flow from Prudhoe Bay of about 2.25 billion cubic feet a day and about 1.25 cubic feet a day from the Mackenzie Delta, growing over the following 4 or 4 years to 2.25 billion cubic feet a day.

We have in the testimony I have submitted today made economic showings based upon several different assumed flows. One, the assumed flow which I just stated. Second, an assumed flow of 3.2 billion cubic feet from Prudhoe Bay and only a billion and a quarter from Mackenzie, staying at that level, and the third, the lower volumes from Prudhoe Bay, 2¼, and with the Mackenzie Delta staying at 1¼. So, we have tried to bracket, if you pardon the word, the various possibilities of flows.

What you will find by inspection of the table in my testimony, Senator, is that irrespective of whether the Delta gas flows achieve 2¼ or stay at the low level of a billion to a billion and a quarter, the economic advantage of the Arctic gas project is very substantial, in the hundreds of million of dollars range. It makes a difference, but not a substantial difference.

Senator STEVENS. Who owns the Mackenzie River reserves?

Mr. BRACKETT. There are a number of producers there, but the bulk of the presently proven reserves and the presently determined reservoirs are Imperial Oil, Gulf Canada, and Shell Canada.

Senator STEVENS. Primarily Imperial?

Mr. BRACKETT. Imperial has the largest ownership, but the other two are substantial also.

Senator STEVENS. So really if I were to be an advocate, you would probably argue with it, but I would say if we should build this pipeline down the Mackenzie River Delta to pick up Imperial's gas we should deliver it where they want to deliver it, rather than where Mr. Blair wants to deliver it?

Mr. BRACKETT. I think not, Senator. The deliveries under the Arctic Gas project would be made to southern delivery points in Canada and they would be essentially the same delivery points as proposed by the Maple Leaf project.

The determination of the destination of the gas would be as is the normal pattern, between buyers and sellers, in the case of Prudhoe Bay gas, U.S. buyers and U.S. sellers, in the case of Mackenzie Delta gas, Canadian buyers and Canadian sellers.

So the destination would not be changed. The difference is our project would be put in sooner and can deliver gas cheaper, whether to the border points or to the Canadian markets.

Senator STEVENS. You made a statement about the environmental damage of the Fairbanks route. I am not an advocate of the Fairbanks route, but as an alternative to the Arctic route, it is preferable as far as Alaska is concerned.

Where do you get the point that there is environmental damage from a route that would follow the oil pipeline corridor, use the roads that are there already and follow the Alaska highway corridor down into Canada?

I just don't understand how you postulate more environmental damage from a route that has already been examined by the FPC environmental staff, by the national environmental organizations and determined preferably, how your company can come in and say it involves more environmental damage. Could you explain that to me?

Mr. BRACKETT. I shall try, sir.

Dr. Banfeld is with me today. Given the precedent a few moments ago, I will not attempt to have him respond, although I would be happy to have him do so. He is a professor at Brock University, director of environmental studies. He is a senior environmental consultant on our project.

Dr. Banfeld and a large staff of other academically accredited biologists have made detailed studies of our routes. Unlike the other bodies which have remarked on this project with different results, they have undertaken actual field work of each of the routes, they have examined the routes, and I might say that in the discussions that I have had with Dr. Banfeld and with the other consultants, he put it rather succinctly to me.

He said it is sometimes superficially attractive to think a so-called disturbed corridor is preferable, but what you have to do first is look at what is the disturbance, how close will the new use actually be—pipelines tend to run in straight lines, roads do not.

Second, you have to look at the methodology that is being used for the new use, what kinds of environmental safeguards are being used, what kinds of environmental safeguards will we use on our route.

Third, you have to look at the length of the routes, and I have already remarked it is 1,000 miles longer for Fairbanks or 300 miles longer if you do not attach the delta gas, and if you do not attach the delta gas to the Arctic Gas project Fairbanks route, then you would have to bring the delta gas out by the Foothills route so it would be even longer than 1,000 miles more.

Now, that is Canadian environment. Maybe I shouldn't worry about that, but I do. So I think on any basis there is less environmental disturbance by the methodology we utilize on our shorter route than through the more sensitive moutainous areas, despite the presence of the Alcan highway and the oil pipeline corridor. We have backed that up in the testimony which is available for your inspection.

And thank you for the question.

Senator STEVENS. It is most interesting in view of the fact we had an oil pipeline down that route for years, and the corridor is already there.

Thank you, Mr. Chairman.

Senator STEVENSON. Senator Mondale.

Senator MONDALE. Mr. Horte, would you tell us your position with the consortium?

Mr. HORTE. I am the president of the Canadian Arctic Gas Pipeline Co.

Senator MONDALE. What is your appraisal in representing the Canadian interests as to the schedule of the NEB and the Berger Commission by way of a decision date?

Mr. HORTE. My appraisal is this, that it has been publicly stated by Chief Justice Burger who is handling the Burger inquiry, that he plans to complete his hearings in the Mackenzie area by the end of June, he plans to have a report prepared by the end of September, and in the Department of Indian and Northern Affairs hands.

With respect to the National Energy Board, there hasn't been a statement made on this definitely. As you know, the hearings are going to be recommended on April 12. In looking at those hearings the time frame that has been lost, 5 months, is really not as serious as it sounds. Phases 1 and 2, which took up most of the time to date had to be reviewed and repeated in any event, whether that panel was reconstituted or not, since the first phase dealt with reserves and they wanted an updating of the reserves, and the second panel dealt with contracts and contracts have been renegotiated and so on.

Probably in terms of actual hearing time, we have lost something on the order of 2 months. The chairman of the new panel, before the

Energy Resources and Public Works Committee of the House of Commons last week, stated in reply to a question that he was very hopeful they could pick up this time and was suggesting such things as longer sitting hours and further he was hopeful they could complete the hearings this year.

The same statement has been made by responsible ministers of the Crown. They plan to complete this year if at all possible. Nobody can give you a guarantee, but certainly that is what those officials are indicating.

Senator MONDALE. So it is your best judgment representing Canadian interests that these proceedings will be done late this year or early next year.

Mr. HORTE. Yes, it is.

Senator MONDALE. Questions have been raised whether these proceedings are—whether the Provinces then will have control over these pipelines in a way that extraordinary taxes could be imposed and so on outside of the terms of the pipeline treaty and outside of an agreement that might be reached.

Mr. HORTE. I could only respond to that as Mr. Brackett did earlier. Not being a lawyer I can only tell you what my understanding is. And that is that the Provinces do not, while they have the power to tax with respect to property taxes, income taxes, et cetera, that the Constitution provides they could not do this in a discriminatory manner, which means that were they to up the tax rate with respect to a Federal facility moving through a particular Province, that the same conditions would have to apply to any other pipeline moving through that province.

Senator MONDALE. So if they wanted to sock it to your pipeline, they would also have to sock it to Mr. Blair's pipeline?

Mr. HORTE. Yes. And they would sock it very strenuously to the Canadian customer, because the other pipelines are primarily serving the Canadian market.

Senator MONDALE. Now, Mr. Brackett, as I understand it, the Arctic Gas proposal is supported by a broad consortium of Canadian and American wholesale and retail pipeline distributor companies.

Mr. BRACKETT. Yes, sir.

Senator MONDALE. Which in our country serve consumers all across the Northern Territory, into the Eastern United States and then into the Western United States and down into California.

Is that correct?

Mr. BRACKETT. That is correct, sir.

Senator MONDALE. Is it the present situation, then, that most of the pipelines which serve the consumers in this area are a part of your effort?

Mr. BRACKETT. Yes, a very substantial portion of the long-line pipeline companies and the two major distributors in California.

Senator MONDALE. Are you aware of any similar concerns that are a part of the El Paso consortium?

Mr. BRACKETT. To the best of my knowledge, El Paso Co. is the sole proponent of that project.

Senator MONDALE. Then if we are trying to get to the question of what makes the most economic sense, assuming these pipeline companies are not part of the United Fund or some nonprofit organization, that they have costed these matters out, looked at all of the questions of procedures, delivery, reliability, environmental issues, and the rest, and as a matter of hard commercial judgment have almost unanimously decided that Arctic Gas makes more sense to them and their consumers than does the alternative.

Mr. BRACKETT. The answer is yes, Senator. The project is structured by use of consultants and staff and heavy use of committees which are composed of the technical, financial, businessmen, and environmental representatives of each of the member companies. And each of those member companies participates in reviewing the work of the project, so it has been a participation and the combined judgments of all of the companies, stretching from coast to coast, that the land pipeline crossing Canada is by far the preferable route in order to achieve the economies of the land pipeline.

Senator MONDALE. Reference was made earlier to the question of seismic troubles. It was suggested that that charge was possibly demagogic.

Do you consider the National Academy of Sciences to be a demagogic organization?

Mr. BRACKETT. I certainly don't, sir.

Senator MONDALE. In their report in 1965 on the Alaskan earthquake, the National Academy of Sciences found that south central Alaska, including Prince William Sound, was one of the most sensitive seismic regions in the world. That study showed that vertical uplift of the Earth's surface in the vicinity of Prince William Sound could be measured as high as 50 feet. In other words, there is a shift in the Earth's crust to that amount.

Assume a 50-foot separation and uplifting of the Earth's crust beneath El Paso LNG plants. Do you think would be good for it?

Mr. BRACKETT. I certainly do not. And I was trying to draw the distinction earlier, Senator, which that makes very graphically.

A pipeline crossing that area would not be benefited by it either. But with pipelines, whether oil or gas, there are automatic shut-off designs, so you would have the problem of replacing only a relatively short segment of pipeline.

The construction period for a massive liquefaction plant, which is vital to that system, however, is a very extended period of time, many months or probably more than that, probably a couple of years with that kind of damage.

It was the distinction between the facilities and the results of that kind of seismic occurrence that I was attempting to draw. I don't want to overstress it. I simply think it is a factor that cannot be ignored.

Senator MONDALE. In fact, in that earthquake, oil storage tanks were ruptured and burned, were they not?

Mr. BRACKETT. That is my understanding; yes, sir.

Senator MONDALE. I don't think this is a demagogic point. I pressed the representatives from Alaska at the last hearing.

I said, what have you done to satisfy yourselves that this largest liquefaction plant in the world won't be destroyed in an earthquake and send us all to heaven sooner than we plan to go.

And their answer was, the Congress has considered that.

We have a lot of powers, but one thing we cannot do is repeal earthquakes. Sometimes we can start them, but we can't repeal them.

Now, I have not heard anybody deal with that question, and if, as I think is the case, we are dealing with a distribution system from resources that may equal all of the rest of the natural gas supplies in the United States, to put it along a zone which might be interrupted for years as a result of such a collapse, and leave many parts of the United States with no alternative system for delivering and receiving gas, it seems to me very, very dangerous.

Mr. BRACKETT. Yes, sir. And we have been impressed by the fact that the testimony before the FPC has not dealt with the problem adequately, either.

Senator MONDALE. I think my time is up.

I just want to put in the record an article that appears in the Washington Star of March 17, indicating, as I predicted in the trans-Alaska oil pipeline dispute, that there are massive surpluses now of oil on the west coast, because, when Alaskan pipeline comes on-line, because among other things, they have difficulty offloading.

[The article follows:]

[The Washington Star, Wednesday, March 17, 1976]

ALL THAT OIL FROM ALASKA MAY BE GOING WRONG WAY

(By Roberta Hornig)

Long-awaited Alaskan oil, touted by two presidents as an important contribution to U.S. energy self-sufficiency, appears to be planned for delivery to where it isn't needed, the federal government now concedes.

When the oil from the Arctic North Slope is ready for delivery in late 1977 or early 1978, California—where it is headed—probably won't be able to use it, the Federal Energy Administration says.

And unless a transportation system is developed to move the oil from the West Coast to where it is needed—the Midwest and the East—the oil may either have to be *"shut in,"* meaning not produced, or sold to foreign countries, FEA says.

The prediction that Alaskan oil would go to the wrong place was one of the prime arguments advanced by environmentalists who held up the controversial Alaskan pipeline project for nearly three years. The pipeline project was approved only in the wake of the Arab oil embargo in 1973.

The new FEA stance appears to back up the environmentalists' contentions. It came to light yesterday when the FEA formally asked the Federal Power Commission "to speed" a decision affecting development of a crude oil pipeline system from California to Texas.

In its intervention, FEA asked the FPC to rule quickly on whether the El Paso Natural Gas Co. can abandon a 700-mile stretch of natural gas pipeline. The objective, according to an FEA official, is to convert the pipeline to one capable of carrying oil.

According to the official, the conversion, along with expanding the pipeline at both ends, would be to carry Alaskan oil from California, where it will not be needed, eastward.

Current plans are for the 789-mile, $7 billion trans-Alaskan pipeline to carry oil from the North Slope to the ice free port of Valdez on the southern coast of the state. From there, the oil would be transported by tanker to Washington state and headed for California via pipeline.

The FEA spokesman said yesterday that California did not need the oil because it was getting what it needs from Indonesia, considered a "safe" importer, meaning one not likely to participate in any embargo, as well as having offshore oil and further projected oil from a naval reserve that likely will be in production by then.

At first, delivery will amount to around 600,000 barrels of oil a day, to be expanded later to 2 million barrels a day.

"The historical pattern to California is that it is energy self-sufficient," the official said.

When asked how he would have commented at the height of the Alaska pipeline controversy, he replied: "Well, luckily, I wasn't around at the time."

Environmentalists, backed by Midwesterners and Easterners, had argued that a better route for the pipeline would have been through Canada, to deliver oil to the Midwest.

When asked what FEA would do if the power commission does not act on the pipeline proposal, the official said the energy agency would have to look at other means of getting the oil from the West Coast.

Asked what methods were being considered, he said that one would involve transporting the surplus, which amounts to half of the Alaskan oil, in tankers around the cost of South America. The Panama Canal cannot accommodate large tankers.

This long-distance routing presumably would raise the cost of oil to consumers and risk tanker spills off stormy Cape Horn.

In its petition to the FPC, the energy agency said that "the expeditious determination of El Paso's application for abandonment (of the gas pipeline) is of critical importance to the natural energy interest.

FEA then went on to say that "an operable west-to-east crude oil transportation system must be in place" when the Alaskan pipeline begins delivering oil because of the projected West Coast surplus.

The FEA official said the agency get involved in the case while determining what parts of the country would have energy difficulties should another oil embargo occur. The official said the surplus oil should have no bearing on another simmering controversy—the routing of a gas pipeline from the North Slope.

Basically, the same two routes are involved. One proposal would carry the gas in a pipeline parallel to the oil pipeline now under construction, southwards to the state of Alaska. The other would route the gas pipeline a short distance across Alaska, and then down the McKenzie Valley in Canada, delivering it to the Midwest.

On a visit to Alaska last year President Ford called the Alaska pipeline a weapon in the struggle to "liberate" the United States from "unreliable" foreign sources of oil.

In signing the pipeline bill in 1973, then-President Richard Nixon hailed the project as being "about three years late but better late than never" and blamed environmentalists for holding it up.

Nixon also said that oil from the North Slope would make up a third of the total the United States would have to import and would help meet the nation's long-term energy needs.

Ever since the project was announced, there have been rumblings that Alaskan oil—or at least some of it—would be destined for sale overseas, especially to Japan.

The U.S. government has always denied this, but former Japanese Prime Minister Eisaku Sato, on a visit to the United States in 1972 said he had been promised Alaskan oil.

Senator MONDALE. And, secondly, I would like to quote from the record the following statement from July 9, 1973:

But there is no question to anyone who really examines the situation that the tremendous need of the Midwestern parts of the United States for energy must be met by natural gas and it can only be met by an Arctic pipeline that connects the Mackenzie River reserves and the North Slope reserves with the great Midwestern portion of the United States.

That statement was made by the great Senator from Alaska, Ted Stevens, and I agree with him.

Senator BUMPERS. If I may inject a little levity, talking about starting an earthquake reminds me of two couples who met on the beach at Miami, and one asked the other "Are you retired?" and he said "Yes," and he said, "What did you do before?" and he said "I had a big furniture business and a fire wiped us out and we collected the insurance and moved to Florida." And he asked him "What are you doing here?" and the other man replied "We had a business too and a flood wiped us out and we collected the insurance and moved to Florida." And the other one asked "How do you start a flood?"

Mr. BRACKETT, you and Mr. Blair both, do either of you have any commitments from the people who own the gas in the Mackenzie Delta?

Mr. BRACKETT. The Arctic Gas project is structured as a transportation company, not a buyer and seller. Accordingly the project we represent would not have any commitment. At the present time there are I think four or five U.S. companies which have contractural commitments to purchase varying volumes of Mackenzie Delta gas from the three producers I mentioned.

Those commitments are subject to the determination of the National Energy Board to allow exports, which in view of Canada's gas situation is very problematic.

In addition, as I understand those contracts, they cover volumes leaving so-called contractural windows for Canadian purchasers.

In addition, Trans-Canada PipeLine Co. has a contract for the purchase of some Delta gas.

Senator BUMPERS. They are part of your consortium?

Mr. BRACKETT. Each of the U.S. companies to which I just alluded and Trans-Canada PipeLine Co are members. And all of those companies have executed letters of intent to transport whatever Arctic gas they receive in reasonable relation to our pipeline over our project.

Mr. BLAIR. Our project is similar for the pipeline transmission service, providing the transmission service available to all comers and it does not include a gas buying or selling function.

At this time we have no purchase commitments. I think besides giving the literal answers, there is something worth pointing out here.

I think the aggregate of those gas reserve dedications by Canadian producers from the Mackenzie Delta to U.S. companies is something on the order of 18 trillion cubic feet when they are all added together. And we believe that one of the necessary occurrences in Canada is going to be an upsetting of substantial amounts of that reserve dedication, perhaps virtually all of it. That is a process we still have to go through. It is perhaps interesting commentary on the amount of reserves that are there, and that can be expected to be available for delivery to a pipeline shortly that the reserve commitments have been as large as those are.

Senator BUMPERS. What I am trying to drive at is for example the Arctic route, Mr. Brackett, is predicated on a certain amount of gas being available from the Mackenzie Delta, and my question is if that amount is not available or if no amount is available, and I assume what the National Energy Board does—incidentally, let me change just a moment.

Both of you have applications with the National Energy Board pending. Is that correct?

Mr. BRACKETT. Yes.

Mr. BLAIR. Yes.

Senator BUMPERS. Are they competing applications or is there a possibility of granting both of them?

Mr. BLAIR. They are competing applications.

Senator BUMPERS. Would it be fair to say if Arctic's application is approved, Mr. Blair, as they say on television, you are out of business, aren't you?

Mr. BLAIR. Well, yes, it is certainly fair to say hypothetically if their project were authorized and could be financed as necessary in the various jurisdictions, we would then have no reason to continue to prosecute the application.

We have a lot of other business.

Senator BUMPERS. Let me reverse the thing. If Mr. Blair's application is approved, what does that do to your project, Mr. Brackett?

Mr. BRACKETT. Well, I think, Senator, I have to answer that in two parts.

I think if the foothills project were approved as now proposed, that would indicate a decision of Canada to not take the joint approach and would probably mean there would be no Arctic Gas project.

However your earlier statement included the question of the premise of our project, and I would like to answer that also.

I think if there were not any Mackenzie Delta gas, the most economical and most preferable route to bring Alaskan gas to the United States would be the same route we have now, except it would be absent a small spur to the Mackenzie Delta region.

We have chosen a very economical route which goes by the Mackenzie gas fields, and can carry that gas.

Senator MONDALE. Are you saying you would go ahead and build the line and just eliminate the 735-mile spur to the Mackenzie Delta?

Mr. BRACKETT. No, I am sorry, Senator, let me try to straighten this out.

If you look at the map you will see the blue line is the Fairbanks route and the blue line which starts from the Mackenzie Delta field and comes down close to the south coast is the 735-mile spur.

That applies only if the Fairbanks/Alaskan Highway route were used, which we are not proposing.

If you look at the white line, you will see that the small spur near the Mackenzie Delta is very short, and it is that which would be eliminated were there no delta gas.

The other think I wanted to make clear is that even if none of the Mackenzie gas were certificated for export to the United States, that does not defeat the purpose of the Arctic Gas project. The Arctic Gas project would then simply carry that delta gas down through the white lines almost to the end of the right-hand line. In other words, to the border between Alberta and Manitoba. We would drop the Canadian gas there, and the Alaskan gas would go on to the U.S. border.

Senator BUMPERS. I recognize you can still carry it, even though it wouldn't be available for export and therefore lessen your cost.

Mr. BRACKETT. Yes, sir, exactly.

Senator BUMPERS. But my question is, is there a possibility that none of the Mackenzie gas will be available for transportation or export?

Mr. BRACKETT. I think it is not possible that would be the case, unless—your initial premise was the Foothills project were determined to be preferable in the Canadian interests.

Senator BUMPERS. In the unlikely event that did happen, would your project still be economically viable?

Mr. BRACKETT. I think it would be economically viable to carry Prudhoe Bay volumes, but I do not believe that under that premise the Canadian Government would grant approvals. I think the essential premise of the Arctic Gas project of carrying Prudhoe Bay and Mackenzie Delta gas is so sound that I can see no reason why they would turn it down, but if they did turn it down, I think they would not certificate two parallel lines, one for U.S. gas and one for Canadian gas.

Senator BUMPERS. There are a whole range of questions I would like to ask, but my time is about up. Do the Provinces in Canada levy the same kind of property taxes that the States here do? In other words, they can tax property in place, but they can't tax it so that it becomes a burden on interstate commerce?

Mr. BRACKETT. Exactly, sir.

Senator BUMPERS. Does this mean, for example, if one of the provinces imposed a tax on the pipeline, not on the pipeline, but let's say there is a 50-mill tax on all property of a certain class, into which the pipelines fell.

That would mean all property in that category, whether it be pipelines or otherwise, would have to bear that same tax?

I understood earlier that the Provinces could not levy a discriminatory tax. In other words, they couldn't levy a tax just against pipelines, that would be higher than other property of a similar kind. Is that correct?

Mr. BRACKETT. It is possible pipelines would become the class, but you are correct, they can not discriminate as between the members of that class, and not only will our pipeline be carrying Canadian gas, so the burden would be on the Canadian users of the pipeline, but it would also fall on all of the other pipelines that carry oil or gas, only, or principally, for Canadians.

So the premise of what you are saying is correct.

Senator BUMPERS. For example, when you talk about being hostage, haven't we also had the ability in the past to keep Canada hostage for the pipelines that run across the northern tier of the United States?

Mr. BRACKETT. Yes, sir, those are the oil and gas pipelines I alluded to before, and of course the Portland, Maine, pipeline that carries a good share of Canada's imported oil across the State of Maine.

Senator BUMPERS. One thing that has not been touched on in previous hearings or today, and I think is relevant, is whether we ought to be taking the gas at all or not.

In other words, I would like some technical information on whether or not it might be in the U.S. long-range best interest, at least as far as the Prudoe Bay is concerned, to reinject the gas in order to improve our recovery of the oil there.

In my State, one of the biggest oilfields ever discovered in the southern part of Arkansas was discovered in 1921 and the field is just about gone, with less than 20 percent of the oil taken out, because we flared the gas there all of those years.

Mr. BRACKETT. I think the response to that, Senator, and I suspect my colleagues would agree with me for the first time today on this, is it is desirable and it is economic.

Studies have been made by the producing companies, who of course have a large economic interest in maximizing oil production, and, second, by the State of Alaska, and by consultants. The examinations made, I believe produce reasonably consistent results by those bodies. It is that by the substitution of water injection and water drive for the gas, it is possible to achieve essentially the same oil recovery, while withdrawing reasonable quantities of gas: the initial volumes of two and a quarter billion cubic feet a day which we posit, without damaging oil recovery. This will be addressed by the Alaska COnservation authorities when the application is made.

I think, therefore, that it is appropriate to utilize this natural gas to fill the current needs of the United States and it can be done without the problem you asked about.

Senator BUMPERS. Thank you.

Senator STEVENSON. Mr. Blair, did you want to comment?

Mr. BLAIR. Yes, Mr. Chairman. I don't think it is clear what quantities of gas will be available. We have gone and inquired of the State officials and the most information I can get is that there are still design matters to be settled in the water drive arrangements for the production of gas which they expect to receive in July of this year, a reservoir production proposal from the producing companies, and having received that proposal, and after making their own calculations, they will sometime later determine what the allowable quantities of gas to be marketed from year to year may be.

And it is partly on the basis of those representations from the State authorities who have authority for the conservation of gas that we have started to take a serious interest in a kind of project that could be smaller initially and then increment gradually in the future.

So I disagree with what Mr. Brackett was suggesting.

Senator STEVENSON. Well, you have kept our record complete. We have had no agreement on any proposition.

Mr. Boyd, did I understand you correctly to testify earlier that the El Paso Project could be financed entirely within the private sector?

Mr. BOYD. Yes, sir. And we have the experts here that can substantiate that and have done so before the PFC.

Senator STEVENSON. By that you mean without any Federal loan guarantees?

Mr. BOYD. That is correct.

Now, I want to be entirely frank. We would expect to use the guarantees and subsides that are available to all shippers, under the maritime provisions of title II.

Senator STEVENSON. Yes, I understand that.

Mr. BOYD. Of course, that is not designed for our benefit, but it is available.

Senator STEVENSON. Mr. Brackett, can the Arctic Gas Project be financed entirely within the private sector?

Mr. BRACKETT. Again——

Senator STEVENSON. Can you agree with Mr. Boyd about his project?

Mr. BRACKETT. Our financial consultants are here, but I will attempt to respond myself.

The proposals that El Paso has made in the financial area rest upon both the title II guarantees and also upon the concept that there can be put into place tariffs for the charges which will in all events call for the passage of all charges to consumers, irrespective of any events, and indeed, irrespective of completion of the project.

Senator STEVENSON. Let me interrupt to get one point straight. Are both El Paso and Arctic Gas requiring a full cost of service, all events tariffs?

Mr. BOYD. We are and I understand they are, too.

Mr. BRACKETT. As I understand the proposal of El Paso, is that their tariff would begin to operate whether or not the project were completed at a particular period in time.

We think there is a significant possibility in two respects, that such tariff proposals may not receive approval at the Federal or at the State level, and I think they would be required at both, with sufficient strength that lenders would be absolutely assured that they would remain in effect.

Failing that, there may be the necessity of a very contingent position by the Government for either project.

We are convinced that the Arctic Gas Project is not in a worse position than El Paso, that indeed it has the financial advantages that I mentioned earlier, greater economic feasibility, greater strength of backing and indeed there is a consortium, and the ability to call in greater measure upon more widespread capital markets.

However, the project is very large, and we have testified, myself and our financial advisers, have testified quite honestly that there is a possibility—we cannot say as a certainty at this point—that contingent support may be needed.

I stress contingent because we stress this as a private financed project in the sense that we see more than sufficient capital in the private capital markets available to us to put the full escalated cost of the project in place with private commitments, and overrun funds to take care of reasonable overrun costs if they occur.

Of course, we have made the best possible estimates that we can to be sure they will not. But I cannot in all honesty state that it may not be necessary, as we move further down the line, perhaps to expedite, perhaps as a necessity, to call upon the possibility of business interruption insurance over the amounts available from private insurance, and/or lender of last resort provisions to guarantee that the project would be completed, but on a commercial basis.

We have not yet reached the point where we can determine that for certain, but I do not wish to mislead and I felt I should spell this out.

We are confident and we have had testimony at the FPC by financial people that this is not a distinction between the El Paso project and ourselves. We think it is a fact which must be faced in either case, and we are striving to the best of our ability to make this a purely private project. That is the way we would like to it be.

Senator STEVENSON. You have anticipated the next question, namely: What assurance, if any, can you both give us that the contemplated full cost of service all events tariffs will be accepted by not only the Federal Power Commission, but by all of the States?

Mr. BRACKETT. I can give you no assurance, Mr. Chairman.

I can refer you to the responses of some states to a questionnaire in that regard from the FPC, which to the best of my knowledge have been uniformly unfavorable.

I do not exult in that response. I simply note it as a fact.

I think you will be hearing from representatives of certain States tomorrow.

Mr. BOYD. Mr. Chairman, I think the law is perfectly clear that the FPC has preempted the field with respect to the all-events tariff and, thus, if the FPC should approve it, those costs could be passed on to the distributor, even over the objection of the State commission having jurisdiction over that distributor.

I would think it would be unwise for them to take that view.

But just to answer the legal aspect of the question, that is what we are confident of.

Mr. BRACKETT. Mr. Chairman, if I might, Mr. Boyd is quite correct, the FPC can authorize a federally regulated pipeline company to include such a tariff provision.

It is not correct that the FPC can force the State to allow its distributors to purchase under the terms of that tariff.

Mr. BOYD. Certainly Mr. Brackett and I are at odds on the law.

From a practical standpoint, the distribution company has no alternative.

Let me explain why.

The distribution company gets the gas from the pipeline company. The Alaskan gas, although it will be substantial, will be a relatively small percentage of the total volume of gas that the pipeline company is selling to the distribution company.

Now, if the FPC authorizes the tariff to reflect both all events aspects of the Alaskan gas as well as the price applicable to gas produced in the lower 48, the distribution company has the impossible alternative of refusing to take it or paying.

In other words, they do without gas, which, of course, is not an alternative.

Mr. BRACKETT. I do not wish to be understood to be objecting to the all-events tariff, nor do I wish to be understood as saying they are not practical—the fact is that if it were sufficient and if it were achieved, the Arctic Gas project would be in at least as good and probably a better position to utilize it as El Paso.

Senator STEVENSON. I have one final question.

Mr. Boyd, I understood you to say that the El Paso project could pick up the MacKenzie Delta gas. I don't understand how that is possible; or did I misunderstand you?

Mr. Boyd. No; although I have observed that if it be desirable from those that are in control of MacKenzie Delta and it would be in the interests of Canada—I don't mean to be facetious, but it is a geographical fact that the distance from Prudhoe Bay to MacKenzie Delta is exactly the same distance as from MacKenzie Delta to Prudhoe Bay and, therefore, if it be in the interests of the United States, as we submit it is, that the Prudhoe Bay gas be marketed in an all-American project and if there is no other way to market MacKenzie Delta gas, and Mr. Blair does offer another alternative, but if there is none, let the MacKenzie Delta gas come over to Prudhoe and go down in the all-American pipeline.

Senator Stevenson. I haven't heard any mention of the Beaufort Sea. Isn't it possible the Beaufort Sea over the MacKenzie Delta will yield substantial gas?

Mr. Boyd. I expect there is potential there, but I suggest to you that that gas is going to go to market and the only question is the route by which it will go to market.

So it is going to be available to the total North American supply.

I think that Mr. Blair's project, for example, for the reasons I mentioned—and I don't want to duplicate this—offers a means by which MacKenzie Delta gas can be added to the total basket in the North American Continent and also the probability that in addition to that you will have the polar gas.

Senator Stevenson. Isn't it true that if the Beaufort Sea resources materialize in large dimensions it would be far more economical to route a pipeline in a trans-Canada route than to start afresh at that point?

Mr. Boyd. Exactly so. And, Senator, this is the principal security risk that the United States assumes if it certificates the Arctic Gas project, for the very reason you mentioned.

That project is going to be built initially to handle the reserves that are known to be at Prudhoe Bay. They are not willing to have any spare capacity in it. That is not economically wise. That is not the way it has been projected. That is not the way people build pipelines.

Now, the initial expandability of a pipeline is the cheapest expandability. And whatever the Canadians may say now, what guarantee can they offer that when additional quantities of gas are found at Prudhoe Bay—which is highly likely, wells are scheduled to be drilled in PET 4 this coming summer—what assurance can be given that the Canadians will see fit at that time, when it is no longer in their interest to give away this expandable capacity, that they will make it available to the United States?

Let me point out what happens should that occur.

The gas at Prudhoe Bay is associated gas, which means it comes out of the hole in association with the oil. Only three things you can do with the gas. You can flare it, which is unthinkable and unlawful. You can reinject it, which is costly, because the gas-oil ratio keeps increasing and, therefore, you have to compress more and more gas to overcome the reservoir pressure and reinject it and, of course, the revenue is lost from the gas and the markets are denied the gas.

All right. So that the only logical thing to do with the gas is to market it and that benefits everybody, the producer, the consumer—

it conserves the gas which otherwise would be consumed in reinjection.

Now, if you can't expand the line across Canada, because they don't see 5 years from now that that is in their interests, and it wouldn't be, what is going to happen to the newly discovered gas?

The quantity will be too small to floor a line. It is coming out of the ground with the oil. What does it mean?

You have to shut down the wells. You lose both the oil and the gas that is newly discovered.

This was one of principal objections that was voiced by the oil lines themselves to the oil line coming across Canada.

They said that the danger was that although the oil line would be built initially to take the quantities of oil that were foreseen, what guarantees could you be given that in the future when it then was obviously not in Canada's interest, but contrary to its interest, that they would expand the oil line to more the additional quantities of oil.

Mr. BRACKETT. Mr. Chairman, that hypothesis is so demonstrably unreal I would like an opportunity to respond to it.

Senator STEVENSON. Can you respond briefly?

Mr. BRACKETT. Yes, sir.

In the first place, the premise of the Arctic Gas project is to begin initial transportation at 3.25 billion cubic feet a day, whereas the capacity of the main line is 4.5 billion cubic feet a day and the line to Prudhoe Bay itself is 4.5. Therefore, Mr. Boyd's comment that we have no spare capacity to start is quite untrue.

Secondly, as he knows, perhaps better than I, natural gas pipelines are infinitely expandable. El Paso, I think, started with one line and now has four by a process of incremental looping.

There is no reason why the expansion of the Arctic Gas project, when needed to carry either Prudhoe Bay or Delta gas, would not take place. It would improve the economics of transportation for both Canadian and U.S. gas. It would involve limited construction along the side of the line, or in some cases the addition of only compressor station facilities at fixed sites.

It is simply raising a red herring to think that this line would not be expanded in exactly the same way as all of the other pipelines in Canada, including Mr. Blair's line, have always been when the economics dictated. It is an economic way to proceed.

There will be no adverse interests to either nation indicating it should not be done.

We have looked at this very carefully before making our proposal and the tariff we provided calls for such expansion.

Senator STEVENSON. Mr. Blair, did you have something to add?

Mr. BLAIR. Yes. I don't agree that it is all so routine as Mr. Brackett suggests, because of the sheer scale of the project that we are discussing.

It is true that year by year we loop our systems, we all know. But I think that the proposition of finding year by year we have another $½ or $1 billion worth of capital requirements in western Canada to meet that year's increments in moving Alaskan gas does raise serious questions that would have to be determined year by year.

No one can say in advance there is nothing to it, we will just do it as normal. There is a completely new element of the huge scale in this instance.

Senator STEVENS. Mr. Brackett, as you know, I have recommended to the State legislature and the Governor, that Alaska exercise its right and take what its entitled to get now and not commit its gas to any pipeline that would not deliver that gas across Alaska.

Now, if the State government sees fit to follow my advice, what happens to your proposal?

Mr. BRACKETT. We think that that would be an unfortunate occurrence, both in the interests of Alaska and the lower 48 States.

But the project would still be feasible and we would plan to proceed.

Senator STEVENS. Would you alter your route to carry the gas down through Alaska?

Mr. BRACKETT. We do not believe that the route, which would proceed farther into Alaska, is the desirable route, either environmentally or economically, and we have no plans to amend the route.

We believe the interests of Alaska can be well served both by its economic interest in the production and sale of the gas and the utilization of the gas reserves in southern Alaska for its population centers.

Senator STEVENS. There are no vast gas reserves in the Prince William Sound area to which Mr. Boyd's pipeline would go. There is absolutely no gas available in that area. The whole Prince William Sound area, which has a vital capacity to increase its production through fisheries and all of the value-added concepts that Mr. Blair mentioned would not be served by your line.

Mr. Boyd, I hope you don't mind my playing my friend's role over here. What is El Paso doing when it proposes to build this big plant in the middle of all of that seismic activity?

Mr. BOYD. Senator, being from Alaska, as you are, you are unquestionably aware of the fact that those buildings, structures, that were built on bedrock, were totally unaffected in the earthquake of 1964.

There is an interesting statement right here. It is related to that. It is called "The Alaska Earthquake," a professional paper prepared by the USGS.

I would like to read a paragraph from it.

> The habitation closest to the epicenter was the home and small hand cannery of Joe Clark at bedrock site on Fairmont Island just 12 miles from the instrumental center of the earthquake. Yet the only effect of the vibrations there was the breaking of a few dishes that toppled from shelves and the glass ashtrays that were knocked off tables.

Now, one of the reasons we picked Gravina Point is that it is possible to put the plant on bedrock at that point.

Now, I understand it to be said, perhaps erroneously, that a similar 1964 earthquake would rupture the oil tanks at Valdez.

Senator STEVENS. No. I think they said the oil tanks were there for World War II——

Senator MONDALE. I quoted a report that they were ruptured and burned.

Mr. BOYD. Well, that is what I was speaking to.

Dealing with earthquakes is a matter of appropriate engineering.

Bear in mind there are 60-story buildings in San Francisco and Los Angeles and they have been built to withstand earthquakes of an anticipated severity, and so, too, the engineering company which has made the study of Gravina Point has assured us that by accepted engineering standards, they could build a plant so it would be totally unaffected by an earthquake more severe than the 1964 earthquake.

Those same guidelines are the guidelines that were employed by the oil companies in choosing Valdez on which the oil storage and terminal is now built.

Senator STEVENS. It is the old town of Valdez, and the tanks there were ruptured by the tidal wave, not by the earthquake. I think my friends would be wise to look into the fact that the tidal capacity there has been avoided by putting the tanks up on bedrock, far above any potential tidal wave.

I really am disturbed about this, particularly in terms of the information we keep here about the seismic activity in California.

One of my friends told me there is a hundred times the possibility of a major earthquake in California as compared to another one in Alaska at the same magnitude during the life of these structures.

Now, certainly you must have had some pretty good advice before you went into this, didn't you?

Mr. BOYD. I did. We have got one of the outstanding engineering companies of the world, and they are not in dispute with others who recognize it is an engineering problem. I might say, in view of the emphasis Mr. Brackett put on the companies that are identified with the Arctic Gas project, that both Pacific Lighting, and PG & E, the two companies that have responsibility for gas distribution in California, Pacific Lighting being the largest gas distribution company in the United States, is sponsoring an LNG project out at Cook Inlet. And there is presently an LNG project that as the Senator knows, built by Phillips and Marathon, under which LNG is being taken out of Cook Inlet and delivered over into Tokyo.

Now, the Pacific Lighting-PG & E project contemplates they will buy gas from Mobil, Standard of California, and Union—I think those are the companies—and they will build a liquefaction plant there to serve LNG to California.

Senator STEVENS. I hope they get that done, because those wells currently in Cook Inlet that are shut down because of what you said, they are exceeding the gas-oil ratio, we must have the gathering plants, the LNG plant to run the production of oil.

Mr. Blair, I would like to ask you, as president of your company that deals with 70 percent of the gas in your country, do you agree with the statements about taxes in regard to your Provinces and the ability of your Provinces to tax that Mr. Brackett indicated?

Mr. BLAIR. The Provinces in Canada have broad powers of taxation, they use them. I feel I should say something about this. My own company is the largest property taxpayer in the Province of Alberta and it is very significant.

There are other taxes that have not been raised today which can be applicable. There is a special fuel tax imposed in British Columbia. But I think generally, certainly not speaking on the side of supposing discriminatory or unreasonable future practice in Canada, I think probably taxation in Canada will be as reasonable as it is in other jurisdictions.

Senator STEVENS. As in Alaska.

I thought maybe my friend was going to get to that. We have a tendency to look at taxes, too. One last question to Mr. Blair, Mr. Chairman.

The Beaufort Sea proposal, we were told—and it has been in the paper—has been held up as far as your country's drilling proposal, because of the request of our State Department to be sure that the environmental standards had been thoroughly reviewed. But the Beaufort Sea proposal, if it were successful in your country, you would be able to handle any Canadian production through your Canadian Foothills line, would you not? I mean if you can loop the Arctic, you can loop the Foothills.

Mr. BLAIR. Oh, yes; very much so.

Senator STEVENS. You are not worried about the ability of your country to be able to handle Beaufort Sea if there are Prudhoe Bay-type size reserves in terms of serving your own needs, are you?

Mr. BLAIR. Not in terms of serving our own needs, which are relatively modest. The distinction there is, I think, to hook the Foothill system to Canada Gas would be specifically geared to the need of Canadians for that gas, and if there is a political difficulty with putting a big investment in of that kind, it will occur only because there is an offsetting public reason in Canada that the supply be added.

The problem I see, the reasons I have been cautious when we talked about the Fairbanks corridor, when I said we weren't out looking for the getting out of the gas through our system is that really there is not that much Canadian benefit to adding more pipelines to move Alaskan gas and there could be a conflict in a given year between demand for another one or two billion service capacity installed and separate Canadian purpose of the same type.

Senator STEVENS. For the record, what is the level of consumption of natural gas in your country now?

Mr. BLAIR. About 2 trillion cubic feet a year.

Senator STEVENS. In other words, the Mackenzie River gas they propose to move through Arctic is more than your total national consumption now. They propose to move two and a quarter trillion——

Mr. BLAIR. No, Senator, this odd language of the gas business has us trapped, because what we are talking of is two and a quarter billion a day, which 365 days a year would be a little less than one trillion cubic feet a year. But I think this is important, that in the Mackenzie Delta we have a prospective source of supply, which is rapidly evolving into a very major source of supply, which is capable of increasing the supply in Canada by about, I'm sorry, capable of serving the Canadian markets to the extent of about 50 percent of their present total demand. So the leverage in Canada is much better than here, we are much luckier on a proportionate basis than United States is in this situation.

Senator STEVENS. But it is a substantial amount in relation to your current needs?

Mr. BLAIR. Yes, it is. And we believe it should be connected as soon as a manageable scheme could be put in place. We are confident Foothills application is one good way of doing that job.

Senator STEVENS. I obeyed the 10 minute rule, just for the record.

Senator STEVENSON. If there are no further questions, we will move on.

Thank you, gentlemen.

It is the Chair's intention, if there are no strenuous objections, to push right through.

[The statement follows:]

STATEMENT OF WILLIAM W. BRACKETT,
VICE CHAIRMAN, ALASKAN ARCTIC GAS PIPELINE CO.

Mister Chairman and members of the Committees, my name is William W. Brackett. I am Vice Chairman of the Alaskan Arctic Gas Pipeline Company, which has home office in Anchorage, Alaska. My office is in Washington, D.C. Accompanying me today is Mr. V. L. Horte, President, Canadian Arctic Gas Pipeline Limited, the Canadian portion of the Arctic Gas Project. Also with us are a number of the experts who advise the project in a wide variety of areas: John J. Robinette, Q.C., Counsel of the Toronto legal firm of McCarthy & McCarthy, Dr. A. W. F. Banfield, Professor and Director of the Institute of Urban and Environmental Studies, Brock University, Dr. John I. Clark, supervisor of Geotechnical and Environmental Studies, Northern Engineering Services Company Limited and Henry B. Taliaferro of Washington, D.C., partner in the firm of Casey, Lane & Mittendorf, counsel to the Alaskan Arctic Gas Pipeline Company. Also present are Mr. P. H. Dau, President of Northern Engineering Services, Ltd., and Mr. G. L. Williams, Director of Field Services of that company; Mr. R. A. Hemstock, Director of Environmental Studies for Canadian Arctic Gas Pipeline Limited; Mr. J. A. Geller, Q.C. of the Toronto legal firm of Campbell, Godfrey and Lewtas; Mr. R. Anderson of the firm of Purvin & Gertz, Inc., Mr. J. Jetter of the firm of Arthur Anderson & Co., and Mr. R. B. Gary, a Managing Director of Morgan, Stanley & Co., Inc., Investment Bankers.

We appreciate the opportunity afforded by the two Committees to discuss the subject of natural gas from northern Alaska. The Arctic Gas Project is the name of the proposal by a group of United States natural gas pipeline companies and Canadian pipeline and production companies, to build a conventional, buried natural gas pipeline to carry gas from Prudhoe Bay in northern Alaska and the Mackenzie Delta in Canada. The pipeline would cross the northern coast of Alaska and Canada, proceed through Canada along the Mackenzie River and divide in southern Alberta, with one line carrying Alaskan gas directly to United States markets in the West, Northwest and Intermountain West. The other delivery line would transport the Alaskan gas to markets in the Midwestern and Eastern United States. The Arctic Gas system would also transport Canadian gas.

We believe that all here will agree that natural gas is our prime, clean-burning source of energy; that much more of it is needed; and that the largest proven and readily available new supply in the United States is in northern Alaska. The detailed written extension of this testimony contains extensive material on those subjects.

The notification of these hearings indicates that the basic questions under consideration are (1) what is the optimum method of transporting the maximum amounts of northern Alaskan gas resources at the lowest possible cost; and (2) how can our government decide that question, best serving the public interest?

It is clear that the companies which sponsor the Arctic Gas Project feel strongly that the optimum method for transporting the maximum amount of gas from the Alaskan arctic at the lowest possible cost is the buried, conventional natural gas pipeline proposed by the Project. Indeed, no one has ever suggested that there is an environmentally preferable, more economical or more efficient way of carrying gas from a source to a market than the conventional, proven technology of an all-pipeline system, unless an ocean lies between the source and the market and makes a pipeline impracticable. Fortunately, there is no ocean between Alaska and the lower forty-eight states. Our sovereign neighbor Canada is there. The companies which make up the Arctic Gas Project provide gas service to the United States, from coast to coast. They have concluded that the presence of Canada does not indicate that a method other than a pipeline should be used. Nor does the fact that northern Alaskan gas reserves are located in the arctic dictate choice of another method for transporting the gas.

These decisions, and a myriad of others, have resulted from the objective studies which the Arctic Gas Project companies began in 1967. The goal was to conclusively determine the measures needed to construct and operate a natural gas pipeline in the arctic, in an environmentally protective, economical manner. The very extensive studies and planning undertaken places the proposed pipeline, we believe, among the most extensively researched industrial projects in history.

Project costs, largely consisting of those studies, have been well over $100 million to date. The field tests and studies have been undertaken objectively, by retaining as consultants, independent and highly-qualified experts in the many disciplines involved, several of whom are here today. The work has involved all aspects of the Project. The companies in the Arctic Gas group have understood the importance of the Project to their own companies as well as to the nation: they must necessarily carry out the Project, if private enterprise is to undertake the task of constructing the facilities to transport Alaskan gas, which is needed by the areas they serve.

One study examined possible alternatives to a conventional gas pipeline. It asked: what is the most environmentally sound, inexpensive, energy efficient and reliable method for transporting gas from northern Alaska to consumers all across the lower forty-eight states? The methods studied included tanker, railroad and even aircraft and submarine transportation, of liquefied natural gas: use of gas to create methanol, which would then be transported; use of gas to generate electricity for transportation by electric transmission lines; and transmission of gas in a dense phase pipeline. The study established that the buried conventional gas pipeline was the best method: most environmentally sound, least expensive, most efficient in the use of energy for transportation, and most reliable.

The Arctic Gas Project's gas pipeline studies have included extensive field experiments and investigation, as well as theoretical work. They have considered the routing, design and methods of constructing the natural gas pipeline, so as to again meet the same criteria.

It is important to know that environmental considerations are primary—not peripheral—to the work of the Arctic Gas Project. Indeed, of the funds spent to date, over $15 million has been spent directly on environmental investigation and planning. In addition, of course, very large additional amounts have been spent on geotechnical study and design work directly related to and affected by environmental considerations. The Arctic Gas Project has produced a vast new body of knowledge of the ecosystems of northern Alaska.

That environmental work resulted in the decision to build a fully buried natural gas pipeline, with the gas refrigerated in the arctic areas to temperatures that will preserve the permafrost. It is to be constructed in those arctic areas during winter months, when few animals are present and when temporary snow roads can be utilized, thus avoiding the necessity for permanent construction roads.

Field studies in the arctic have been conducted to determine the feasibility and cost of those elements peculiar to arctic construction of the pipeline. Those experiments in the field, including the building of test snow roads, and the development of special construction equipment, have proved the practicability of the proposed construction methods. They have been used extensively to estimate construction costs. In other words, the plans to build the line in the winter, to utilize advanced machinery that has been developed, and to use planned construction methods and snow roads, all of which provide environmental safeguards, are based on testing and experience, not merely theories.

The environmental work also established that the proposed prime route in Alaska—195 miles along the Beaufort Sea coastal plain—is the most preferable route environmentally, given a buried pipeline and winter construction when the wildlife is not present. That route is flat, avoiding the difficult and delicate topography of the Brooks Range, with its higher animal population. The Arctic Gas route is the shortest and most direct route, reducing the mileage of any disturbance. The pipeline will be completely buried, and the surface will be revegetated, using techniques and seeds developd by Arctic Gas research for fast cover, while indigenous ground cover grows back. When construction is complete and the pipeline is fully covered, four compressor stations, each fifty miles apart, will remain above ground in Alaska. We conducted field studies of compressor noise to determine the effect on wildlife. Those simulations established that at worst, the noise will be above normal levels for the area on an average of about one quarter of a mile. Thus, only a very limited amount of wildlife habitat around the station will be affected, and some wildlife, such as caribou, are expected to be undisturbed even within that limited area. In addition, most of the types of wildlife which are ever present in the area are there seasonally, for quite limited periods.

The Arctic Gas route crosses the coastal plain of the Arctic National Wildlife Range. On that plain, there is already human activity, including the native village of Kaktovik, both active and inactive DEW line stations, some airstrips and other signs of human activity. There is frequent aircraft passage. The area is quite different from the mountainous areas of the Range to the south. Existing Wildlife Range legislation contemplates such uses as pipelines, if environmental safeguards are employed. This Arctic Gas is committed to do.

The results of our environmental work has been not only used in planning, but also is incorporated in our environmental report and thirty-four volumes of detailed environmental assessments plus archaeological and socio-economic works, all of which have been filed with government agencies and made available to the public. This work demonstrates conclusively that the buried, refrigerated natural gas pipe line along the coastal route is environmentally acceptable, and preferable to the alternatives examined, including the use of what has been called the Fairbanks-Alcan Highway route. That latter route would be much longer and would pass through mountainous areas where winter construction is impossible, and which are more sensitive wildlife areas.

In addition to being environmentally preferable, the Arctic Gas route will be about three billion dollars less expensive than the Fairbanks-Alcan route, in 1975 costs. It would cost United States consumers hundreds of millions of dollars per year, as shown in the later detailed portion of this presentation, to use that longer route. The cost to Canadian consumers would also be raised by very large amounts, unless all of the cost increases were allocated to the United States, as the initiator of such route. If, as has been suggested by some persons, the Fairbanks route pipeline system were not to include a line to the Mackenzie Delta gas fields, the per unit cost of transportation to be paid by United States consumers would be still higher: at least another hundred million dollars a year higher than if the full Fairbanks system were built. But, as noted, the full Fairbanks system is far more expensive than the Arctic Gas route. Finally, consideration of a Fairbanks route assumes the unlikely event that Canada would ever agree to such a routing, which would prevent transportation of gas from the Canadian arctic in the line. Preventing such transportation would hurt the United States, as well as Canada, as I will describe shortly.

It must be clearly understood that an all pipeline system built in cooperation with Canada is an enormous advantage to the United States, rather than a disadvantage, as some would suggest.

First, the all pipeline system could directly deliver Alaskan gas to markets all across the lower forty-eight states at a transportation cost savings each year of over $700,000,000. In other words, it would cost the United States consumers at least that amount more, annually, if the initial volumes of Alaskan gas were transported by the liquefaction-LNG tanker system proposed by El Paso, and the savings grow as volumes of gas increase. These savings are caused by the fact that the liquefaction and regasification of natural gas is an expensive process, as compared to pipeline transportation. Oil can be shipped in tankers without change of its form, but this is not true of natural gas. In addition, the Arctic Gas pipeline costs benefit from two volume advantages: economies of scale are increased by the higher amounts of gas achieved by transport of Canadian, as well as Alaskan, gas and by the fact that more gas is delivered by a pipeline system than by a liquefaction system, because less gas is used in the transportation process.

These cost savings are not limited to just some areas of the country. There are very large cost savings for all areas: the Northwest and California, where the LNG would be landed, as well as the Midwest and East.

The fact that an all land pipeline across Canada uses much less of the gas for transportation than the liquefaction-tanker system provides energy, as well as cost, advantages. At initial volume levels, the excess gas usage of a liquefaction system would be at least 160 billion BTU per day. To put that in perspective, that saving is enough energy to supply the residential needs of any one of thirty states and more than the total residential requirements of Maine, New Hampshire, Rhode Island, Vermont, Delaware, South Dakota, Alaska and the District of Columbia combined.

A significant additional advantage in cooperating with Canada is that by the joint Arctic Gas Project, Canada can obtain access to new gas reserves in her own arctic regions, five to ten or more years earlier than she will be able to build a Canada-only pipeline for that purpose. This is important to the United States, since Canada now exports to the United States, from its non-arctic reserves, approximately one trillion cubic feet of natural gas per year. The Canadian National Energy Board has estimated that by the early 1980's Canada's domestic demand will exceed her supply by about that same amount—unless Canadian supply is supplemented by her own arctic reserves. Therefore, if we are to continue to receive gas from Canada, which is critically important to the United States, the Arctic Gas Project must be built. A line along the Fairbanks corridor, with a leg to the Mackenzie Delta gas fields, would not achieve this advantage, however.

The Arctic Gas Project has other advantages. A pipeline can be more economically expanded to carry new gas supplies, and the Arctic Gas pipeline is located in areas of likely new gas supplies. The Arctic Gas Project will provide balance of payments benefits to the United States, and will stimulate economic activity and employment. And the Arctic Gas pipeline can be put into operation sooner than the system proposed by El Paso.

If cooperating with Canada will produce all of these advantages, why not build the Trans-Canada pipeline?

I must say to you bluntly that there is no reason not to build it—there is no disadvantage to the United States involved in this international project. It is a classic case of international trade working to benefit both nations. The entire history of our trade relationship with Canada gives no reason to give up that benefit. The United States northeast surface transportation system has been changed in reliance on the use of the St. Lawrence Seaway. It is a cooperative project, and through the entire reach of the St. Lawrence River, the Seaway lies entirely in Canada. United States products are subject to Canadian control—and the system works, to the benefit of both nations. There is no reason to believe the Arctic Gas Project would be any different.

Canada also relies on the United States. The transportation of oil and gas is an example. Almost half of the natural gas produced in Canada's western provinces and consumed in Canada's eastern areas is carried in pipelines into the United States, and then back into Canada for consumption in the east. The same is true of almost all of western Canada's oil which is consumed in eastern Canada. Indeed, Canada has just taken the decision to expand the Lakehead Pipeline system which carries crude oil from western Canada south of the Great Lakes and back into Ontario, rather than building an all-Canada line. Much of the oil imported into Canada from abroad flows in a pipeline across the State of Maine. Indeed, if the Arctic Gas Project is built, the percentage of Canada's hydrocarbons flowing through the United States will still be much larger than the percentage of U.S. hydrocarbons flowing across Canada.

Canada has never obstructed, impeded or threatened the flow of United States commodities—energy or otherwise—across Canada. She has adopted export supply and price policies with respect to her own scarce commodities sold to the United States, and others, as they have come into short supply in Canada. So have we. So has every nation. But that does not suggest that she would interfere with the flow of United States gas across her nation, after authorizing that transit.

If more assurances are needed, the Congress has now been advised that on January 29, 1976, officials of our State Department and of Canada initialled a treaty. That treaty reportedly provides that neither nation will interrupt the transportation of oil and gas across their respective territories; neither will tax the oil and gas of the other nation in transit; and neither will discriminate against such transportation systems in either taxation or regulation. That treaty would bind the two federal governments. Existing Canadian law binds the Provinces in much the way that our states are bound by the Commerce Clause of the Constitution, so that Provinces cannot tax or interfere with inter-provincial flows, or regulate inter-provincial pipelines, or discriminate against them in taxation. Canadian willingness to provide treaty guarantees, the provisions of Canadian law as to Provinces, the history of our dealings with Canada, and the self interest involved in achieving this joint project and maintaining amicable transportation arrangements, provide all the assurance anyone can legitimately ask, or that is needed.

I have mentioned that an all pipeline system is not only environmentally preferable and the least expensive transportation method, but is also most efficient in use of energy, and that such efficiency would save a highly significant amount of gas. It is also true that a conventional, buried natural gas pipeline is by far the most reliable and secure transportation system. Indeed, it has a record of reliability unmatched by any other mode. The comparison of reliability and security must also take into account that El Paso proposes to build a liquefaction plant on the southern coast of Alaska in one of the world's most active earthquake zones; that it proposes to build a liquefaction plant several times as large as any ever built or planned, stretching technology beyond any known limits; that it proposed to haul all the Alaskan gas on the largest LNG tankers ever planned, through difficult international waters and land it all on the southern California coast for regasification. Apart from the earthquake risks and the risks of untested technical scale, what happens if a tanker is lost, carrying one eleventh of a huge supply of natural gas which will comprise perhaps ten percent of the nation's interstate supply?

Further, El Paso proposes to carry its Trans-Alaska pipeline across the same Yukon river bridge with the Alyeska crude oil pipeline. Then all of northern Alaska's oil and gas which goes to the lower forty-eight states would be carried through the same international waters, and be delivered to the same area in the United States.

That proposal is neither secure, reliable or sensible, when compared with a buried pipeline through Canada.

I suggest that the facts I have touched upon show that the question of the best method for transporting Alaskan gas has been intensively studied and conclusively answered. It is the all pipeline system across Canada proposed by the Arctic Gas Project.

The second question is how our government can grant authorizations to the best system in the fashion best serving the public interest?

S. 2950, sponsored by Senator Mondale and twenty-nine other Members of the Senate, who represent States from one end of the country to the other, requires the approval of the Arctic Gas Project, promptly after enactment. That result is, we submit, wholly in the public interest.

The cost to the American consumer of delay is a central issue. That cost can be determined by adding two factors. First, if you assume an annual inflation rate of seven to eight percent, a year's delay would increase construction cost, for which the consumer must ultimately pay, by over $600,000,000. That produces millions of dollars in increased transportation costs, each year. Second, delay in obtaining access to northern Alaska's gas delays the time when dependence on foreign oil can be reduced by almost $2 billion per year.

Those additional costs, and greater dependence, need not be suffered for the sake of further study. The Arctic Gas Project has been extensively studied. A voluminous record has already been built relative to both the El Paso Project and the Arctic Gas Project. A final Environmental Impact Statement on the

Arctic Gas Project by the Department of the Interior will be issued any day. A final Environmental Impact Statement on both projects is expected to be issued by the Federal Power Commission environmental staff during April. That the Arctic Gas Project is the best method of transporting Alaskan gas has been established. It should be approved. We are confident that it will be approved, but the question is when.

Making it possible for the work to begin to bring northern Alaskan gas to the contiguous 48 states is a very important national energy step. Congress can take that step on the basis of available information.

Canada is expected to complete its deliberations on the Arctic Gas Project near the end of 1976, or early 1977.

S. 2950, if passed in this session, would produce government authorizations for the Arctic Gas Project in 1976. A shortened appeal, if any is filed, might extend the final date into 1977. If no legislation is passed, that timing is delayed by two to three years. If S. 3167, proposed by the Administration, or some other "procedural bill" were enacted, it appears that the decision would be at least a year later than under S. 2950, as indicated on the following chart.

We believe that the result achievable by prompt and favorable consideration of S. 2950—the "Alaskan Natural Gas Pipeline Authorization Act of 1976"—is in the national interest.

Thank you, Mr. Chairman. My colleagues and I stand ready to answer your questions.

COMPARATIVE POTENTIAL SCHEDULES FOR APPROVAL OF A NORTH ALASKAN GAS TRANSPORTATION SYSTEM

[Assumes enactment of S. 2950 or Administration Bill on Aug. 1, 1976]

	Federal Power Commission decision	Department of Interior and other agency action	Presidential decision	Congressional action	Subsequent FPC and other agency action	Court Appeals completion [1]
Under existing law.	July 1977	Late 1976 and after.	None	None	None—was completed July 1977.	Late 1978 to late 1979.
Under administration bill.	Initially Jan. 1, 1977.	Initially Feb. 1, 1977.	Aug. 1, 1977.	Oct. 1, 1977	Nov. 1, 1977 (but much later if there were congressional disapproval of presidential decision).	Greater possibility of no appeal—If any, early to mid 1978.
Under S. 2950	Oct. 1, 1976	Oct. 1, 1976, or earlier.	None	None—was completed in 1976.	None—was completed October 1976.	Greater possibility of no appeal—if any, early to mid 1977.

[1] Later if Supreme Court grants review.

I. THE BACKGROUND AND PURPOSE OF THE ARCTIC GAS PROJECT

The Arctic Gas Project was conceived and designed to provide the most environmentally acceptable, economic, efficient and reliable means of transporting the huge volumes of natural gas in Arctic North America to markets critically in need of such gas supplies in the lower 48 of the United States and southern Canada. The facilities to do this consist of a natural gas pipeline from northern Alaska, south across Canada along the Mackenzie River, to the markets throughout the United States. That pipeline will transport Prudhoe Bay gas, already equal to over 10% of the nation's gas reserves, and much greater amounts of additional gas which are being developed in the Arctic, to the markets which need it.

The proposed Arctic Gas pipeline from Alaska through Canada will divide in southern Canada into two legs which will run to points on the Idaho and Montana borders with Canada. From there, companion pipelines will carry arctic gas directly to United States markets in the West, Northwest, Midwest and East. The pipeline will also transport gas from producing fields in the Canadian arctic areas.

The Arctic Gas Project was begun in 1967. Following years of research and planning, which has thus far required well over $100,000,000 of cost, applications for government approvals were filed in the United States and Canada in March, 1974.

The sponsors of the Project are a group of the leading natural gas pipeline and distribution companies of the United States and Canada, and the major Canadian gas producers. Those sponsors and cooperating companies are:

United States Companies

Columbia Gas Transmission Coorporation which serves customers in the District of Columbia, Kentucky, Maryland, New York, Ohio, Pennsylvania, Virginia and West Virginia.

Michigan Wisconsin Pipe Line Company, which has market areas in Illinois, Indiana, Iowa, Kansas, Michigan, Missouri, Ohio, Tennessee and Wisconsin.

Natural Gas Pipe Line Company of America (a subsidiary of Peoples Gas Company), which serves customers in Illinois, Indiana, Iowa, Kansas, Missouri, Nebraska, Oklahoma, Texas and Wisconsin.

Northern Natural Gas Company, which markets gas in Colorado, Illinois, Iowa, Kansas, Michigan, Minnesota, Nebraska and South Dakota.

Pacific Gas & Electric Company, which is the San Francisco and northern California supplier which participates through a Canadian affiliate.

Pacific Lighting Gas Development Company, which, through affiliates, serves customers in central and southern California.

Panhandle Eastern Pipe Line Company, which serves customers in Illinois, Indiana, Michigan, Missouri and Ohio.

Texas Eastern Transmission Corporation, which delivers gas in Alabama, Arkansas, Illinois, Indiana, Kentucky, Louisiana, Mississippi, Missouri, New Jersey, New York, Ohio, Pennsylvania, Tennessee and Texas.

Northwest Energy Company participates cooperatively, and serves customers in Arizona, Colorado, Idaho, Oregon, Utah, Washington, and Wyoming.

Canadian Companies

Alberta Natural Gas Company Limited
Canada Development Corporation
Gulf Oil Canada Limited
Imperial Oil Limited
Northern and Central Gas Corporation Limited
Shell Canada Limited
The Consumers Gas Company
TransCanada Pipelines Limited
Union Gas Limited

This document will set forth the amounts of gas in the Alaskan and Canadian arctic which are to be transported by the pipeline, the great need of gas consuming areas for that gas, the work done and standards achieved in developing the pipeline system to transport the gas, and the reasons why the Arctic Gas Project is the most advantageous way for the United States to transport natural gas from northern Alaska.

The following discussion is quite detailed, so that full information will be available to the members and staffs of the Senate Commerce and Interior Committees, and to the Members of the Senate as a whole. Further reference material is set forth in the Appendix.

II. A DESCRIPTION OF THE ARCTIC GAS PROJECT, ITS PREPARATORY WORK AND ITS CURRENT STATUS

A. A General Description of Arctic Gas' Proposed Route and Facilities

The component parts of the Arctic Gas Project have filed requests for authority from the applicable governmental agencies of the United States and Canada to construct and operate its proposed system. Alaskan Arctic Gas Pipeline Company has filed for authority to construct and operate a 48-inch buried and chilled natural gas pipeline commencing at Prudhoe Bay, Alaska, and travelling east across the arctic coastal plain for approximately 195 miles to the Alaska-Yukon border. At the border, Canadian Arctic Gas Pipeline Limited's proposed 48-inch pipeline facilities will commence. The Alaskan gas will be hauled by Canadian Arctic in pipeline facilities traversing the Mackenzie River Delta to a junction with Canadian Arctic's proposed 48-inch mainline near Tununuk Point. At this point, Canadian gas from the Mackenzie Delta area of Canada's federal Northwest Territories will be commingled with Alaskan gas and transported in a southerly direction up the east side of the Mackenzie River to a point near Caroline, Alberta. At Caroline, gas destined for delivery to pipeline companies and markets serving the midwestern and eastern portions of the United States and Canada will be transported through one delivery leg to a point near Monchy, Saskatchewan, on the Montana-Saskatchewan border. Gas destined for delivery to northwestern and western United States' markets will be transported through a second delivery leg, which ends at a point near Kingsgate, British Columbia, on the border between Idaho and British Columbia. Canadian gas destined for eastern Canada will leave the eastern leg of the Arctic Gas system at Empress, Alberta, where the line connects with that of TransCanada PipeLines Limited. Other points of connection for supply of Canadian gas to other parts of Canada will also be provided.

From the Monchy delivery point, Northern Border Pipeline Company proposes to construct and operate a pipeline across the States of Montana, North Dakota, South Dakota, Minnesota, Iowa and into Illinois.

The termination of Northern Border near Chicago constitutes a change in previous plans. This would not change the destination of Alaskan gas: it would not mean reduced deliveries to areas east of Chicago. What it does mean is that the amounts of gas purchased by companies which serve those more eastern areas will be delivered by exchange. The Alaskan gas will physically remain with the companies which take delivery at or west of tthe Chicago areas, and those eastern companies will receive from the western companies an amount of Texas and Louisiana gas which will then be delivered to eastern markets in existing pipelines. This reduction of length of Northern Border will cause a significant reduction of cost for all areas served by Northern Border.

In the western United States, it has been decided that a consolidation of applications and facilities is desirable. Specifically, the application for facilities formerly known as "Interstate Transmission Associates" has been withdrawn. Instead, additions will be made to the already existing pipeline of Pacific Gas Transmission Company and its parent, Pacific Gas and Electric Company, which runs from the border point at Kingsgate through Idaho, Washington, Oregon and California. Those facilities will be used to transport not only gas purchased by Pacific Gas and Electric for its northern California market areas, but also gas purchased by Northwest Pipeline Company for its northwestern multi-state market area, and Pacific Lighting Company's southern California area. In addition, it is proposed to have Northwest Pipeline, and the New Mexico and Arizona portion of the El Paso facilities deliver a portion of Pacific Lighting's Alaskan gas. This consolidation of facilities, and accompanying consolidation of facilities in Canada, will cause significant reductions in transportation costs of all areas served by the Arctic Gas Project, and particularly in the Northwestern and Western areas of the United States, which reductions are not reflected in the cost figures shown in a separate section of this document.

The 48-inch main line of the Arctic Gas Project will carry approximately 4.5 billion cubic feet of gas per day when full compression horsepower is installed. The line can, of course, be expanded by looping and adding compression in order to carry additional volumes of gas as they become available. Present planning calls for start-up capacity and throughput of 3.25 billion cubic feet per day, with expansion to 4.5 billion in about four years, but these levels can be modified to carry whatever gas is available.

B. The Disposition of North Slope Gas

Alaskan Arctic has been planned to operate as a transporter of Alaskan natural gas, and not as a buyer and seller. Accordingly, there will not be a single buyer of North Slope gas: instead, prospective buyers of gas have negotiated agreements relative to the purchase of the gas from the producing companies which are the owners of the Prudhoe Bay gas. This has been done on the basis of one to one individual company negotiations, between the producers and the natural gas pipeline and distribution companies which serve the various parts of the nation.

This is the traditional, normal pattern by which the natural gas supplies which are to be available to the different areas of the United States have been determined: the individual natural gas pipeline and, sometimes, distribution companies carry out their own activities to secure gas for the areas they serve. Those activities include competing against each other to purchase gas from producers, and development of their own gas reserves. The various gas producing areas of the United States have been developed in that manner, and this multiplicity of individual efforts has developed a substantial natural gas transmission and distribution system across the nation.

Experience has also shown a pattern of development of additional gas reserves in producing areas, once a pipeline to that area has been established: the producers then are aware that further investment of funds to develop gas reserves, in addition to those originally discovered, is justified because there will be a practical way to market the new gas reserves. That is the situation in northern Alaska now. The large gas reserves of the Prudhoe Bay field are now established. What is now needed is the establishment, with certainty, that there will be a pipeline to transport gas from northern Alaska to the lower 48 states: that will stimulate the development of further gas reserves. And those reserves will be available for purchase by pipeline and distribution companies, whether the same or different companies as contract for the initial quantities of gas.

At the present time, some of the Prudhoe Bay gas is the subject of agreements between producers and purchasers. Other quantities of that gas were the subject of similar agreements which have been cancelled in the aftermath of the decision of the FPC at the end of 1975, ruling against "advance payments" from purchasers to producers. Other gas has never been the subject of contract, and all of the gas is subject to the right of the State of Alaska, under its land leases to the producers, to take one-eighth of the gas itself, or one-eighth of the proceeds of the producer's sale of the gas.

It has been suggested that the normal national pattern of distribution of gas, by the private negotiations of individual buyers and sellers, be replaced by a system of governmental allocation of the gas supply. This would be a different governmental involvement than is now the case, since no governmental authority now allocates gas supply between pipelines. There are a number of reasons for this. One is the effect of allocations upon individual incentives to develop gas supply. A second is the lack of information and expertise to make allocations. A third is the extreme amount of time which would be required to carry out allocation proceedings.

As to incentives, an example is that the sponsor companies of the Arctic Gas Project have expended well over one hundred million dollars, and have utilized the efforts of their personnel, to advance the planning and applications for a transportation system which will make northern Alaska gas available to consumers. They have utilized the traditional processes of individual bargaining between purchaser and seller to try to secure contractual rights to the gas in question. Relative to the Arctic Gas Project, the companies have indicated a willingness to furnish private equity funds necessary to make the project viable, assuming acceptable approvals and acceptable current conditions.

Clearly, incentives to engage in private pioneering activities would be substantially reduced, and probably destroyed, if it became obvious that gas were to be allocated on the basis of some formula, and would not be subject to the efforts of the companies in question. What would be the incentive for any company to expend funds and efforts if it made no difference concerning the new gas supplies the company would obtain? And since any allocation probably would involve a very large number of companies, the amount of gas available for any single company could be so small as not to justify extensive efforts relative to the pipeline system needed. Under those conditions, what will be the source of pioneering efforts and of equity capital?

When the subject of allocation is raised, it also becomes a significant question as to why it should be considered relative to a single source of gas (in this case, northern Alaska gas). What is the rationale for limiting allocation to such single source, rather than including new gas from all sources, and gas from existing sources? Further, what is the justification for dealing only with natural gas, when it is total energy, or at least interchangeable energy in various categories, which is relevant overall. An allocation considering not only natural gas, but all energy supplies available to every area across the nation served by natural gas pipelines, would have to include examination of all the natural and synthetic gas supplies available to those areas. And since such a major portion of the gas demand here involved concerns high priority industrial usage, a careful examination of the availability of alternative energy sources also would be required.

The scope of the proceeding required for the foregoing purposes would be staggering. The time required to make a concurrent nationwide assessment of all market areas and to insure that such assessment was based on comparative information collected on a uniform basis cannot be prudently estimated. Just to perform the foregoing task on a single interstate pipeline has required lengthy, virtually unending proceedings before the FPC. To attempt to do this on a national scale literally would mean years in proceedings before the FPC and in appeals by interested parties: those parties would include every interstate pipeline, local gas distribution systems, state and local political subdivisions, state commissions, industrial consumers, and consumer groups in the United States. To comprehend what would be involved in such a proceeding argues forcefully for its immediate rejection. If such a proceeding were to be conducted, it is safe to say that the availability of the Prudhoe Bay gas supplies to consumers in the United States would be delayed by many years, a circumstance that is indefensible. No project could be financed and, therefore, constructed, without knowing what facilities had to be constructed, what markets would be served and who the equity owners would be.

Arctic Gas, an organization open to companies wishing to participate, believes everyone, including natural gas pipeline and distribution companies and gas consumers, whether recipients of initially contracted Alaskan supplies or not, should recognize that the availability of the vast potential supplies from the North Slope can most readily benefit their needs, and those of the entire nation, if there is early certification of a transportation system to market, and if the present pattern of distribution of gas through individual negotiations of private buyers and sellers is continued.

C. The Current Status of Governmental Authorizations

The Arctic Gas Project has made application in the United States to the Department of the Interior and the FPC in March, 1974. The Department of the Interior completed a Draft Environmental Impact Statement relative to the project in June, 1975, and the Final Environmental impact Statement reportedly will be issued in March or April, 1976.

In the FPC hearings, cross-examination of the direct cases of the applicants and most of the answering cases of other parties has been held. An FPC Staff Draft Environmental Impact Statement has been filed, and cross-examination relative to the final statement (expected in April or May, 1976) is required. The filing of answering and rebuttal evidence by the applicants, cross-examination of those cases, briefs to the Law Judge, Law Judge Decision, briefs to the FPC, FPC Decision, petitions for rehearing and action on such petitions is required, before court appeal may begin.

D. Description of the Studies Undertaken by Arctic Gas to Assure the Environmental Acceptability and Engineering Integrity of Its Project

The FPC requires that an applicant for a certificate of public convenience and necessity to construct and operate natural gas pipeline and related facilities file comprehensive engineering design and operating information demonstrating a project's engineering feasibility (see, 18 C.F.R. §157.14, Exhibits G, G–I, and G–II). The FPC's regulations also provide that persons who will be subject to its jurisdiction design, install, inspect, test, construct, operate, replace and maintain facilities authorized by any certificate in accordance with the Federal Safety Standards promulgated by the Office of Pipeline Safety (see, 18 C.F.R. §157.14(a)(9)(vi)).

The engineering techniques developed to assure that the proposed pipeline will be constructed, operated and maintained in a safe and efficient manner have involved compliance with those requirements, but the work has gone far beyond that. Voluminous design, geotechnical, seismic, metallurgy, construction, operation and maintenance studies have been conducted over the past seven years at a cost of tens of millions of dollars. The results of this effort are reflected in extensive testimony and exhibits in the FPC hearing record (see, *e.g.*, Exh. AA–12,[1] Dau, Clark, Newmark, Slusarchuk, Cooper, Minning, Morgenstern, Purcell and Hurd).

---

[1] References to exhibits (Exh. ——) in this document refer to exhibits introduced before the FPC.

While the Arctic Gas Project basically involves conventional natural gas pipeline construction,[2] geotechnical studies were required to insure the integrity of the system in permafrost systems. These studies may be classified as follows: detailed field work, creation of special tests and test sites, and office studies. They cover such fields as terrain and geological reconnaissance, test drilling, hydrological and river engineering studies, geothermal studies, study of special terrain problems, terrain typing, and meterological studies. An explanatory outline of the foregoing studies is appended hereto as an Appendix.[3] The foregoing studies not only have established that a natural gas pipeline can be safely and dependably constructed in permafrost regions, but have measurably advanced scientific knowledge of arctic construction.

In order to assure the construction, operation and maintenance of a safe and reliable pipeline, it was necessary for Arctic Gas to construct and operate test facilities and to undertake related research programs. To this end, test facilities were constructed at Prudhoe Bay, Alaska, Sans Sault Rapids, Northwest Territories, and Norman Wells, Northwest Territories. In addition, snow road tests were conducted at Inuvik and Norman Wells, Northwest Territories. Frost effect studies were carried out in Calgary, Alberta, and the other locations listed above. The test site studies encompassed revegetation, geothermal and meteorological studies, geotechnical studies, snow road and other construction technique studies, pipe stress studies, and studies of the operation of a chilled and buried pipeline (Item Q, Appendix A fully describes these studies and that document is attached hereto as an Appendix). In short, these studies demonstrated the engineering feasibility and environmental acceptability of the construction, operation and maintenance of the proposed pipeline in permafrost and discontinuous permafrost regions.

Similarly, as discussed more fully in the environmental section of this document, unprecedented environmental baseline and disturbance field programs were undertaken by independent consultants to Arctic Gas on vegetation, wildlife (birds and mammals) and fish. Field studies were also undertaken on the abiotic components of the environment, e.g., water, air, etc. A general description of these studies is also contained in Item Q, Appendix A, which is attached hereto as an Appendix. A detailed analysis of the biological studies undertaken by Arctic Gas is reported in the Biological Report Series prepared by Arctic Gas and is contained in Appendix B to the testimony of Mr. R. A. Hemstock, Director of Environmental Studies for Canadian Arctic. That Appendix B is attached hereto as an Appendix. In addition, Arctic Gas commissioned extensive socioeconomic studies in both the State of Alaska and Canada, as well as the preparation of archaeological programs which will protect cultural resources which may be encountered along the proposed route. These have been published as supplements to the Biological Report Series.

E. General Description of Alternative Modes and Routes Considered by Arctic Gas

Chapter V of the Arctic Gas Environmental Report, which has been filed with the Senate Commerce and Interior Committees, describes alternate modes studied by Arctic Gas of transporting the Prudhoe Bay gas to the lower 48 of the United States, *e.g.*, liquefaction of the gas and use of various modes to transport it; using the gas to create electricity, which would be transmitted; transporting gas in a dense phase pipeline system; and using the gas to create methanol, which would be carried in a pipeline system. In each case, the overland "all-gas-phase" pipeline system was determined best on almost all relevant bases, which is not surprising since that is the conclusion which has been accepted since pipeline transportation of natural gas commenced (Exh. AA–12, Brackett, pp. 14–15).

One of the alternative systems which has been studied extensively is the gas liquefaction-tanker system of the type proposed by El Paso Natural Gas Company. In later sections of this document, comparisons will frequently be made between such system and the Arctic Gas Project. Accordingly, that system will be described here rather fully. It is proposed to consist of:

---

[2] There were approximately 263,000 miles of natural gas transmission pipeline constructed in the United States as of December 31, 1974. American Gas Association 1974 Gas Facts, p. 50. This extensive network of interstate pipeline pass largely unseen, beneath the ground, with a safety, efficiency and environmental record unmatched by any other form of transportation.

[3] It is in evidence in the FPC hearing record at T. 2917–32.

(1) An 809 mile, 42-inch diameter pipeline from Prudhoe Bay across Alaska to Gravina Point on Prince William Sound.

(2) A huge plant including storage tanks at Gravina Point for the liquefaction and storage of the natural gas transported from Prudhoe Bay.

(3) A marine terminal adjacent to the LNG plant at Gravina Point for the berthing and loading of LNG tankers.

(4) An LNG tanker fleet operating on a 1900 mile nautical trade route from Gravina Point to Point Conception on the California coast approximately 120 miles north of Los Angeles.

(5) Coastal facilities at Point Conception, to be owned and operated by Western LNG Terminal Company, for the unloading and storage of the LNG and for its vaporization and transportation to various points in California.

(6) Beyond the Western LNG facilities, El Paso Alaska would depend upon building new pipelines, using and changing its existing facilities and ultimately working out arrangements with other pipeline companies for the transportation of the gas to market areas, either directly or by exchange-displacement. Included in the construction of additional pipeline facilities in the lower 48 would be a 418 mile, 42-inch pipeline across Texas to the Gulf Coast.

To analyze a liquefaction-tanker system, and the El Paso proposal, Arctic Gas retained the services of the consulting engineering firm of Purvin & Gertz, Inc. to make an independent analysis of the El Paso Alaska LNG transportation system. An independent assessment of each segment of the transportation system has been made by Purvin & Gertz and the following organizations:

(1) Northern Engineering Services Company Limited,
(2) John J. McMullen Associates, Inc., Maritime Engineers,
(3) Williams Brothers Engineering Company,
(4) The following member companies of the Alaskan Arctic consortium:
(a) Columbia Gas Transmission Company
(b) Michigan Wisconsin Pipe Line Company
(c) Natural Gas Pipeline Company of America
(d) Northern Natural Gas Company
(e) Panhandle Eastern Pipeline Company
(f) Texas Eastern Transmission Company
(g) Pacific Gas & Electric Company
(h) Southern California Gas Company

Chapter V of the Arctic Gas Environmental Report, referred to above, also describes the alternative corridors considered for delivering the northern gas supplies to market, i.e., the Interior Route, the Fairbanks (Fairbanks-Alaska Highway) Corridor, the Fort Yukon Corridor, the Offshore Corridor and Common Corridor concepts.

Before discussing these various alternative corridors, however, it is necessary to understand that Arctic Gas selected its proposed coastal route from an environmental, engineering, economic, energy conservation and service reliability standpoint, having consideration for the project objectives, i.e., access to the Alaskan North Slope and Canadian Mackenzie Delta gas supplies and delivery of those gas supplies directly to market in the lower 48 of the United States and Southern Canada. The final route selection involved consideration of the technical and economic feasibility of the various alternatives, together with environmental and sociological considerations. Natural terrain barriers and sensitive environmental areas were avoided to the extent possible, and the proximity of the pipeline to other known and probable future sources of supply was a relevant factor.

As Mr. Hemstock testified, inter alia, (Exh. AA–12, Hemstock, p. 14):

"The route was initially selected on the basis of the use of the most favorable topography, together with a desire to keep the pipeline as short as possible. One of the basic criteria was that the crossing of stable ground would minimize the disturbance to the ground so that the route avoided, insofar as possible, any slopes which were considered to be marginally stable. This preliminary route location was reviewed with biologists to assess the impact on the flora and fauna that might be anticipated. The route was then further finalized on the basis of field information and there were frequent meetings in the early years of the study between the engineers and biologists to examine major variations. After the route had been finalized to this extent, it was plotted on photomosaic sheets similar to those which are provided in the application and designated as alignment sheets. At this stage, formal meetings were called, as described later, to which engineers from all disciplines, together with specialists from the environmental sciences, reviewed the route on a mile-by-mile basis. It should be understood that, in many cases, there might be two engineering disciplines which could not agree on a final selection because of varied requirements, or that there may have been two environmental disciplines which disagreed. The purpose of the joint meeting with input from each area was to arrive at a suitable overall solution."

Having reviewed the various corridors from an economic, geographic, engineering, environmental, energy conservation, and socio-economic standpoint, as amended in light of the interaction between the disciplines, it was concluded that although both the proposed coastal route and interior alternative route were environmentally acceptable (Exh. AA–13, Banfield, p. 8), nevertheless, from an overall environmental standpoint, the coastal route was preferable to the interior alternative route (*Ibid.*) A more complete analysis of the preference for the coastal route is contained in the section of this document on the environment. The proposed coastal route, which traverses the flat coastal plain and not the foothills and Brooks Mountain Range, is preferable to the alternative interior route from an environmental and engineering standpoint (Exh. AA–12, Dau, pp. 6–7). The interior alternative route would also cost several hundred million doollars more than the proposed coastal route (*Ibid*).

With respect to the Offshore Beaufort Sea Corridor, the greatest concerns lie in the technical area, since Arctic Gas could not guarantee that a pipeline could be constructed on the offshore route within the time period available and, furthermore, with present technology, it is not certain that the pipeline could be repaired promply if there were to be an interruption during the period of freeze up or breakup. Obviously, continuity of supply is one of the most important factors in the consideration of the feasibility of any main trunk pipeline and, therefore, the proposed coastal route is significantly preferable to the Offshore Corridor in this regard (Exh. AA–12, Hemstock, p. 13). The Offshore Corridor also would cost several hundred million dollars more than the proposed coastal route.

The Fairbanks Corridor is discussed in a separate section and in the environmental section of this document in considerable detail. Suffice it to state at this juncture that Arctic Gas determined it to be less preferable to the proposed coastal route from an economic, environmental, engineering, energy conservation and service reliability standpoint. It would cost approximately three billion dollars more than the proposed coastal route, have greater overall potential for environmental damage, require difficult construction through the Brooks Mountain Range, cross areas of high seismic risk, and use far more fuel than the proposed coastal route in delivering the gas to market.

The Fort Yukon Corridor is subject to many of the same criticisms as the Fairbanks Corridor. It would cost at least one billion dollars more than the proposed coastal route (Item Q, Chapter V, Section B, Subsection 1.5, pp. 5–6), have more difficult construction since it too would traverse the Brooks Mountain Range and have greater overall potential for environmental damage (*Id.* at Section 1.9).

Finally, the use of a "Common Corridor" is also discussed in the section of this document on environment, in the context of the El Paso Alaska Company proposal. As can be seen from that discussion, there is no "magic" in using a Common Corridor for location of utility facilities. Rather, it is one consideration to be taken into account in the total mix of factors in determining the routing of a pipeline. An analysis of the utilization of a Common Corridor, in the context of the capital and operating costs, environmental considerations, delivery of gas directly to markets, system reliability, and energy conservation indicates that the Arctic Gas proposed coastal route is preferable to the use of a Common Corridor (*Id.* at Subsection 1.8).

III. NATURAL GAS FROM NORTHERN ALASKA IS URGENTLY NEEDED BY THE NATION TO HELP ALLEVIATE THE SERIOUS GAS SUPPLY SHORTAGE FACING THE NATION

There is no doubt that a critical gas supply shortage presently exists in the United States. Virtually all major interstate natural gas pipeline transmission systems are curtailing service to their existing customers.

To establish a framework for assessing the gravity of the need for Alaskan gas in the lower 48 states, the current gas supply-demand imbalance must be recognized. Natural gas production in the lower 48 states peaked in 1973, declining by 1.3 Tcf (trillion cubic feet), or six percent, in 1974. This is equivalent to two percent of the total energy consumption in the United States during 1974.

On July 22, 1975, the Government Operations Committee of the House of Representatives approved a subcommittee report on "federal preparedness to deal with the natural gas shortage emergency this coming winter." This Congressional report attempts to document the scope and seriousness of the present natural gas shortage emergency. The report stated the expectation of winter natural gas curtailments creating emergency situations affecting many industries, and provides:

"Nearly 50 percent of American Manufacturing depends upon natural gas far in excess of one-half of its fuel-based energy. These industries represent at least one-half of the manufacturing value added, shipments, and employment outlets of the American economy.

"Industries with an excess of 80 percent dependence upon gas, but faced with severe curtailments, include chemicals, petroleum refining, fertilizers, sugar, metal cans, steel pipe and tubing, oil-field machinery, and nonferrous metals. Any disruption of these basic industries as a result of curtained gas supply will have a twinfold disastrous effect—increasing unemployment and reducing productivity. Attendant price increases can also be anticipated."

The report concludes that "the economic health and national security of the Nation are endangered because of the potential adverse effects on employment and industrial production."

For the decade ahead, the FPC Bureau of Natural Gas has estimated that gas production will decline to 13.8 Tcf in 1985, from 22.5 Tcf in 1973, if reserve additions follow the 1968 and 1973 pattern.[4] This would be a decline of 39 percent, if trends continue, and is equivalent to 12 percent of total energy consumption during 1974 in the United States. Just to make up the projected decline in 1985 would be a herculean effort. It would require over ten projects of the magnitude here proposed, or approximately 100 standard-sized coal gasification plants.

In the western, northwestern, midwestern and eastern areas of the United States that would be initially and directly served by the lower 48 transportation systems associated with the Arctic Gas Project, the gas supplies here involved are required by existing consumers for the highest priorities of usage, i.e., residential, small commercial, large commercial, and firm industrial requirements for plant protection, feedstock and process needs.[5] Thus, the gas supplies from Prudhoe Bay would replace declining existing supplies required for the highest priorities of service.[6]

Without Alaskan gas, the United States could face annual losses of many billions of dollars in Gross National Product, and hundreds of thousands of jobs, with resulting human suffering. United States industry, which in 1974 employed 20 million persons and contributed over $460 billion to Gross National Product, consumed 24,081 trillion Btu's of energy. It consumed 52 thousand Btu's for each dollar of Gross National Product, and over 1.2 billion Btu's for each person employed. Assuming the unavailability of alternative sources of energy, the additional gas from Alaska translates to $17 billion in Gross National Product, and 740,000 jobs annually. If it is assumed that other substitutable forms of energy will be available and environmentally acceptable, during the period to 1985, the most likely alternative would be increased dependence on foreign oil, with resulting adverse impact on the economy and the overall national interest. In addition, residential consumers also would be curtailed in many areas and forced to bear the economic burden of conversion to other forms

[4] "A Realistic View of U.S. Natural Gas Supply", December 1974.

[5] See *e.g.,* Section 2.78 of the FPC's General Policy and Interpretations which delineates priorities of service, 18 C.F.R. § 2.78.

[6] See the testimony of Messrs. Brickhill and Schantz in Exhibit NB–12, together with Sections 1.1 and 8.1, as supplemented, of Item NB–P: testimony of Messrs. Haavik, Rowe and O'Keefe and PG–50, together with Exhibits PG–26 through PG–29: testimony of John H. Belson in Exhibit IT–17, together with Exhibits IT–18 through IT–20; testimony of E. C. Rockwood in Exhibit NA–9, together with Exhibits NA–6, NA–7 and NA–8.

of energy, again assuming other forms of energy are available and environmentally acceptable. Those conversion costs would, of course, be in addition to the greater cost of the alternative energy itself, increased operating costs, and loss of the ease of usage and air pollution advantages of gas.

A. The Arctic Gas Supplies Will Serve The Highest Priority Markets

As noted above, the gas supplies here involved will be utilized to serve the highest priority markets. For example, research undertaken in 1975 by Northern Border Pipeline Company of the market areas served by its sponsors indicates that by 1981, supplies of gas from the lower 48 states will not be sufficient to meet the requirements of Priorities (1) and (2) on its members (essentially requirements by residential and commercial customers). The 1981 situation for such areas may be estimated as follows:

TRILLIONS OF CUBIC FEET PER YEAR

Priority	Requirements	Available lower 48 supply	Deliveries from north slope
1	3.7		
2	1.9		
3 to 9	1.6		
Total	7.2	[1] 4.3	0.5

[1] Also includes LNG and coal gas.

Based on this projection, it is clear that there is a critical need for not only all available North Slope gas, but also additional gas from other sources to meet growing residential and commercial requirements in the Northern Border Pipeline Company market area.

An analysis of the prospective supply-demand outlook in California and in the Pacific Northwest results in the same basic conclusion (see testimony of Messrs. Haavik, Rowe and O'Keefe in Exhibit PG–50, together with Exhibits PG–26, PG–27, PG–28 and PG–29; testimony of John H. Belson in Exhibit IT–17, together with Exhibits IT–18, IT–19 and IT–20; testimony of E. C. Rockwood in Exhibit NA–9, together with exhibits NA–6, NA–7 and NA–8.

Thus it is projected that most, if not all, of the Alaskan gas supply will be consumed in the residential and commercial sectors of the market. The balance of the supply will be utilized for feedstock and process purposes, and for storage injection, all Priority 2 uses. Only negligible, if any, gas will be utilized for boiler fuel.

There is no real question concerning the "marketability" of the gas here involved. The shape of the market for Alaskan gas in the lower 48 states will be determined by the availability of gas, not by the market price. The proposed pipeline and distributor customers of Arctic Gas have studied the marketability of North Slope gas in their market areas. Estimates were made for the period January-June, 1975. These studies indicate that gas competes with distillate fuel oil and electricity in both the residential and commercial sectors. In 1973, electricity captured 57 percent of the net increase in residential heating installations (new homes and conversions) in the United States, according to trade association data.

The burner tip prices of gas were expressed in 1975 dollars and included the "rolled-in" impact of new sources expected between 1975 and 1981, *i.e.*, new lower 48 supplies, LNG coal gas and North Slope gas. These prices were compared with the January-June, 1975 prices of competitive energy. The results, when averaged for Northern Border and the West Coast companies, were as follows, when "burner tip" prices are expressed in cost per million of BTU's:

	Residential	Commercial
Gas	$1.91	$1.72
Distillate fuel oil	2.54	2.33
Electricity	4.95	5.18

It is clear that the burner-tip price of gas can increase substantially before reaching the current price of electricity, which is significant since electricity is apparently capturing over half of the new and conversion residential heating market in the United States. While distillate fuel oil is priced less than electricity, the price of distillate fuel cannot be accepted as a competitive ceiling *per se*. Consideration must be given to premiums given by consumers to gas as compared to oil, and discounts given by consumers to oil, including security and reliability of the sources of oil. Also, recognition must be given to the fact that gas is a premium energy form compared with fuel oil, on the basis of convenience, cleanliness and versatility.

In sum, the gas marketing companies which seek to secure Alaskan gas for their markets have projected that there will be substantial demand for all of the Alaskan gas in question under presently conceivable conditions. It also is obvious that cost considerations will allow Alaskan gas to be priced competitively with other available energy sources, and there is every incentive for producers, wholesalers and distributors to do so, since their revenue needs are dependent upon their being able to market the gas.

B. There Is No Real Alternative to Prompt Delivery Of the Arctic Gas Supplies Via the Arctic Gas Project

There is simply no alternative to the prompt delivery of the arctic gas to markets in the lower 48 of the United States, via the Arctic Gas Project, in light of the serious energy crisis presently facing the nation. Our country needs every source of energy it can reasonably and prudently develop in the foreseeable future, both from the standpoint of national and international security, and to retain and improve, for this and future generations, our standard of living. The supply of United States gas here involved offers the largest, cheapest, most reliable and readily available source of energy to interstate markets. The Arctic Gas Project not only promises to make additional gas supplies available from the United States, but as discussed below, also to help maintain existing imports from Canada, since it will permit current development of the Mackenzie Delta reserves. Certainly, no project on the horizon can offer an alternative to this promise. As will now be shown, the alternative of not developing these gas supplies now would produce a worsening of an already critical gas supply situation, with attendant burden to our citizens, including increased reliance on foreign oil, where substitution is physically possible.

In the first place, the gas supplies here involved are required for the highest priority of usage irrespective of complete success in obtaining all other projected natural gas supplies. The market for Alaskan gas is the residential, commercial and high priority industrial markets, where denial of gas service at best results in extensive and expensive conversion of facilities, and at worst, will impair the health, safety and economic well-being of the market areas affected.

Second, reference to utilization of alterative energy sources does not consider any comparative evaluation of either the technical or economic availability of any alternative energy sources or the political or environmental consequences to the United States. Greater hardship from want of energy than has been experienced has been avoided only by filling the gap with continuing large imports of foreign oil. In 1974, about 37 percent of the petroleum and petroleum products used by the Nation was imported, with well over one half of that total being imported from the OPEC countries. Those countries have recognized the international political and economic power their supply position has created. Some of the OPEC nations have used that power, demonstrating that such sources are no longer stable or reliable. The economic cost to the United States of relying on such large imports is clear. Prices have multiplied geometrically to the point that our payments for foreign oil rose to about $25 billion in 1974. Domestic oil and LPG production is projected to continue to decline. Moreover, coal is not a direct substitute for gas in future gas markets, being limited to boiler fuel applications, and the supply of electricity will depend on rapid increases in coal production and nuclear generation.

IV. THE ARCTIC GAS PROJECT WILL MAKE THE LARGE GAS SUPPLIES ON THE ALASKAN NORTH SLOPE AVAILABLE TO UNITED STATES MARKETS AND WILL MAXIMIZE IMPORTS OF CANADIAN GAS

Natural gas reserves amounting to over ten percent of the nation's gas supply have been proven in the Prudhoe Bay field of Alaska. They provide the basis for the Arctic Gas Project, since sufficient gas is productible without injury to oil production to make the project feasible.

Substantial gas reserves are also available in the Mackenzie River Delta area of Canada's federal Northwest Territories, which will also be carried by the Arctic Gas Project. This addition to Canada's gas supply will assist Canada in meeting its gas export commitments to the United States.

Finally, the proven reserves in both areas constitute only a fraction of the potential reserves which it is anticipated will be proven. The Arctic Gas pipeline will stimulate discovery and development of those additional reserves.

A. The Gas Suppliers Supporting The Arctic Gas Project

Alaskan Arctic has employed the consulting petroleum engineering firm of DeGolyer & MacNaughton of Dallas, Texas to review the available data from the North Slope of Alaska, and the Mackenzie Delta area of Canada, and to prepare natural gas reserve and deliverability estimates for those areas. The results of the DeGolyer & MacNaughton studies have been presented in evidence in the FPC hearings.[7]

El Paso Alaska has submitted Prudhoe Bay field gas supply evidence in the FPC hearings through Mr. A. M. Derrick, Vice President for gas supply of El Paso Natural Gas Company, the corporate parent of El Paso Alaska, and that evidence also will be discussed herein.[8]

(1) The Prudhoe Bay Gas Supply

The known hydrocarbon-bearing reservoirs in the Prudhoe Bay field are the Kuparuk River oil pool, Prudhoe oil pool and Lisburne oil pool. The DeGolyer & MacNaughton reserve estimates are restricted to the Prudhoe oil pool, since it contains by far the majoirity of the reserves of the Prudhoe Bay field and reserves in the Kuparuk and Lisburne pools are not proved at this time. Accordingly, the DeGolyer & MacNaughton estimates of proved saleable gas reserves in the Prudhoe Bay field after allowance for shrinkage are as follows:[9]

	Proved recoverable reserves (trilions of cubic feet at 14.73 lb/in a and 60° F)
Zone:	
Sag River sandstone—associated gas	1.980
Sadlerochit sandstone—associated gas	12.677
Sadlerochit sandstone—solution gas	7.859
Total	22,516

El Paso Alaska's witness, Mr. Derrick, estimates that the Prudhoe Bay (Sadlerochit) field contains approximately 24.3 trillion cubic feet of gas available to the pipeline,[10] which estimate compares to the 22.516 trillion cubic feet estimated by DeGolyer & NacNaughton.

DeGolyer & MacNaughton estimates the followin gaverage daily and annual gas deliveries for the Prudhoe Bay field for the first fifteen and a half years of gas production.[11]

---

[7] The DeGolyer & MacNaughton Prudhoe Bay gas supply study is contained in Item by Reference AA–H supported by the testimony of Mr. W. J. Sleeper in Exhibit AA–12 and at T. 1194–1260. The DeGolyer & MacNaughton Mackenzie Delta gas supply study is set forth in Item by Reference AA–H and Exhibit AA–33. and supported by the testimony of Mr. A. E. Olson in Exhibit AA–12 and at T. 1272–1371 and by the testimony of Mr. Olson and Mr. O. E. Camargo att T. 12, 110–309.

Messrs. Sleeper and Olson are petroleum engineers with broad and extensive backgrounds in the estimation of oil and gas reserves. Mr. Camargo is a petroleum engineer specializing in petrophysical engineering, particularly in the field of well log analysis and related problems. The qualifications of Messrs. Sleeper and Olson are detailed in Exhibit AA–12 under the tabs bearing their names, and for Mr. Camargo at T. 12,112–113.

[8] The El Paso Alaska gas supply estimates for the Prudhoe Bay field are set forth in Exhibit EP–53 and explained in Mr. Derrick's testimony in Exhibit EP–100 and at T. 1377–1451; 10,541–551.

[9] Item AA–H, p. 4 of Prudhoe Bay Report.

[10] Exhibit EP–53, Schedule 5.

[11] Item AA–H, Prudhoe Bay Report, p. 12.

Year	Gas deliveries—millions of cubic feet (all volumes at 14.73 lb/in²a and 60° F) Average daily	Annual
1 (6 mos.)	2,000	365,000
2	2,000	730,000
3	2,040	744,600
4	2,250	821,250
5	2,250	820,250
6	2,250	821,250
7	2,250	821,250
8	2,250	821,250
9	2,250	821,250
10	2,250	821,250
11	2,250	821,250
13	2,250	821,250
14	2,250	821,250
15	2,250	821,250
16	2,250	821,250
Total delivery (12.51585 trillion cubic feet)		12,515,850
Total delivery as percent of—saleable gas reserve		56

The foregoing schedule shows daily availability of gas for transportation by the pipeline during the first 2½ years of gas production of approximately 2 billion cubic feet per day, and thereafter of 2.25 billion cubic feet per day.

The Van Poollen study for the State of Alaska would indicate that the ultimate oil recovery from the reservoir will be decreased if gas is sold at a rate of 2 billion cubic feet per day, unless the reservoir pressure is partially maintained by the injection of water. At the producing rate of 1.6 million barrels of oil per day, and with water injection, the recoveries listed in that report are:

Run	Cumulative oil produced (in billion of standard barrels per day)	Oil recovery (percent)	Cumulative gas removed (in trillions of cubic feet)	Gas recovery (percent)	Gas sold (in billion of cubic feet per day)
11	7.76	(40.55)	[1] 1.094	(2.71)	0
17	7.20	(37.64)	17.083	(42.30)	2
21	7.91	(41.35)	19.613	(48.56)	2

[1] Gas reinjected into the reservoir.

The increase in oil recovery between Run No.'s 17 and 21 was obtained by changing the "operational limits." This indicates that the method of operating the field can have a significant effect on the recovery of both oil and gas, so it is important to know the intentions of the operator. In this respect, the three major working-interest owners have stated that they plan to produce the gas at a rate between 2 and 2.5 billion cubic feet per day. Arctic Gas has estimated 2.25 billion cubic feet per day.

Physical tests of oil production and water injection will be useful in the precise operation of the field, but are not required to fix minimum limits sufficient to determine gas project feasibility. The establishment of initial production limits by the State of Alaska is anticipated in 1976. Arctic Gas does not believe that there will be substantial change in the production rates described heheinabove as a result of the State of Alaska's actions, particularly in light of the Van Poollen study and the estimate of producers on the level of gas production from the Prudhoe Bay field (2 to 2.5 Bcf/d). El Paso Alaska estimated a much higher availability (3.3 Bcf/d), and there is much less chance that this level of gas availability will be realized on the basis of the presently proven Prudhoe Bay reserves.

(2) *The Mackenzie Delta Gas Supply*

With respect to the Mackenzie Delta fields in Canada in which there have thus far been discoveries, DeGolyer & MacNaughton estimates recoverable saleable reserves for the eight presently known fields in this area by proved, probable, and possible categories as follows:[12]

[In millions of cubic feet at 14.73 lb/in²a and 60° F]

Field or area	Proved	Probable	Possible	Total
Adgo	78,280	58,511	111,903	248,694
Mallik	60,044	100,880	276,600	437,524
Niglintgak	315,421	146,391	195,001	656,813
Parsons Lake	531,790	538,780	413,951	1,484,521
Reindeer	5,294	5,414	7,315	18,023
Taglu	2,728,191	61,799	0	2,789,990
Titalik	10,131	48,022	123,000	181,153
Ya Ya	97,316	60,604	234,000	391,920
Total	3,826,467	1,020,401	1,361,770	6,208,638

By way of comparison, Canadian Arctic has employed the Canadian consulting petroleum engineering firm of J. C. Sproule and Associates, also to estimate the reserves in the Mackenzie Delta area, and that firm's estimates of recoverable saleable gas reserves for the same eight fields or areas are as follows.[13]

[In millions of cubic feet]

Field or area	Proved	Probable	Possible	Total
Adgo	54,500	87,000	59,100	200,600
Mallik	16,300	54,000	320,000	390,000
Niglintgak	321,500	274,600	74,900	671,000
Parsons Lake	701,000	122,400	808,800	1,632,200
Reindeer	3,400	10,700	23,800	37,900
Taglu	2,534,700	138,500	0	2,673,200
Titalik	32,000	23,700	95,300	151,000
Ya Ya	165,800	41,000	204,400	411,200
Total	3,829,200	751,900	1,586,300	6,167,400

The difference in the proved reserve estimates between DeGolyer & MacNaughton and J. C. Sproule is only 1/10th of 1%. The difference for all three categories is only approximately 1%.

For the Mackenzie Delta area, DeGolyer & MacNaughton estimates annual, daily average and peak day gas available from the present proved, probable and possible reserves as follows:[14]

[12] Exhibit AA-33, p. 1.
[13] T. 13,435.
[14] Exhibit AA-33.

[In millions of cubic feet—All gas volumes at 14.73 lb/in²a and 60° F]

Year	Annual deliveries	Daily average deliveries	Peak day deliveries end of period
1	312, 111	855	2, 259
2	312, 111	855	2, 156
3	312, 111	855	2, 053
4	312, 111	855	2, 059
5	312, 111	855	1, 860
6	312, 111	855	2, 020
7	312, 111	855	1, 814
8	312, 111	855	1, 807
9	312, 111	855	1, 601
10	312, 111	855	1, 574
11	312, 111	855	1, 415
12	307, 517	843	1, 265
13	282, 189	773	1, 323
14	269, 885	739	1, 176
15	253, 381	694	1, 024

The daily average column of the foregoing table simple indicates a rate of take based upon 1 Mcf of deliverability for every 7300 Mcf of reserves, or a rate of take that would deplete the reserves in twenty years. The peak day column indicates the ability of the reservoirs to produce on any given day through the fifteen period, if the daily average deliveries are made.

More recently DeGolyer & MacNaughton has determined that just the proved reserves in the Mackenzie Delta area are capable of producing at a rate of 1.25 Bcf/d for the first four years of production. Having consideration for the development of the probable and possible reserves of the area, and the very substantial additional gas discoveries that may be anticipated from the potential reserves, it is reasonable to assume initial gas availability from the Delta area at a minimum equal to 1.25 Bcf/d, climbing to much higher rates as the area develops beyond the initial years. However, as a practical matter, we would not anticipate that such amount of reserves would be produced at that level over time.

(3) Potential Supplies on the North Slope of Alaska and in the Beaufort-Delta Area

The Alaskan North Slope encompasses an area of approximately 80,000 square miles. Since approximately 110 exploratory wells have been drilled, it is apparent that there have been only approximately one test for every 727 square miles, and many of these are clustered in the Prudhoe Bay area. It is reasonable to consider, therefore, that exploration of the Alaskan North Slope has just begun, despite the large reserves already found.[15]

Based upon analysis of a report estimating the speculative resources of oil and natural gas in Alaska issued by the Division of Geological and Geophysical Surveys ("DGGS") of the State of Alaska in June 1974, DeGolyer & MacNaughton believes that it is reasonable, if not conservative, to estimate that there are additional potential reserves in the Alaskan North Slope onshore area of approximately 41.8 Tcf. This volume, added to the American Petroleum Institute's estimate of proved reserves for the area, indicates ultimate gas potential of 67.8 Tcf in the North Slope onshore area. The DGGS report also estimates offshore gas potential in the adjacent Beaufort and Chukchi Sea provinces to be an additional 46.5 Tcf. Combining the foregoing onshore and offshore potentials, DeGolyer & MacNaughton believes it is reasonable to assume potential gas reserves for these areas of 114.3 Tcf, approximately five times the presently proved and saleable reserves in the Prudhoe Bay field.[16]

A representative of the Department of the Navy has testified in the FPC hearings that, based upon a study which the Navy commissioned in 1969 with the Arctic Institute of North America, the Navy estimates that its Petroleum Reserve No. 4, which is located to the west of the Prudhoe Bay area, contains approximately 14.3 billion barrels of recoverable oil and 78.65 Tcf of natural gas.[17] The Navy is in the third year of a seven year exploration program of Petroleum Reserve No. 4. It has completed two (2) of twenty-six (26) explora-

[15] Item AA–H. Prudhoe Bay Report, p. 2.
[16] Item AA–H. Prudhoe Bay Report, p. 3.
[17] T. 11,973–974.

tory wells and 3500 line miles of seismic work. Although it views the exploration program as "relatively modest" in view of the size of the area, it believes it will have a better understanding of what reserves there may be as the program proceeds, and by the end of the fourth year of the program will be able to transfer some of the reserves from the "potential" to "proven" category.[18]

With respect to the Mackenzie Delta-Beaufort Sea area, and based on present seismic knowledge of existing structures beyond the 36-foot depth limit in the Beaufort Sea, DeGolyer & MacNaughton is confident that the ultimate recoverable reserves for this region should substantially exceed 50 Tcf.[19]

To place the foregoing estimates in perspective, the total gas reserves available to interstate pipelines in the United States as of December 31, 1973, were approximately 134.3 Tcf.[20] Clearly, there is a vast potential for additional gas supplies from both the Alaskan North Slope and the Mackenzie Delta-Beaufort Sea regions. While Arctic Gas has shown that only the gas supply capability from these fields which have already been discovered sustains the feasibility of its projects, it cannot be emphasized too much that one of the best means of stimulating development of the potential supplies is the early approval and construction of a pipeline outlet to natural gas markets.

B. The Artic Gas Project Will Help to Maximize Levels of Exports of Gas Supply From Canada

The fact that the Arctic Gas Project is designed to service the Mackenzie reserves will be beneficial to the United States, as well as Canada, in several basic ways, as discussed later, including the fact that volume transportation of United States and Canadian gas jointly produces economies of scale in transportation costs with benefits to each Nation. What should be noted here is that Canada, too, is running short of energy. However, Canada's likely large volumes of gas (not only in the Mackenzie Delta, but also in the Beaufort Sea as well as in other arctic areas), will help solve that problem. The Arctic Gas Project is the most feasible way to secure that Delta and Beaufort gas, since there is not yet enough gas a make a "Canada-only" line feasible, and it would provide more expensive transportation in any event. When the Arctic Gas Project is accomplished, and the gas reserves of the arctic areas of Canada are developed, the prospects of greater volumes of gas to be sold to the United States than would otherwise be the case are clear, with obvious potential benefits to the United States.

This fact is clear, since the United States is now importing substantial quantities of gas (about three billion cubic feet a day) from Canada. Canada, without early access to its Delta reserves, will have difficulty in meeting its own needs and existing export commitments. In fact, shortages may occur prior to connection to Delta supplies, which could result in a sharing of such shortages between the export and domestic Canadian markets. Access by Canada to its arctic gas will greatly reduce, and hopefully eliminate, the chances of such occurrence. Since the imports of three billion cubic feet a day exceed the anticipated initial volumes from Alaska. This puts into perspective how important this benefit of the Arctic Gas Project really is.

C. Authorization of the Arctic Gas Project Will Stimulate Exploration, Development and Production of Northern Gas Supplies in Alaska and Canada

One of the most important factors affecting the pace of discovery and development of gas reserves in the North is the question of whether, and when, a pipeline for marketing of the gas will be constructed. It is costly to expend substantial funds to drill too far in advance of the time when gas can be marketed, and a deterrent exists so long as there is a possibility that the gas cannot be marketed at all, because of the absence of a pipeline. The presence of a pipeline capable of rapid expansion will, therefore, stimulate exploration, development, and production of Northern Alaska gas supplies since a market will exist which will justify the expenditure of substantial sums in locating and producing gas supplies. As discussed elsewhere in this brief, the Arctic Gas Project is best located (it traverses the Arctic Coastal Plain adjacent to offshore Alaska) and best designed (it is a conventional natural gas pipeline system which can tailor expansion to additional gas supplies as they become available) to generate additional exploration and development.

---

[18] T. 11,971–974.
[19] Item AA–H, Mackenzie Delta Potential Reserves, p. 27.
[20] The Gas Supplies of Interstate Natural Gas Pipeline Companies—1973, Federal Power Commission.

70-636 O - 76 - 9

In Canada, this same fact holds true. Exploration drilling programs have been proceeding steadily in the Mackenzie Delta area and the Beaufort Sea region, and substantial reserves have been discovered. This process is continuing, but it must be emphasized that anticipation of a timely transportation system to allow the production and marketing of hydrocarbons is essential of the continuation and expansion of any exploration and development program.

As additional gas reserves are developed, all of the pipeline and distribution companies in the lower 48 will have the opportunity to negotiate for those supplies, just as for initial volumes, all to be transported by the Arctic Gas Project. This in turn will create additional incentive for producers to explore and produce additional gas supplies.

V. THE DESIGN OF THE ARCTIC GAS SYSTEM

Comprehensive evidence demonstrating the ability of the Arctic Gas system to deliver, on a reliable basis, the volumes of gas available from the Prudhoe Bay and Mackenzie Delta areas to markets in the lower 48 of the United States is fully set forth in the FPC hearing record.[21] The system will be a 48-inch outside diameter pipeline operating at 1680 psia and extending from Prudhoe Bay across the Mackenzie Delta area where it will turn southward to Caroline, Alberta. At Caroline, the 48-inch system will continue eastward to Empress on the Alberta-Saskatchewan border and an interconnection with TransCanada PipeLines Limited. From Empress, a 42-inch pipeline will continue southeastward to a point on the Montana-Saskatchewan International Boundary near Monchy, Saskatchewan where Canadian Arctic will interconnect with the Northern Border system. Also from Caroline junction a 30-inch pipeline owned by Arctic Gas and, in British Columbia, Alberta Natural Gas Limited, will continue southwestward to a point on the Idaho-British Columbia International Boundary near Kingsgate, British Columbia, where it will interconnect with the facilities of PGT. Compressor stations will be installed as required, and when
facilities of PGT. Compressor stations will be installed as required, and when
capacity of approximately 4.5 Bcf of natural gas per day. This capacity could be readily expanded by adding "looping" (parallel pipeline) and a fully powered 48-inch loop were added to the system, the capacity would double to approximately 9 Bcf/d.

Mechanical and Systems Design

The mechanical and systems design and system capability was developed under the direction and supervision of Mr. Hoyt Purcell of Northern Engineering Services Company Limited, a consulting engineer with approximately 20 years of experience in the costing, construction and design of natural gas pipeline facilities.[22] Extensive design work for the Arctic Gas system was undertaken by the design group under his direction and supervision (See Exhibit AA–12, Purcell, pp 8–29). The Arctic Gas system is technically feasible and will permit dependable transportation of the gas supplies involved at a minimum cost of transportation.[23] It was designed, like other pipelines, with a particular interest in the stability and security of the pipeline, which requires a basic concern for the physical environment. Design objectives, therefore, include the preservation of the integrity of the physical environment since the steps necessary therefore also protect the integrity of the pipeline.[24]

Special consideration was given in the design of the Arctic Gas system to the scale of the project; its large diameter, high operating pressure, and large gas volumes. Another special consideration related to the permafrost environment through which approximately 1,000 miles of the pipeline will be constructed, and some special design considerations related both to the large scale of the project and the Arctic environment.[25] With respect to the scale of the project, the engineering studies established that long, large diameter pipelines trans-

---

[21] With respect to the Alaskan Arctic and Canadian Arctic systems, this evidence generally is set forth in Exh. AA–12, Clark, Newmark, Slusarchuk, Cooper, Minning, Morgenstern and Purcell; Items AA–G, AA–T, AA–Q (under Tab D); T. 2933–3275, Clark, Slusarchuk, Cooper, Mining and Morgenstern; T. 3586–3617, Newmark; T. 3780–3843, Purcell; T. 15,276–281, Purcell and Clark; T. 15,482–515, T. 15,531–546, Purcell; T. 15,553–610, Clark; Exh. AA–34 (Section 8 b 1 through 8 b 7); Exh. AA–35 (Flow Diagrams).

[22] Exh. AA–12, Purcell pp. 1–3.

[23] *Id.* at p. 29.

[24] *Id.* at p. 8.

[25] *Id.* at pp. 9–10.

porting more than two billion cubic feet daily cannot be operated without using gas chillers or coolers. Without chillers or coolers, the large blocks of horsepower required at each station to transport the large volumes of gas would increase the temperature differential between the ground and the gas so that the flowing temperature would tend to increase from station to station and exceed practical limits. The installation of cooling stations on the downstream side of each compressor station, therefore, has been incorporated in the design.[26]

With respect to the permafrost environment, some of the permanently frozen ground contains excess ice which can cause the ground to become unstable and erodible if it thaws. In order to stabilize the right-of-way and thereby maintain the integrity of the pipeline, Arctic Gas will operate the pipeline at temperatures generally lower than the average annual ground temperatures.

To maintain the gas flowing temperature below the ground temperature, it is necessary to remove the energy imparted to the gas during compression, plus the heat flow from the ground to the gas. To do this Arctic Gas will adopt a technique commonly used in the gas-processing industry, a closed-cycle mechanical refrigeration system using propane as the refrigerant. Each compressor station in the permafrost region incorporates a chilling station immediately downstream of the compressor, so that the temperature of the gas entering the ground downstream of the station can be controlled at the appropriate level. These chilling stations are to be powered by gas turbines and will dispose of the energy removed from the gas by cooling the propane refrigerant in air-cooled heat exchangers.[27]

The low flowing gas temperatures required special metallurgical considerations for the pipe steel. A design temperature of —10 degrees F. was specified for pipe to be installed in the northern portions of the pipeline system. This design temperature provides a margin of safety against the minimum flowing temperature expected in the system, which is approximately 0 degrees F. under normal operating conditions. The gas temperature will be maintained above —10 degrees F. under any operating condition, by minimum suction temperature override controls that will cut back on the compression horsepower if the gas temperature approaches —10 degrees F.

Because of the very large volumes to be transported via the system, and its operating temperature and pressure, it also was necessary to conduct extensive studies and tests to insure that the system would be designed so as to provide a high degree of insurance against fracture initiation and, in the unlikely event of fracture initiation, that such fracture would not propagate for any length so that immediate, expeditious repair could be effected. The results of these studies and tests indicate that any defect at which a fracture could initiate would be so large that they would be readily detected during fabrication or in construction, inspection and testing.[28] In the extremely unlikely event of a fracture, the Arctic Gas design is based on the use of mechanical reinforcing bands around the pipeline at suitable spacings to assure the arrest of a possible fracture and facilitate expeditious repair.[29]

Geotechnical Design

The geotechnical design considerations for the pipeline were the responsibility of Dr. John I. Clark and a team of geotechnical engineering experts working under his supervision and direction. Dr. Clark likewise is employed by Northern Engineering Services Company Limited, having been seconded to them from R. M. Hardy and Associates Limited in the capacity of supervisor of geotechnical and environmental studies. R. M. Hardy and Associates is a consulting geotechnical engineering firm that has been operating in Canada since 1950. That firm has been involved for some 20 years in geotechnical investigations relating to pipeline route selection, slope stability and design of river crossings. Dr. Clark has conducted extensive research in geotechnical engineering and published a number of technical articles. He was elected the first Alberta Director of the Canadian Geotechnical Society and has served as Western Region Vice President of the Canadian Geotechnical Society within the Engineering Institute of Canada. He is an Associate Director of the Canadian Geotechnical Journal; a member of the Organizing Committee for the 3rd International Conference on Permafrost and a member of the International Society of Soil

---

[26] *Id.* at p. 10.
[27] *Id.* at p. 11.
[28] *Id.* at p. 17.
[29] *Id.* at p. 19.

Mechanics and Foundation Engineers.[30] Dr. Clark's geotechnical work is supplemented in special fields by the evidence of the following:

(1) Dr. William A. Slusarchuk assisted Dr. Clark in geothermal analysis and research into frost heave and frost effects. Dr. Slusarchuk has had extensive experience in research in permafrost engineering and has published numerous technical papers and articles respecting geothermal effects and frost heave.[31]

(2) Dr. Richard H. Cooper is a consulting engineer and a principal in the firm of Northwest Hydraulic Consultants Ltd., who has had an extensive background in river crossing engineering design in permafrost regions. Dr. Cooper previously carried out assignments in the development of river and flood plain crossings for the Alyeska project and has published a number of technical articles.[32]

(3) With respect to geologic assesment of the proposed route and designation of preferred and alternative borrow areas, Dr. Clark was assisted by Gretchen Valentine Minning, a professional geologist who likewise has authored or co-authored a number of technical geological publications involving arctic regions.[33]

(4) Dr. Nathan M. Newmark, Professor of Civil Engineering in the Department of Civil Engineering and in the Center for Advanced Study at the University of Illinois provided work on seismicity and seismic design. Dr. Newmark is a leading authority in respect to seismic design; has received numerous awards and honors and published many technical works and papers.[34]

(5) Dr. Norbert R. Morgenstern, Professor of Civil Engineering at the University of Alberta is an expert in the mechanics of slope stability and landslides. Dr. Morgenstern is a recipient of numerous honors and has authored or co-authored a number of publications in geotechnical fields with particular reference to slope stability in permafrost regions.[35]

Dr. Clark's testimony before the FPC generally describes the geotechnical consideration pertinent to construction of the pipeline, and the very extensive studies undertaken by Arctic Gas in this regard. Those studies are described in appendices attached hereto.

Pipeline geotechnical research facilities were constructed and operated in three locations in the northern regions of Canada and Alaska to gather data and gain experience which would assist in the design of a reliable, safe and environmentally sound pipeline system. The test facility sites were carefully selected to provide permafrost and terrain conditions which were representative of considerable lengths of the proposed route. As it was realized that the pipeline would encounter terrain units and conditions different from those that could be selected at any given site, the site conditions selected tended towards the more difficult end of the possible range. A large number of remote ground temperature measurement sites were established along the right-of-way. A fourth test facility has been built and is currently under operation in order to study the frost effects caused by operating a buried chilled gas pipeline in unfrozen frost susceptible soil.[36]

Field drilling programs have been carried out, related to verification of terrain typing and examination of specific areas such as potential river crossing sites or cleared areas for permafrost regression studies. In addition, a number of studies have been made to assess the river regime in the reaches of a number of proposed river crossings. Studies have been made of ice breakup with particular emphasis on the Point Separation Crossing. These have been repeated since 1973 and will continue in the future. An on-going interdisciplinary study was initiated, wherein data on groundwater behavior have been gathered as a part of the total study program.[37]

Small watershed hydrologic field studies were commenced in July, 1974. These studies will continue through the design and construction phases. The proposed studies are intended to provide the base line hydrologic data in undisturbed terrain which will be crossed by the pipeline and the Mackenzie Highway. The studies will provide understanding of the magnitude and distribution of surface dranage to be used in the overall design of the drainage and erosion control

---

30 Exh. AA–12, Clark, pp. 1–4.
31 Exh. AA–12, Slusarchuk, pp. 1–3 and App. A, thereto.
32 Exh. AA–12, Cooper, pp. 1–4.
33 Exh. AA–12, Minning, pp. 1–3.
34 Exh. AA–12, Newmark, pp. 1–3 and Appendices A–C, thereto.
35 Exh. AA–12, Morgenstern, pp. 1–4 and Appendices A–B, thereto.
36 Exh. AA–12, Clark, pp. 8–9.
37 Id. at p. 9.

measures. This will provide a measure of the magnitude of potential icings over an operating chilled pipeline and thus lead to the implementation of effective control measures where required. Subsurface flow will be computed from the observation of ground water table, slope and measure of insitu permeabilities. The permafrost table will be probed to determine the thickness of the active layer through which this flow occurs. Surface flow also will be studied by monitoring the flow in two small creeks which will drain a part of the Chick Lake basin. These flow measurements will be related to precipitation data with a view to improving the currently available method of predicting small channel flows.[38]

The comprehensive geotechnical studies and tests conducted by Arctic Gas and its consultants, which have been fully set forth on the evidentiary record in the FPC hearing, conclusively demonstrate that the pipeline may be safely and reliably constructed in permafrost regions, both from an engineering and environmental standpoint.[39]

VI. THE CONSTRUCTION PLAN OF THE ARCTIC GAS SYSTEM

The Arctic Gas Project involves solely the transportation of natural gas by pipeline. The methods for the safe and reliable construction of natural gas pipelines, and for the avoidance or effective mitigation of any undesirable impacts, have been thoroughly developed and proven in the more than fifty years of experience in pipeline construction. To illustrate the minimal nature of the physical impact of a pipeline, it is necessary only to recognize that more than 263,000 miles of natural gas transmission pipelines have been constructed throughout the lower 48 states.[40] Yet the ordinary citizen normally is wholly unaware of their physical existence,[41] although he certainly is aware that he can heat his home, cook his food, in many instances obtain employment, and enjoy a myriad of benefits because of their existence and operation.

From the standpoint of the construction planning for the Arctic Gas systems, the Southern Canadian and lower 48 systems involve conventional natural gas pipeline construction. Generally speaking, conventional pipeline construction involves the acquisition clearing and grading of the right-of-way; the stringing of the pipe sections for installation; the trenching of the ditch; bending of the pipe where required; the lining up and welding of the pipe sections, along with inspection of the welds; the coating of the pipe to prevent corrosion; and the lowering of the coated pipe into the ditch. After this, the pipeline is hydrostatically tested and backfill is placed into the ditch and the surface cleaned up and generally restored to its pre-existing condition. The area along the right-of-way disturbed during construction will be revegetated, and only a narrow right-of-way will be kept clear of trees, tall shrubs and brush, the remainder reverting to its previous use or condition. In farm or grazing land, the entire right-of-way can revert to its previous usage.[42]

In general, the foregoing construction procedures are likewise applicable to Arctic construction, except that additional measures must be taken to insure the integrity of the pipeline and the protection of the environment in permafrost areas. The comprehensive geotechnical and other engineering and environmental studies undertaken by Arctic Gas in this respect are set forth in an Appendix. In addition, planning of the Arctic construction also had to take into consideration arctic working conditions, and the times at which particular work could be accomplished to minimize disturbance of the area affected along the right-of-way.

Development of the construction plans for Alaskan Arctic and Canadian Arctic was under the direction of Mr. Phillip H. Dau, President of Northern Engineering Services Company Limited of Calgary, Alberta, who is a consulting engineer with more than 25 years of experience in the design, cost estimation, construction planning and management for the construction of pipelines and related facilities for numerous projects in Western and Northern Canada. Engineering studies for the pipeline to Prudhoe Bay and the Mackenzie Delta

---

38 *Ibid.*
39 *Id.* at p. 5.
40 American Gas Association 1974 Gas Facts, p. 50.
41 While landowners along the right-of-way may be aware of the construction of the pipeline, the construction itself takes place for the most part within a very limited period of time; generally, about four weeks at any single point.
42 Exhibit AA–12, Dau, p. 19; Item NB–P, Sec. 1.5.

area commenced in 1969, and a comprehensive and reliable construction plan has been carefully developed to insure that construction will be completed in a reasonable period of time consistent with dependable pipeline construction procedures permitting maximum protection of the environment. The construction schedule may be generally described as follows. In the initial summer, surveying, installation of support facilities and installation of construction communications would be done. During the first winter, pipeline right-of-way clearing would commence. The materials and equipment required in Northern Canada would be shipped by Mackenzie River barge and stockpile in the second summer. Pipeline installation would start in the second winter, and continue in southern areas during the third summer. Pipe laying would continue during the third winter to complete the system to the Mackenzie Delta. The fourth winter would see completion of the system to Prudhoe Bay. Compressor station installation would be carried on, over the same period, to the level required to carry initial volumes, and continue as required over subsequent years to accommodate increased quantities. Gas deliveries would commence from the Mackenzie Delta area in the fourth summer, and from Prudhoe Bay in the fifth summer.[43]

Logistics

The construction plan will require the movement of large quantities of pipe, fuel, compressor station materials, contractors' equipment and camps and other miscellaneous items. In general the logistical plan [44] calls for the material and equipment required for the construction of the Alaskan Arctic system, except for borrow material, to be transported from a U.S. West Coast consolidation point—Seattle has been used for planning purposes—around Point Barrow to Prudhoe Bay, Camden Bay and Demarcation Bay on the Beaufort Sea. This method employs ocean-going barges for the long haul and shallow draft lighters for delivering of materials to shore, and has been well-developed in DEW line resupply and Alyeska pipeline work. An alternative ground routing possibility would entail use of the Alaska railroad which runs from Seward to Fairbanks and connecting road transport over the Alyeska Highway from Fairbanks to Prudhoe Bay. Ground transportation of materials and equipment to construction points along the coast will make use of snow and ice roads as more fully discussed later.

Project Control

Carefully planned procedures have been incorporated into the construction plan to insure maintenance of close control over all construction activities.[45] These procedures include, among others, that Arctic Gas will have direct supervision of the contractors and will conduct the detailed planning, coordination, inspection and testing of the work. Arctic Gas will prescribe the overall construction schedules, thus insuring that pipeline construction in arctic and muskeg areas is restricted to the winter construction season, and land usage by Arctic Gas and its contractors will be strictly controlled.

The Arctic Gas inspection program will include employment of its own environmental inspectors and socio-economic monitors, in addition to the engineering inspectors normally employed on pipeline projects. These inspectors will report directly to Arctic Gas, with day-to-day field control and monitoring authority and responsibility. Arctic Gas will retain authority to order a stoppage of work if it deems it desirable because of environmental or social concerns.

Construction worker training programs will be conducted that will involve comprehensive orientation, education and training of construction workers in such matters as arctic survival, arctic construction techniques, familiarization with the arctic environment, and aspects of native and northern cultures.

Construction Procedures

The Arctic Gas system will involve both conventional winter pipeline construction and arctic pipeline construction. The fundamental difference is that in arctic construction, the right-of-way is not cleared of snow. Rather, snow accumulation is encouraged over the entire right-of-way. This serves several

---

[43] Exh. AA–12, Dau, p. 13 as amended by Exhs. AA–34 (Construction Plan) and AA–35 (Schedule by Construction Year with Supporting Schedules).

[44] The logistical planning is generally set forth in Exh. AA–12, pp. 13–14; Exh. AA–34 (Construction Plan, pp. 8–9), and Exh. AA–35 (Figures 1 through 6 and Route Maps).

[45] Exh, AA–12, Dau, pp. 14–16.

purposes. It promotes a protective cover over the surface vegetation. This provides a base for the construction of a snow road for vehicular traffic, a working surface for heavy construction equipment, and a separation layer between the vegetation and the spoil pile.

Another difference is that grading of the right-of-way is minimized in arctic construction. This is because in areas of sensitive permafrost, gradng can cause perma-frost degradation. For example, rather than cutting side slopes, filling techniques will be employed to the greatest extent possible in order to achieve grade. Fill material for such purpose will be snow compacted to sufficient density to carry construction traffic. If required, water will be used to manufacture supplemental snow. When sufficient snow is not available, ditch spoil or borrow will be used. Earth used as a fill material will be placed over a layer of ice or snow to provide a separation of the fill from the ground surface. This will limit the effect on vegetation during the backfill operation.[46]

Borrow areas, consisting principally of granular material, will be required for the construction of all-weather roads, pads at compressor and measuring stations, airstrips, docks and wharves and for concrete aggregate and select backfills. The location of the preferred borrow sources, and alternates, are shown on the pipeline route maps contained in Exhibit AA–35. The majority of the borrow pits will be developed and worked in the winter season. Most of the access roads connecting the borrow pits with the haul destinations will be winter roads or snow roads in arctic construction areas. Those borrow pits which will be used during all seasons will have permanent access roads.

In the ditching operating the ditch will be excavated to a minimum width of six feet and to a depth sufficient to provide for a minimum of 30 inches of cover. In areas where filling has been used, the 30 inches will be measured from the original ground surface. Detailed locations where extra depth ditch is required, by buoyancy control or by frost heave protection, will be determined in the field.[47]

Where possible, wheel ditchers will be used. Arctic Gas has conducted extensive research and testing into the development of a ditcher particularly suitable for this project—the Arctic Ditcher. Use of such ditcher will significantly decrease the time otherwise required for the ditching operation, thereby permitting greater progress than presently reflected in the construction schedule.[48]

As a possible aid in the revegetation process, tundra removal may be beneficial in certain areas of continuous permafrost, particularly along the coast. The upper tundra layer (approximately 18 inches thick) will then be removed from the ditchline prior to the main ditch excavation by using a ditching machine or other equipment. This material will be deposited along the outside edge of the spoil bank area so that it can be easily segregated from the main spoil for subsequent replacement on top of the backfiill mound.[49]

The gravel pads at sites for compressor stations will be used initially as stockpile and campsites for the construction of the pipeline and support of operations and maintenance activities until the station is constructed. When compressor stations are constructed, metal-clad insulated buildings will house the major components. These buildings will be supplied in a prefabricated form, thus simplifying erection and assembly at the station site. The mechanical and electrical equipment required for stations will be supplied in modules constructed, assembled and tested in southern centers. The main gas and gas refrigeration piping will be prefabricated to the extent practicable.[50]

Prior to the hydrostatic testing of the pipeline, it is proposed to run electronic devices through the pipeline to detect any injurious defects not previously detected, particularly those that may have occurred during construction. This will minimize the possibility of pipe replacement after the hydrostatic test.

The cleanup operation will follow the completion of construction activity as closely as possble. All surplus construction material will be collected and returned to the original construction stockpile points or to other designated storage areas. All waste construction material will be removed and disposed of at designated locations. Combustible waste will be burned. Other materials will be buried at station sites, or other facility sites or at abandoned borrow pits. All buried material will be covered with at least 24 inches of fill.[51]

---

[46] Exh. AA–12, Dau pp. 16–17.
[47] Exh. AA–12, p. 19.
[48] Dau T. 3765–3773; Exh. AA–19.
[49] Exh. AA–12, p. 19.
[50] Id at, pp. 19–20.
[51] *Id.* at 20.

In the first spring following construction, the right-of-way will be seeded and fertilized. Aircraft will be utilized to seed the straight and relatively level portions of the pipeline. Other areas will require use of helicopters. Ground crews will be used at hillsides, river crossings or other areas requiring the spreading of erosion control mats, the planting of shrub cuttings or the application of seed by hand.[52]

Snow and Ice Roads

Snow roads will be used in all areas of sensitive permafrost in order to provide access to rights-of-way, borrow pits, stockpile sites and wharves, and to provide a traffic lane for construction traffic along the working side of the pipeline right-of-way. It is expected that, in general, snow roads will be used in areas north of 65 degrees latitude. Wherever possible, snow roads will be located on existing cut lines and the pipeline right-of-way.

The types of snow road to be developed in a given area will depend upon availability and characteristics of the snow, and other meteorological factors, and the construction method will vary accordingly. Snow roads will be of two general types. The first, which is to be used for all access roads and the traffic lane on the pipeline right-of-way, will be of sufficient road width to accommodate two lanes of traffic (approximately 32 feet) and of a density capable of sustaining a heavy volume of vehicular traffic. The second type, which is to be used only as the working surface on the remainder of the pipeline right-of-way, will be of lesser density than the first type and will not require as smooth a surface, as it will be used only by slow-moving construction equipment.

If sufficient snow is available from any source (*e.g.*, naturally, in the area, or by harvesting it from other areas or by manufacturing it), the snow will be leveled and compacted with low ground pressure vehicles. In order to increase the density and the surface hardness to levels required to support traffic, a pulverizer-mixing machine will be used to mechanically process the snow after the minimum of compacted snow cover exceeds six inches in depth. Processing will be followed immediately by roller compaction. Once the required surface density and hardness have been reached, wheeled vehicle traffic will commence.

In the event sufficient snow is not available, or where the processing and compaction sequence does not produce a sufficiently hard surface, the processed snow road will be strengthened by the addition of water to form an ice cap. An ice-capped snow road will normally have approximately five inches of water penetration in the snow surface.

A December, 1975, DOI staff study, which accompanied a report to Congress pursuant to Public Law 93–153, questioned whether Arctic Gas could depend on snow and ice roads to the extent contemplated in the construction plan. While Arctic Gas does not know the basis for such position, and such position has not been made a part of the FPC evidentiary record, Arctic Gas does know that it has conducted very extensive testing of snow and ice roads at its Inuvik test facility in the Northwest Territories, and at other locations. These tests have conclusively shown that such roads can be effectively utilized, irrespective of the amount of snowfall during the construction period, without environmental damage.[53]

Summary

The construction of the proposed Arctic Gas system within the time period set forth herein, and employing the construction procedures described, is conclusively supported by the comprehensive construction planning, research, testing and engineering studies undertaken by Arctic Gas. Moreover, the construction schedule involves considerable latitude, so that in the event delays are encouraged, construction may be completed within the same overall time frame without disruption to the environment. In this respect, it should be noted that the construction schedule allows for a considerable number of non-productive days. And even if the non-productive days allowed for in the construction plan were not sufficient other measures could be followed such as:

(1) Crews would be able to work longer hours than anticipated, until the work is on schedule.

(2) Crews can be augmented with additional men and equipment, to accelerate the schedule.

(3) With the application of additional natural or manufactured snow to the right-of-way, the delayed construction season could be extended longer than that

---

[52] Ibid.
[53] Exh. AA–12, Dau pp. 17–18; Dau T. 3465–66; Hurd T. 3981–3992; Exh. AA–19.

shown in the application schedules, if allowed by other environmental considerations.

(4) Additional construction spreads can be added in the second construction year, if the first year schedule is not met.

There is every reasonable basis to be confident that the Arctic Gas Project will be constructed according to its proposed construction plan and within the time estimated therefor.[54]

VII. DISCUSSION OF ENVIRONMENTAL CONSIDERATIONS RELATING TO THE CONSTRUCTION, OPERATION AND MAINTENANCE OF THE ARCTIC GAS PROJECT

Summary

The body of this Section VII on the environment sets forth the relevant environment considerations pertaining to the Arctic Gas Project, and demonstrates that: (1) Arctic Gas has proposed a route and method of operation with an acceptable environmental impact, since the construction, operation and maintenance of the pipeline and related facilities will not have a serious adverse impact on the environment, and any potential impact will be local and short-term in nature; (2) the proposed coastal route is preferable, from an overall environmental basis and numerous other bases, to all of the other routes and modes of transportation studied by Arctic Gas, including the Fairbanks-Alaska Highway Corridor; (3) the proposed coastal route is preferable to the El Paso alternative system; and (4) the proposed project will not adversely affect the Arctic National Wildlife Range ("ANWR"), wildlife usage of the ANWR, or be incompatible with the purposes for which the ANWR was established.

The substantial evidence supporting these conclusions is summarized in the following sections. There is also detailed the overwhelming lack of environmental field work undertaken by El Paso in connection with its project. El Paso has years of filed work ahead of it, at a cost of millions of dollars, before it could proceed to construction. This is an important environmental consideration relating to assuring that the Arctic gas supplies promptly are brought to market. In sharp contrast, Arctic Gas could promptly proceed to construction of its pipeline once it receives appropriate governmental approvals on the basis of the substantial data it has gathered.

El Paso has not yet supplied any environmental assessment of its proposed project east-of-California. El Paso has also refused to file with the Department of the Interior for the requisite right-of-way permits necessary to implement its project. Having consideration for the fact that it has been over two years since Arctic Gas filed for such authority (March 1974), and in light of the substantial amount of field work required, it is not unreasonable to assume a comparable time lag for the El Paso analysis by the Government.

During the past decade there has been an unparalled international public awareness of the importance of protecting our natural environment. In response to the demand for legislation assuring that the Federal Government adequately investigate the environmental consequences of its major actions significantly affecting the quality of the human environment, in 1969 the United States Congress enacted the National Environmental Policy Act ("NEPA"), 42 U.S.C.A. §§ 4331, *et seq.* The policy of that statute is to assure that the (42 U.S.C.A. § 4331(a)):

"Federal Government, in cooperation with State and local governments, and other concerned public and private organizations, . . . use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans."

Pursuant to the requirements of Section 102(2)(C) of NEPA (42 U.S.C.A. § 4332(2)(C)), and pertinent governmental regulations implementing that Act, the Arctic Gas Project[55] has conducted pioneering international environmental research to assure that its proposed project will be constructed, operated and maintained under conditions whereby "man and nature can exist in productive harmony". Prompt approval of the Project will permit the Government to

---

[54] Exh. AA-12, Dau pp. 21–22; Dau T. 3756–58.

[55] In Alaska, Canada and the contiguous 48 states.

foster and promote the Nation's welfare and to "fulfill the social, economic, and other requirements of present and future generations of Americans".

A. The Arctic Gas Project Will not Have a Serious Adverse Impact on the Environment and any Potential Impact Will be Short Term, Local in Nature and Acceptable

Alaskan Arctic and Canadian Arctic have invested over 15 million dollars during the past five years in unprecedented environmental research on wildlife (mammals and birds), fish and vegetation, air and water quality, and in the prepartion of extensive socio-economic studies and archaeological programs, in order to, among other things, assure an environmentally acceptable route and mode to transport the vast amounts of natural gas in the Arctic regions of North America to markets critically in need of such supplies in the lower 48 of the United States and the southern regions of Canada.[56]

This ongoing research is thoroughly reported in the 34 volumes of the "Biological Report Series" published by Arctic Gas to date (and the various archaeological and socio-economic supplements to such Series). It is summarized in Alaskan Arctic's Environmental Report (Item Q) filed with its application to FPC at Docket No. CP74-239 for a certificate of public convenience and necessity to construct and operate a pipeline and related facilities along its proposed coastal route.[57] The environmental work undertaken by Arctic Gas has been recognized to be of immense scientific value and the results of such research have been made available to the Governments of the United States and Canada, the academic and scientific community, and the public at large.[58]

Arctic Gas' environmental research was undertaken under the supervision and direction of a team of highly respected independent scientists.[59] For example, Dr. A. W. F. Banfield, a world-renowned mammalogist, who presently is Professor of Environmental Studies and Director of the Institute of Urban and Environmental Studies at Brock University, provided overall advise and expertise (particularly on mammals) to the environmental program conducted by Arctic Gas. Dr. Banfield, a Fellow of the Arctic Institute of North America, formerly was the Director of what is now the Canadian National Museum of Natural Sciences, and has conducted considerable work in Arctic and sub-Arctic regions throughout the world since 1946. Other independent consultants included:

(1) *Fish.*—Dr. Peter J. McCart, President of Aquatic Environments Ltd., a zoologist with particular expertise in ichthyology, who previously served as a consultant to Alyeska Pipeline Service Company;

(2) *Mammals.*—Mr. Ronald D. Jakimchuk, President of Renewable Resources Consulting Services Ltd., a zoologist, formerly Regional Wildlife Coordinator for the Canada Land Inventory for the Canadian Wildlife Service, and Mr. David G. Roseneau, Senior Wildlife Biologist for Alaskan Programs for Renewable Resources, with Degrees in Wildlife Management and Zoology;

(3) *Birds.*—Dr. William W. H. Gunn, President of LGL Ltd., a zoologist with particular expertise in ornithology;

(4) *Vegetation.*—Mr. Donald L. Dabbs, Manager of the Environmental Division of R. M. Hardy and Associates Ltd., with Degrees in Agriculture and Plant Ecology;

(5) *Geotechnical.*—Dr. John I. Clark, Director of Geotechnical and Environmental Studies for Northern Engineering Services Company Ltd., a Civil Engineer specializing in soil mechanics and foundation engineering; and

---

[56] Northern Border, ITA(A) and PGT have invested over four million dollars in environmental studies in connection with their proposed pipelines in the lower 48 of the United States.

[57] This work has also been presented to the Department of Interior in support of applications for rights-of-way across Federal lands. In June 1975, the DOI Staff issued a 17-volume Draft Environmental Impact Statement (hereinafter referred to as "DOI-DEIS") with respect to the Arctic Gas Project proposal. Extensive comments on the DOI-DEIS were submitted by the Artic Gas Project in October 1975. The DOI Staff has not yet issued its Final Environmental Impact Statement ("FEIS").

[58] A general description of the history and scope of Arctic Gas' environmental program is contained in the direct testimony of Mr. R. A. Hemstock, Director of Environmental Studies for Canadian Arctic, before the FPC in El Paso Alaska Co., *et al.*, Docket Nos. CP75-96, *et al.* This testimony will hereinafter be cited (Exh. AA-12, Hemstock, pp. 5-6). The direct testimony of Arctic Gas' other environmental experts will be cited in the same manner.

[59] Similarly, the environmental work undertaken in the lower 48 of the United States was performed by, among others, Ecology & Environment, Inc. and Woodward-Envicon, Inc.

(6) *Socio-Economic (Alaska)*.—Mr. David Boorkman, a Partner in Urban and Rural Systems Associates, who specializes in social and economic impact assessment and who has done extensive socio-economic work for, among others, the Federal, state and municipal governments, including the State of Alaska.

These specialists have worked closely with Mr. Hemstock and Dr. Karl E. Francis, Director of Environmental Affairs for Alaskan Arctic, both of whom have extensive experience in Arctic and sub-Arctic regions. Mr. Hemstock is a Civil Engineer and has over 30 years of pipeline and related experience in Arctic and sub-Arctic regions. In 1973, he was elected a Fellow of the Arctic Institute of North America. In 1975, he received the John Campbell Sproule Memorial Plaque for his contribution to Northern engineering by the Canadian Institute of Mining and Metallurgy. Dr. Francis holds Degrees in Geology and Mineralogy, Natural Resources and Geography. He has done graduate work in glaciology and has conducted broad research across Arctic North America.

The educational and professional background of each of these individuals is explained more fully in the testimony submitted by them to the FPC (Exhs. AA–12 and AA–13) in connection with Alaskan Arctic's application and such individuals were cross-examined with regard to their respective studies and the conclusions reached as a result of those studies. Of course, many other professionals with training in the environmental disciplines and with experience in the North worked on this project throughout the years.

The field and laboratory environmental research programs which have been conducted by Arctic Gas have extended from Prudhoe Bay in Alaska to the two delivery points on the International Boundary between Canada and the lower 48 of the United States.[60] These studies included the alternative interior route through Alaska and the Yukon Territory. "Baseline studies" were designed to obtain fundamental information on the existing environment along the coastal and interior routes on wildlife, fish and vegetation and the chemical and physical properties of air, soil and water. "Disturbance Studies" were designed to assess the effects on wildlife, fish and vegetation of disturbances arising from the construction, operation and maintenance of the proposed pipeline such as compressor station noise, aircraft activities, human presence, etc. (Item Q, Appendix A; Exh. AA–12, Hemstock, Appendix B). All of these studies were designed and carried out in order to assure the construction and maintenance of an environmentally safe and socially and economically desirable pipeline (Exh. AA–12, Hemstock, pp. 5–6).

The environmentalists have concluded that their studies are adequate to assess: (1) the existing environment along the coastal and interior routes; and (2) the potential impact of the proposed pipeline on that environment (Exhs. AA–12 and AA–13). The mammal, fish, geotechnical and socio-economic consultants prefer the coastal route, the bird consultants prefer the interior route, and the vegetation consultants believe that there is no clear advantage of one route over the other. From an overall environmental standpoint, Dr. Banfield prefers the coastal route as does Dr. Francis and Mr. Hemstock.[61]

Although both the coastal route and the alternative interior route are environmentally acceptable, the various reasons for the preference for the coastal route over the alternative interior route may be briefly summarized: (1) the coastal route is preferable from a mammal standpoint because the winter construction proposed by Arctic Gas will avoid interactions with the Porcupine Caribou Herd during the calving, overwintering and migration periods. It also reduces impacts on other species such as Dall sheep and will avoid the habitats of furbearing species which are considered to be of greater significance along the interior route than along the coastal route (Exh. AA–12, Jakimchuk, pp. 11–12); (2) the interior route, which would require some summer construction, travels for much of its length through valleys that are used by substantial numbers of mammals, particularly the Canning River Valley which is an

---

[60] Arctic Gas has also undertaken less extensive environmental assessments of alternative pipeline corridors such as the Fairbanks Corridor, Fort Yukon Corridor and Offshore Corridor, as well as alternative modes of transportation of the gas. These alternative corridors and modes of transportation are discussed fully below in Section C.

[61] As originally filed by Canadian Arctic with the National Energy Board of Canada, the coastal or "Prime Route" was designed to avoid crossing the Mackenzie River Delta. However, Canadian Arctic has since amended its application before the National Energy Board to reflect a pipeline routing traversing the Delta. Such pipeline routing is preferred to the originally filed circum-Delta route from an overall environmental standpoint. The cross-Delta routing does not affect the location of Alaskan Arctic's line from Prudhoe Bay to the Alaska-Yukon border.

important wildlife area (Exh. AA-13, Banfield, p. 9) ; (3) the proposed coastal route will traverse a relatively homogeneous physiographic unit and will, therefore, substantially reduce the number of potential environmental problems associated with the interior route. That route would traverse numerous terrain types, each of which present their own complex network of environmental problems (Exh. AA-13, Francis, p. 4) ; (4) the probable impact on fish along the coastal route will be less than that on the interior route because it is more difficult to avoid critical areas along the interior route particularly in the Canning River Drainage (Exh. AA-13, McCart, p. 13) ; (5) the proposed coastal route is easier to construct and rehabilitate from a geotechnical and terrain standpoint than the interior route where more geotechnical problems would be encountered (Exh. AA-12, Clark, pp. 24-25) ; (6) the proposed coastal route is preferable from a socio-economic standpoint because it is the shortest route and, therefore, will have the least socio-economic impact on the State of Alaska (Vol. 26, Boorkman, T. 4011) ; (7) the proposed coastal route is the shortest route in the State of Alaska and, therefore, will have minimum facility requirements and a minimum impact on the environment (Exh. AA-13, Francis, p. 4) ; and (8) the pipeline along the proposed coastal route will be in close proximity to offshore Northern Alaska where it is expected that additional gas reserves will be found and developed. There would be less environmental impact if these potential gas reserves could be connected to a pipeline near the coast instead of constructing lines to run inland for a junction with the interior route (Exh. AA-12, Hemstock, pp. 15-16; Exh. AA-13, Banfield, p. 9.)

The ornithological consultants prefer the interior route because they principally are concerned about some presently unforseen factor or combination of factors degrading portions of the shoreline environment, an important area for birds (Exh. AA-13, Gunn, p. 17). It is Dr. Banfield's judgment that since the pipeline will be constructed in the winter when the birds are not there, such concern is much less significant than other considerations concerning the interior route relating to mammals which are described above (Exh. AA-13, Banfield, p. 8).

These independent specialists believe that the coastal route can be constructed without serious adverse impact to wildlife, fish and vegetation, provided that Arctic Gas constructs, operates, and maintains its proposed pipeline in accordance with the plans it has developed and that adequate environmental safeguards are employed in accordance with their recommendations (Exh. AA-12, Dabbs, p. 2; Jakimchuk, pp. 2-3; Exh. AA-13, Roseneau, p. 2; McCart, p. 3; Gunn, p. 3; Banfield, p. 3). The environmentalists agree that Arctic Gas has taken practicable steps to avoid or mitigate potential adverse environmental impacts both in locating its line so as to avoid environmentally sensitive areas and through the development of major engineering features such as winter construction of a buried and chilled pipeline. Other environmentally mitigative features include revegetation and restoration of the right-of-way, the use of winter snow and ice roads, the use of low ground pressure vehicles, control of aircraft flight patterns and traffic, and the development of management procedures for the control of personnel (Exh. AA-12, Jakimchuk, p. 13; Exh. AA-13, Roseneau, p. 9; McCart, pp. 11-13; Gunn, p. 18; Banfield, p. 11; Boorkman, p. 39).[62]

In sum, substantial record evidence demonstrates that Arctic Gas has undertaken sufficient studies to assess the environment and the impact of its project

[62] Arctic Gas has developed an archaeological program which will protect any cultural resources which may be encountered along the proposed route. For example, as stated in Item Q, Chapter VI, Section C, p. 19, potentially productive archaeological sections and locations have been identified along the route and classified as being high, medium or low priority. Archaeological survey of selected high priority sections and localities will be carried out ahead of construction activities either before or accompanying preliminary surveys or preparation activities. Archaeological crews will accompany ditching and other construction or excavation activities to provide surveillance of any archaeological sites exposed at that time. Sites discovered before construction will be avoided or will be salvaged in advance of construction wherever possible. Sites discovered, but not otherwise affected by construction, will be clearly marked and identified for future investigations. Contingency salvage plans are being developed for sites discovered during ditching or other excavation.

The importance and identification of artifacts will be included in the environmental training program for construction personnel. Procedures for reporting discoveries to archaeologists will be implemented. Arctic Gas will arrange that the artifacts will be deposited in appropriate public repositories and expects that most will be placed in suitable northern museums.

on that environment. Moreover, Arctic Gas' project will not have a serious adverse impact on the environment since it has undertaken, and will undertake, practicable and reasonable steps to avoid or mitigate any potential adverse environmental effects. Indeed, it is anticipated that any potential impact will be short term and local in nature (Exh. AA–12, Dabbs, p. 2; Jakimchuk, pp. 2–3; Exh. AA–13, Roseneau, p. 2; McCart, p. 10).[63]

Finally, it is Dr. Banfield's judgment that the potential environmental impact of the project is acceptable. He testified (Exh. AA–13, Banfield, pp. 7–8):

"To determine whether environmental impact is acceptable, I favor the method of comparing the environmental effects of the proposed human activity with the observed effects of natural disturbances. There are many natural disturbances such as solifluction, slumpings of the active layer, caribou trails, and stream erosion which cause local environmental disruption to certain physical and biotic components in the environment. However, other natural forces such as soil erosion, sedimentation and plant succession heal the disturbances in a natural time span. I believe that where, as here, the impacts resulting from human activity such as clearing a right-of-way, trenching backfilling, and crossing rivers are no greater than disturbance due to the natural phenomena discussed above, and especially where we are assisting natural plant succession by revegetating the right-of-way, then the environmental impact is acceptable.

"While this test applies to the construction of the pipeline, it is not designed to take into account the construction or operation of compressor sations. Obviously, the environmental impact of compressor stations is site specific. Therefore, to objectively appraise the environmental acceptability of such facilities, it is necessary to evaluate such things as the significance of the amount of land withdrawn for the site and the disturbance associated with the site in terms of its impact on wildlife, fish and vegetation. The land to be withdrawn for the proposed compressor stations in this case is insignificant in terms of the total land available in the area in which the pipeline is proposed to be located and will not have a significant impact on wildlife habitat. Moreover, the potential disturbance from compressor station noise and associated human activity will not have a significant adverse impact on wildlife because it will be mitigated to the extent practicable as set forth in Arctic Gas' Environmental Report. On this basis, I consider the construction and operation of the compressor stations environmentally acceptable."

B. The Arctic Gas Project Will not Adversely Impact the Arctic National Wildlife Range, Wildlife Usage of the Range, or be Incompatible With the Purposes for Which The Range was Established

The proposed coastal route does, of course, traverse the northern portion of the Arctic National Wildlife Range and, therefore, a discussion of the ANWR and the potential impact of the pipeline on the ANWR is appropriate at this juncture. Figure 1 shows the location of, among other things, Arctic Gas' proposed facilities in the ANWR.

The ANWR was established by Secretary of the Interior Fred A. Seaton by Public Land Order 2214, dated December 6, 1960. The ANWR is not a "wilderness area" since it has not been designated as such by Congress.[64] As a "wildlife range", the ANWR is administered by the Secretary of the Interior under the "National Wildlife Refuge System Administration Act of 1966"[65] which provides, *inter alia*, that the Secretary is authorized to (16 U.S.C.A. § 668dd (d)(2)):

"(2) permit the use of, or grant easements in, over, across, upon, through, or under any areas within the System for purposes such as but not necessarily limited to, powerlines, telephone lines, canals, ditches, pipelines, and roads, including the construction, operation, and maintenance thereof, whenever he

---

[63] Northern Border's environmental witnesses, Messrs. Gallagher and Strobel, testified, inter alia, that Northern Border's environmental assessment accurately describes the existing environment and the environmental impact that may reasonably be expected from the construction and operation of the proposed pipeline (Exh. NB–13, Gallagher, p. 9) and that Northern Border has taken practicable steps to avoid or mitigate potential adverse environmental impacts (Exh. NB–13, Strobel, pp. 4–6). ITA(A) and PGT environmental witnesses have rendered similar conclusions (see, *e.g.*, Exhs. IT–21 Schuert, pp. 2, 5–7; IT–68, pp. 2–3; Exh. PG–50, Downey, p. 13).

[64] "Wilderness Act", 16 U.S.C.A. §§ 1131–36 (1974).

[65] 16 U.S.C.A. §§ 668dd–668ee (1974).

determines that such uses are compatible with the purposes for which these areas are established."

Thus, no legal barrier exists to locating a pipeline in the ANWR. Moreover, as will now be shown, the location of Arctic Gas' proposed pipeline in the northern portion of the ANWR will not be incompatible with the purposes for which the ANWR was established.

The ANWR is located in a remote portion of northeastern Alaska and is bordered on the north by the Beaufort Sea, on the east by the Yukon Territory, and on the west and south by the State of Alaska. It is a huge expanse of land of approximately 9,000,000 acres in size and is comprised of Arctic coastal plain, foothills, and the Brooks Mountain Range. Arctic Gas' proposed pipeline will be located in the northern portion of the ANWR in the Arctic coastal plain.

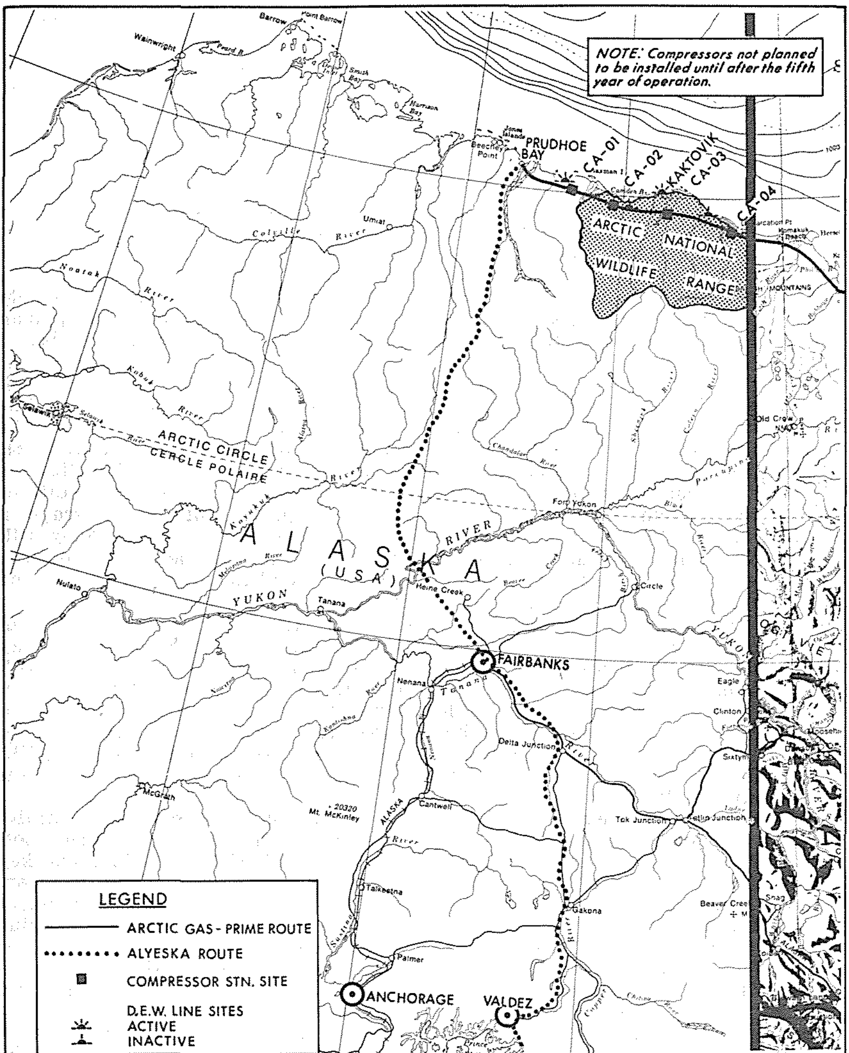
From the standpoint of wildlife, the Arctic coastal plain is distinguished for two principal reasons: (1) it is the traditional calving grounds for the Porcupine Caribou Herd; and (2) the area along the coast of Alaska is known for its seasonal use by birds. The area used by the Porcupine Caribou Herd for calving is approximately 2,000 to 4,000 square miles, a substantial portion of which is located in the Yukon Territory (Vol. 22, Biological Report Series, Chapter IV, p. 62), and the proposed pipeline route is located north of the major portion of the calving grounds. The pipeline will be constructed during the winter when the Herd is on its wintering grounds well to the south of the pipeline alignment and well before calving takes place (Exh. AA–12, Jakimchuk, p. 12). Future compressor stations (which are planned to be required after the fifth operating year of the pipeline) are scheduled for summer construction, however, strict measures have been designated in Arctic Gas' Environmental Report (Item Q) to avoid aircraft overflights, vehicular interference and other construction activities within the calving grounds during the calving period (*Ibid.*). In Mr. Roseneau's view, the Herd will not avoid the calving grounds because of the presence of the pipeline and related facilities (Vol. 16, Roseneau, T. 2538).

With respect to raptor, shorebird and waterfowl utilization of the coastal plain, Dr. Gunn testified, *inter alia*, that disturbance to birds can be kept within acceptable limits provided his "recommendations are followed [*i.e.*, timing and regulation of construction, operation and maintenance activities, location of pipeline and related facilities, etc.] and that Arctic Gas constructs, operates and maintains its proposed pipeline in accordance with the construction, operation and maintenance plans contained in its Environmetal Report and that these plans are strictly adhered to" (Exh. AA–13, Gunn, p. 3).

As noted above, Arctic Gas has undertaken over five years of intensive environmental studies in the North. The expert botanists, mammalogists, ornithologists, and ichthyologists undertaking these studies have concluded that if Arctic Gas constructs, operates and maintains the pipeline as it proposes, and follows their recommendations, it will not have a serious adverse impact on fish, wildlife or vegetation. Obviously, the "wildlife range" principally was established for the benefit of wildlife (Exh. AA–13, Francis, p. 5; Vol. 19, Francis, T. 2855). Therefore when, as here, it can be shown that the pipeline will not seriously adversely impact wildlife usage of the coast (Exh. AA–12, Jakimchuk, p. 13; AA–13, Roseneau, p. 10; McCart, p. 4; Francis, p. 5; Banfield, pp. 11–12), and, therefore, the coastal portion of the ANWR, it follows that the pipeline will not be inconsistent with the principal purpose for which the ANWR was established. Moreover, the construction of the pipeline through the ANWR will not have a serious adverse impact on the ANWR itself since it is planned to restore disturbed areas to their natural state through revegetation and other mitigative measures (Exh. AA–12, Hemstock, p. 16; AA–13, Francis, p. 5).

Given these facts, the focus of attention of some persons apparently opposed to the pipeline has shifted to the "aesthetic" or "wilderness" characteristics of the ANWR. This follows that portion of Secretary Seaton's Public Land Order 2214 which provides in part, that the purposes of the ANWR include the preservation of "unique wildlife, wilderness and recreational values." Although the ANWR is not a "wilderness area", since it has not been designated as such by Congress, the argument is made that the entire ANWR is *de facto* wilderness. This plainly is incorrect with respect to the coastal portion of the ANWR.

The area in which the pipeline will be buried has been used as a transportation corridor by both primitive and modern man as well as for traditional



PROPOSED LOCATION OF FACILITIES IN ALASKA

NORTHERN ENGINEERING SERVICES COMPANY LIMITED
CALGARY ALBERTA
ENGINEERS FOR
ALASKA ARCTIC GAS PIPELINE COMPANY

FIGURE 1

economic and technological purposes (Exh. AA–13, Francis, p. 5, Vol. 9, Hemstock, T. 1535). Today, the area is used as a land, air and marine corridor for the transportation of men and materials (Vol. 19, Francis, T. 2858–59). Economic activities commenced along the coast with the advent of whalers in the mid-nineteenth century (Vol. 9, Hemstock, T. 1535). Whalers exploited wildlife and, as a result of their presence, a local economy developed with the Native peoples. A village of approximately 160 people exists at Kaktovik which is located on Barter Island. Subsequently, Defense Early Warning ("DEW Line") stations were established by the United States Government in order to protect the National security.[66] An active DEW Line station (with about 50 personnel) presently exists at Barter Island and other abandoned DEW Line sites along the coast (Vol. 19, Francis, T. 2829). For example, abandoned DEW Line stations are located about 30 miles to the west of Barter Island at Camden Bay and 35 miles to the east of Barter Island near Demarcation Point. Figure 1 shows the location of Kaktovik and these existing and abandoned DEW Line stations along the Arctic coastal plain. According to the boundaries delineated by Public Land Order 2214, these facilities either are located within the boundaries of the ANWR, or are immediately adjacent to such boundaries. There were extensive air and sea operations to build and support the DEW Line stations in the 1950's and 1960's (Vol. 9, Hemstock, T. 1535). Today, air activities support the DEW Line station at Barter Island. The area have involved (*i.e.,* the coastal plain) certainly cannot be compared with an area such as Fairbanks, but plainly it is no "wilderness", as that term is commonly understood, for it evidences the presence of both primitive and modern man (Exh. AA–13, Francis, p. 5; Vol. 9, Hemstock, T. 1534–38; Vol. 10, Dabbs, T. 1712).

With respect to "aesthetic qualities" of the coastal portion of the ANWR, the pipeline will be buried and the ditch line revegetated so that the pipeline itself cannot be said to detract from the ANWR's "aesthetic qualities." In the future, a maximum of four compressor stations in Alaska (three in the ANWR), about 50 miles apart, will be installed as necessary to assure full utilization of the line (thereby keeping consumer costs to a minimum), but those stations should not materially detract from the "aesthetic quality" of the landscape in light of the DEW Line stations presently located along the coast. They will add to the evidence of man's presence, but their impact will be local in nature. In any event, any "aesthetic impact" will be dependent upon the perception of the individual, the method by which the coast is viewed, *i.e.,* land, air or sea, and the nature of the surrounding elements (air, water, odor, vistas, wildlife, temperature, etc.) at the time it is viewed. The pipeline right-of-way and associated facilities will be more visible from the air as are the DEW Line stations. On the ground, these facilities will be unperceived relatively short distances away from their actual location. The construction, operation and maintenance of the proposed pipeline and related facilities certainly will not alter whatever recreational use presently is made of the 9,000,000-acre ANWR. For example, fishing, hunting, mountain climbing or other recreational uses will remain unaltered.

Some have suggested that the pipeline "would cut across an essentially undisturbed continuum of Arctic Coast, Arctic Coastal Plain, Northern Foothills and the Brooks Range" (DOI-DEIS, Pt. I, Vol. 1 of 1, p. I–215). The key word here is "essentially", and that requires emphasis, for whatever "continuum" there may have been has already been broken by the establishment of DEW Line sites and by the villagers of Kaktovik. Moreover, the pipeline will only traverse the Arctic coastal plain and will not be in the foothills or the Brooks Mountain Range. Finally, the area where the pipeline will be located is not "unique" inasmuch as similar sequences of terrain can be found on other parts of the coastal plain.

In the final aanlysis, it is clear that the pipeline will not adversely affect wildlife usage of the ANWR, the ANWR itself, nor be incompatible with the purposes for which the ANWR was established.

In a recent article in the Sierra Club Bulletin, dated February 1976, by Mr. Brock Evans, entitled "Alaska's Second Pipeline", it is asserted, inter alia (pp. 19–20, emphasis in original):

"To illustrate the damage that could be done, the 'primary route' would cut through the heart of the great Arctic coastal plain, which comprises the northern third of the wildlife range; through the migrating and calving grounds of the second largest caribou herd in North America; and through important waterfowl nesting habitat. But it would not be any mere sliver of pipe; it would have three compressor stations operating day and night, and each station would have its own airport, with permanent twenty-four-hour lights. In addition, numerous communication towers would be scattered along the route,

---

[66] It is not unreasonable to suggest that a pipeline transporting vitally needed Arctic gas supplies is just as necessary from the standpoint of National security as the DEW Line sites.

each with its own permanent lights. Constant airplane surveillance—up to six times a day—to detect leaks would also be necessary.

"Wilma Frey, a special consultant to the Sierra Club, has determined the environmental damage that would be done on the broad flat coastal plain by the intrusion of these facilities. Assuming that sounds would be heard within a radius of thirty to forty miles from the source (according to a government EIS) and that lights could be seen within a radius of twenty miles from the source, the construction and maintenance of the gas pipeline would for all intents and purposes constitute a 'taking' of *all* the coastal plain, as well as most of the foothills of the Brooks Range. From three to four million acres are involved, and they would never be the same so long as the pipeline were in operation."

In order to place this "doomsday scenario" of "taking" in proper perspective, it is necessary to understand the physical aspects of the pipeline and its related facilities. The pipeline will indeed traverse a portion of the Arctic coastal plain. However it will be buried[67] in a six or seven foot wide ditch, with the top of the pipe being a minimum of 30 inches below the original ground surface. The ditchline will be crowned with excess spoil (to account for subsidence) and tundra will be replaced where beneficial (Item Q, Chapter II, Section E, p. 39). The pipeline right-of-way will be 120 feet wide and will extend over approximately 195 miles from Prudhoe Bay on the east to the Alaska-Yukon border on the west. The entire land requirement for the pipeline itself in Alaska is approximately 2,800 acres, which is less than 0.0008 of 1 percent of Alaska's total area of 586,400 miles (Item Q, Chapter II, Section C, p. 7). The disturbed areas of the pipeline right-of-way will be restored, revegetated and returned to their prior usage (Exh. AA–12, Dabbs, p. 2; Item Q, Chapter II, Section E, p. 39) to assure that the disturbance associated with clearing trenching and backfilling will only be temporary in nature (Exh. AA–13, Francis, p. 5).

Four maintenance station sites about 50 miles apart and about 15 acres each (Item Q, Chapter II, Section E, p. 39) have been designated in Alaska (three in the ANWR) because of their suitability for use as future compressor station sites (Item Q, Chapter II, Section B, p. 4). These compressor stations are not planned to be required until after the fifth operating year of the pipeline. Additionally, two material stockpile sites will be constructed and will be located on the coast near Camden Bay and Demarcation Bay (*Id.* at 5). Airstrips 2,400 feet in length will be located near the four maintenance station sites and the two stockpile sites (*Ibid.*). The only permanent roads (about 30 feet wide) to be constructed are those necessary to connect the airstrips to their respective maintenance station sites or material stockpile sites (*Ibid.*). The total estimated land requirements for the permanent support facilities will not exceed 900 acres (Item Q, Chapter II, Section C, p. 7). On balance, therefore, Alaskan Arctic will utilize approximately 3,500 acres of land (not more than 900 on a permanent basis) on the Arctic coastal plain for its pipeline and related facilities in Alaska instead of "'taking' *all* of the coastal plain [an asserted 3 to 4 million acres], as well as most of the foothills of the Brooks Range" (emphasis in original).[68]

It also should be noted that the ANWR does not encompass the entire vast Arctic coastal plain. Rather, the ANWR extends from Brownlow Point on the west to the Alaska-Yukon border on the east (Public Land Order 2214) or a distance of approximately 130 miles. The entire Arctic coastal plain can be said to extend from the Mackenzie Delta in Canada on the east to Point Lay in Alaska on the west, a distance of approximately 750 miles. Therefore, it is not correct to equate the coastal portion of the ANWR with the entire Arctic coastal plain since it represents only a part of the coastal plain.

As noted above, there would be four (three in the ANWR) future compressor stations in Alaska which are not planned to be required until after the fifth operating year of the pipeline. Arctic Gas conducted compressor station sound simulator tests which indicated that simulator noise was at ambient noise levels at an approximate average of 1,320 yards at a tundra location under worst case conditions (Vol. 5, Biological Report Series, January 1974). Indeed,

---

[67] Short segments of the pipeline will be located above ground at the measurement station at Prudhoe Bay and at the proposed maintenance stations.

[68] The exact temporary land requirements for borrow areas will not be known until the final selection of these areas. At a maximum 850 acres may be required (Item Q, Chapter II, Section C, p. 7).

biologists working at various experimental sites reported that unattenuated noise emissions from the simulator were generally inaudible to the human ear at one-half to one mile. This should be compared to the "assumed" 30 to 40 miles stated in the article and apparently derived from the DOI–DEIS, Part II, Volume 1 of 3, page II–899. It also should be compared to another statement appearing in another section of the DOI–DEIS which provides more correctly (Part III, Vol. 2 of 3, page III–1115, emphasis added):

"The principal source of noise during the operational phase of the pipeline would be the compressor stations, located at 40- to 50-mile, intervals along the route. *Thus, these sources would be very localized in nature, but at each site they would produce noise with continuous sound levels on the order of 60 db(A) at 800 feet. This suggests that there would be a significant noise impact beyond the immediate vicinity of the station, and audibility possibiliy as far as a mile.*

"Other operational noises, such as from aircraft operating on occasional inspection flights, would be quite dispersed in both space and time and probably would not constitute a significant impact; low-flying aircraft however would cause some annoyance."

Arctic Gas' sound simulator experiments on wildlife indicate that noise from compressor stations will not have a serious adverse impact on wildlife but could cause local disturbance such as the loss of some feeding areas near the compressor station sites for waterfowl such as snowgeese (see, *e.g.*, Vols. 5, 14 and 23, Biological Report Series, January, February and August 1974, and Item Q, Chapter II, Section I, pp. 97–98).

Moreover, contrary to the assertions in the article, there would not be "permanent twenty-four-hour lights" associated with the compressor stations since it is not expected that it will be necessary to permanently illuminate such stations. Lights will be required during routine operation and maintenance operations, but it is not expected that this would be more than three to four times per week. In any event, it is difficult to understand the concern expressed in his connection. If permanent lighting were required, it would have its greatest impact during the winter. But during the coastal plain is essentially devoid of wildlife. And during the summer, when there is continuous or near-continuous light, the presence of compressor station lighting will not alter the existing environment. Furthermore, it is inconceivable that compressor station lighting could be seen "within a radius of twenty miles from the source" and Arctic Gas is unaware of any observations to support this allegation. Electric lighting is not unknown on the coastal plain in the general vicinity of the pipeline route. For example, the villagers of Kaktovik light their homes. The DEW Line station at Barter Island has a lighted runway and lighted buildings. These lights cannot be seen at relatively short distances from their locations.

The article also asserts that "numerous communication towers would be scattered along the route, each with its own permanent lights." Arctic Gas has now adopted a satellite communications system thereby eliminating the need for the terrestrial microwave communication towers referred to in the article. There will, however, still be a need for shorter (about 100 feet) radio communication towers associated with the future compressor stations (Exh. AA–34, Section 8b7).

Finally, the article provides that "[c]onstant airplane surveillance—up to six times a day—to detect leaks would also be necessary". This is incorrect. The frequency of Arctic Gas' aircraft line patrols will vary according to the season. Air patrols are necessary to detect any factors which may threaten the line or its surrounding terrain so that corrective proceures may be undertaken at an early stage. Most airline patrols will probably be done by small, fixed-wing, low-speed aircraft operating one or twice monthly. During spring run-off periods, patrol flights may be required weekly. Ideally, line patrol flights should be carried out at between 100 and 150 feet above the right-of-way. During periods when flights at this altitude may disturb wildlife, the patrol will be rescheduled or will be made at higher altitudes, and the aircraft will descend to a lower altitude only when it is considered necessary to accurately define a condition on the right-of-way which appears suspect from the higher elevation. Senior supervisory and aviation personnel will consult with environmental personnel in order to obtain data on wildlife conditions in the area of any required flight so as to assist in the selection of a suitable aircraft, and a flight path and altitude which will minimize the effects on wildlife (Item Q, Chapter II, Section G, p. 75). Moreover, observations during 1973 indicated that existing aircraft traffic along the coast averaged one flight every four daylight hours (Exh. AA–13, Gunn, p. 12).

Arctic Gas submits that it is indeed unfortunate that the Sierra Club Board of Directors has "resolved that the club must oppose any intrusion into the wildlife range or into its proposed extensions to the south" especially when its decision appears to have been predicated upon such wholly erroneous information and especially when Arctic Gas' studies demonstrate that it has selected the least environmentally damaging route from among those studied. Similarly, to assert that "[i]t is the opinion of all environmental groups, as well as that of the government and Federal Power Commission experts, that irreparable damage to wildlife and wilderness will result from either of Arctic Gas' preferred routes" plainly is incorrect. Neither the DOI or FPC Staff have voiced any such opinion. Nor could they in light of the substantial evidence to the contrary submitted by Arctic Gas. Moreover, we doubt that the Sierra Club Board of Directors opinion is representative of "all environmental groups." The article should be recognized for what it is and what it is not. It is an emotional plea to influence the members of the Sierra Club to oppose the Arctic Gas Project in complete disregard of facts.

C. The Evidence Demonstrates that Arctic Gas has Proposed the Most Preferable Mode and Route for the Transportation of the Northern Gas Supplies to Market

Chapter V of Alaskan Arctic's Environmental Report discusses the alternative routes and modes considered by Arctic Gas for delivery of the Northern gas supplies to market (Item Q). Included in Item Q is a discussion of alternative routes and corridors, *i.e.*, (1) the Interior Route; (2) the Offshore Corridor; (3) the Fairbanks Corridor; (4) the Fort Yukon Corridor; and (5) a Common Corridor.[69] Figure 2 shows the location of these Corridors (Item Q, Chapter V, Section B, Subsection 1.2, Figure 2–1).

Of all the alternative routes discussed in Item Q, only the Fairbanks Corridor has received substantial attention. For example, in its "Draft Environmental Impact Statement for the Alaska Natural Gas Transportation Systems" (November 1975), in *El Paso Alaska Co., et al.*, Docket Nos. CP75–96, *et al.*, (hereinafter "FPC-DEIS"), the FPC Environmental Staff has recommended, *inter alia*, that (Vol. I, p. I–255):

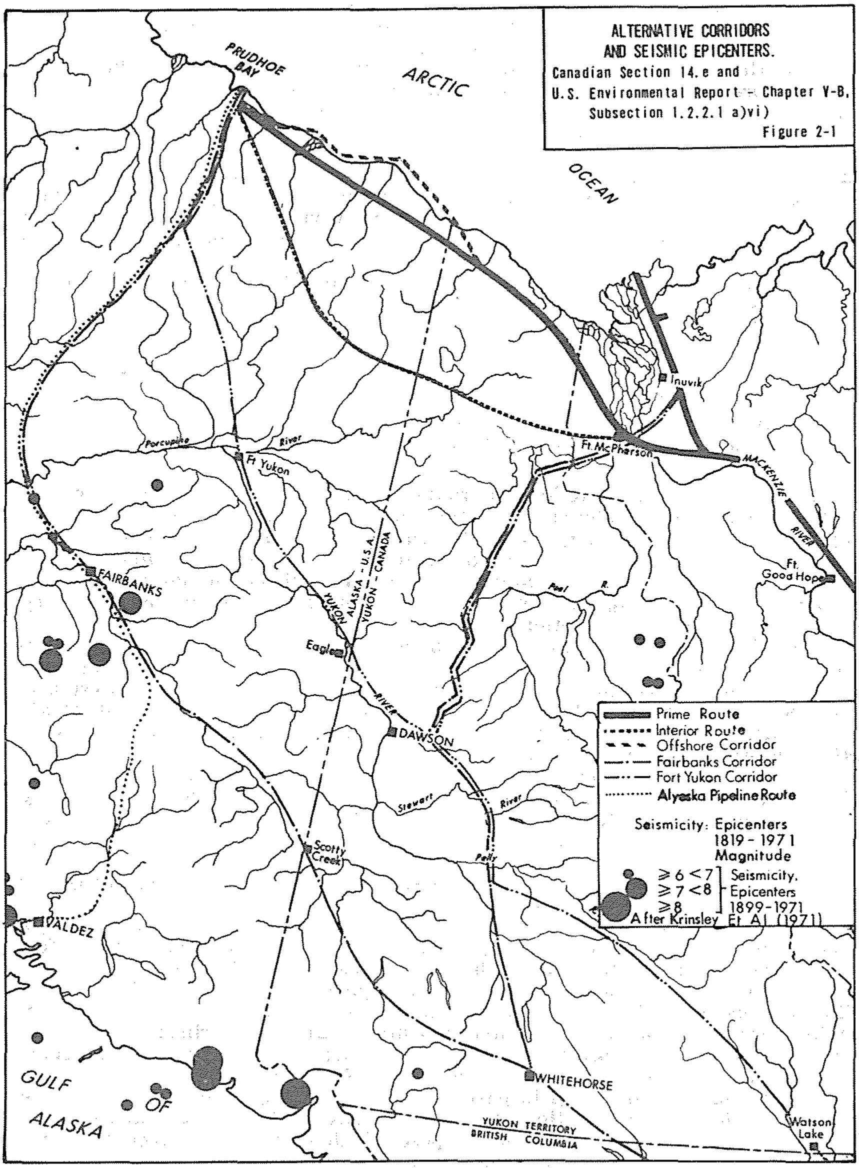
"The Alaskan Arctic route of the Arctic Gas System should be constructed along the proposed Fairbanks Corridor alternate route. This right-of-way would involve construction of approximately 735 miles of pipeline in Alaska. The first 460 miles would extend south from Prudhoe Bay adjacent to the Alyeska oil pipeline right-of-way to just northeast of Fairbanks. From that point the route would proceed southeasterly along the Alaskan Highway for 275 miles to the Canadian border."

The FPC Environmental Staff does not give any rationale in support of this conclusion or state the reasons why, in its view, it is environmentally preferable to the coastal route proposed by Arctic Gas. Arctic Gas submits that the substantial record evidence submitted in support of its application to the FPC demonstrates that its proposed coastal route is preferable to the Fairbanks Corridor from an: (1) environmental; (2) engineering; (3) energy conservation; (4) reliability-of-service; (5) cost; and (6) timing standpoint (See generally Item Q, Chapter V, Section B, Subsection 1.9).

These factors are discussed in part in this Section. However, it must first be recognized that the applications filed by the Arctic Gas Project are explicit in setting forth the comprehensive purpose which they are designed to serve. That purpose has, at all times, been twofold: (1) to obtain the vast natural gas supplies from the two major producing areas of the Arctic coastal regions of Alaska and Canada; and (2) to directly deliver such natural gas supplies to markets by a conventional pipeline transmission system with a minimum amount of environmental impact, and yet achieving maximum economy. The Fairbanks Corridor simply does not achieve these goals.

---

[69] The alternative systems for delivering the Arctic gas supplies to market discussed in Item Q include: (1) an electric generation and HVDC transmission system; (2) a dense-phase pipeline system; (3) a methanol pipeline system; (4) an LNG railway system; (5) an LNG monorail system; (6) an LNG tanker system; (7) an LNG submarine system; (8) an LNG airplane system; and (9) an LNG helifloat system.



VII-20 FIGURE 2

From an environmental standpoint, and on the basis of the statement and analysis of the two routes in Arctic Gas' Environmental Report (Item Q), the proposed coastal route is preferred to the Fairbanks Corridor by the mammal (Vol. 17, Jakimchuk, T. 2572–73), fish (Vol. 18, McCart, T. 2669–70), vegetation (Vol. 11, Dabbs, T. 1819–30), socio-economic (Vol. 26, Boorkman, T. 4011), and geotechnical consultants as well as from an overall environmental standpoint by Dr. Banfield (Vol. 22, Banfield, T. 3287–95), Dr. Francis (Exh. AA–13, Francis, p. 4), and Mr. Hemstock (Exh. AA–12, Hemstock, p. 16). Generally speaking, the reasons for this preference are the same as those set forth above in the comparison of the proposed coastal route with the alternative interior route. The ornithological consultants prefer the Fairbanks Corridor because it "avoids areas of primary importance to waterfowl" along the North Slope and Mackenzie Delta and "gets off the coastal slope, North Slope about as quickly as it can by going due south" (Vol. 18, Gunn, T. 2750). However, Dr. Banfield has concluded, on an overall environmental basis, that the "Fairbanks corridor [would have] more environmental impact than the coastal route" (Vol. 22, Banfield, T. 3290–91). Certainly, this system would require that there be another "corridor" in Canada extending south from the Mackenzie Delta, through the Yukon, to a connection point with the Fairbanks Corridor pipeline along the Alaska Highway, near Whitehorse, Yukon Territory (Item Q, Chapter V, Section B, Subsection 1.4, p. 1).

It is true, of course, that the Fairbanks Corridor gives the superficial appearance of following disturbed areas and thus creating only "incremental" impact. Although the gas pipeline in the Fairbanks Corridor would run in the general vicinity of the Alyeska Oil Pipeline, it deviates from it by substantial distances at many places, and is not on the same right-of-way as the oil pipeline, even before it swings to the east and totally leaves the "oil corridor". Whether it is environmentally preferable to have two pipelines adjacent, or more widely separated is a question which seems to have supporters on both sides. What is important to note is that the Fairbanks Corridor does not contemplate adjacent pipelines so that:

(a) If adjacent location is an advantage, it is not achieved by the Fairbanks Corridor, which thus does not have an advantage over Arctic Gas' proposed coastal route; and

(b) If adjacent location is a disadvantage, that is not produced either by the Fairbanks Corridor or by the proposed coastal route.

With respect to the so-called "corridor concept", and particularly the Fairbanks Corridor, Dr. Banfield testified (Vol. 22, Banfield, T. 3287):

"I have in mind a great number of statements that have been in literature and in the press that suggest that the order of magnitude of environmental impact to be expected on southern corridors, particularly the Fairbanks corridor, are of a very minor concern at this point. They would be very minor, and not really of the same . . . level of concern as for the northern routes that have been selected by the applicant.

"My review of the information and my understanding as an ecologist of boreal forest ecology, as well as Arctic ecology . . ., my experience on the ground, my work in the area has led me to believe that certainly from the point of . . . popular view, that they are seriously underestimating what would be the true environmental impact, both on—well, I will restrict myself to the biotic components of the environment."

He further testified (Vol. 22, Banfield, T. 3322):

". . . I believe that the advantages of a common corridor have been overstressed in much of what one reads in the literature and also hears at discussion.

"The word used is 'incremental impact,' and I believe it has been too readily accepted by most that this incremental impact is a fractional addition to the primary impact produced by the first facility. This has been accepted without really critical analysis.

"I am not aware of any data to substantiate that conclusion. There are logical reasons to believe that the cumulative impacts of two facilities are synergistic and will multiply the total impacts to an unacceptable total beyond the tolerance levels of terrain, water, fish, and wildlife to accommodate to the total impact."[70]

Likewise, it is clear in the circumstances of this case that the utilization of a "corridor" in Northern Alaska for a highway, oil pipeline and gas pipeline would have other very serious drawbacks. For example, three distinct systems (a highway, a hot oil pipeline and a chilled natural gas pipeline) utilizing the Yukon River Bridge crossing poses a major problem of service interruption in the event of that span's failure. Indeed, a corridor may become over-utilized to the point where incompatible uses become a safety hazard.

An "oil transportation corridor" has been established from Prudhoe Bay to Valdez and, in light of anticipated developments, should be retained for that

---

[70] Dr. R. Sage Murphy of Dames & Moore, El Paso's environmental consultants, testified on cross-examination that "incremental" could be "unacceptable" (Vol. 62, Murphy, T. 9407) and that Dames & Moore had not undertaken any specific studies to determine what it "even [would] be looking for to make a determination of what is incremental" (*Id.* at T. 9411).

purpose. Consideration is now being given to the development of hydrocarbons from Naval Petroleum Reserve No. 4. Since the present design capacity of the Alyeska Oil Pipeline is 2,000,000 bbls per day, a second hot oil pipeline will be required to be constructed when oil reserves from Naval Petroleum Reserve No. 4, or many other areas of Northern Alaska, are developed.

Of greater significance, the Fairbanks Corridor does not efficiently serve the Canadian gas supplies in the Mackenzie Delta or other areas of potential gas supplies. The proposed Arctic Gas System is situated so that it tranverses the last major unexplored sedimentary basins of the North American Continent. North America's future energy requirements, when compared to existing supply, vividly demonstrate that development of both the onshore and offshore sedimentary basins of Alaska and Canada will be required. After considering these probable natural gas producing areas, it becomes clear that North Slope gas should be transported eastward north of the Brooks Mountain Range to markets in the lower 48. The Arctic Gas pipeline is best suited to do this from the standpoint of location. It also is best suited to obtain additional gas supplies with minimal environmental impact since its design capacity of 4.5 Bcf per day can be obtained by the installation of compressor stations in Alaska. The very location of the proposed coastal route (and design of the system) is one of the substantial reasons why it is favored over the inland corridors. Mr. Hemstock testified (Exh. AA–12, Hemstock, pp. 16–17):

"Perhaps even more important is the fact that the north coastal area, particularly the offshore, is looked upon by geologists as having the greatest potential for further gas reserves. If this evaluation is correct then one would anticipate in the future, development of these reserves and pipelines along the coast and perhaps threading through the mountains to the southern alternative routes to carry this gas to markets. There is, therefore, a substantial possibility that if the Fairbanks or Fort Yukon corridors were used, there would later be need to construct some or all of the northern portion of the Arctic Gas' proposed coastal route to connect additional gas supplies. Clearly, such a situation would mean many more miles of pipeline in this region, and the ultimate result would be a pipeline or pipelines in areas along the coast where the coastal route is not proposed."

Similarly, Dr. Banfield testified (Exh. AA–13, Banfield, p. 9):

"In addition, I think it is important to recognize that if gas reserves are found in the Beaufort Sea or off the coast of the Yukon and there are pipelines coming in from the sea, they will have to connect up to a trunk pipeline some place. To me, it would be less destructive to the environment if the junction could be made relatively near the coast. Otherwise, the lines would have to run a hundred miles or so inland to be joined to a pipeline constructed along the interior route. In that event, there would be a series of parallel pipelines running in from the coast from each field southward to join onto the east-west interior line. In my opinion, this is an important factor in favor of the coastal route."

The fact that the Arctic Gas Project is designed to service the Canadian reserves will be beneficial to the United States, as well as Canada, in several basic ways, which are discussed in this document. This includes the fact that access by Canada to its Arctic gas will greatly reduce, and hopefully eliminate, the chances of reduced exports of gas to the United States. Since gas is a clean-burning fuel, this is an important environmental consideration.

The Fairbanks Corridor also is more difficult from a design and construction point of view. It is approximately 1,000 miles longer than the proposed coastal route, *i.e.*, 550 additional miles of pipeline would be required in Alaska and 480 additional miles of pipeline would be required in Canada. The difficulties inherent in the construction of the Fairbanks Corridor are obvious, *i.e.*, unlike Arctic Gas' proposed coastal route which traverses flat coastal plain, the Fairbanks Corridor passes through the Brooks Mountain Range, which poses several environmental and engineering problems, and also requires extra construction because of its length. In this regard, it is highly questionable whether a pipeline could be constructed along this route within the same time frame as Arctic Gas' proposed coastal route. The Fairbanks Corridor would also require about six percent more fuel than the proposed coastal route (Item Q, Chapter V, Section B, Subsection 1.4, p. 6) because of its extra length and the additional compression required (*Ibid.*).

Any argument that the Fairbanks Corridor could be made more attractive by eliminating the Mackenzie Delta lateral is patently incredible. First of all, it ignores the *quid pro quo* of international projects. Canada would have no incentive to permit a pipeline to cross its territory if that pipeline were not designed to permit access to the Canadian Arctic gas reserves. Secondly, as discussed above, without early access to its frontier reserves, the United States could face a reduction of the volumes of gas presently being imported from Canada, with resulting adverse environmental and other effects.

Other comparisons are appropriate. Seismic activity along the proposed coastal route is low. The United States Geological Survey in a 1971 preliminary paper by Krinsley, *et al.*, entitled, "Existing Environment of Natural Corridors from Prudhoe Bay, Alaska to Edmonton, Canada" (USGS Open File Report No. 164) states that "[s]eismicity does not pose significant engineering problems" (page 18). Seismic activity along the Fairbanks Corridor is considerably higher especially in the Fairbanks and Big Delta areas of Alaska and the Shakwak Valley in Canada (see, Item Q, Chapter V, Section B, Subsection 1.4, pp. 5 and 28).

Faults are not a major factor along the proposed coastal route. However, routes through southern Alaska and into Canada by the Alaska Highway lie in close proximity to the Denali Fault in Alaska.

The use of a "corridor" for the location of facilities is only one of the considerations to be taken into account in the total mix of factors necessary to determine the location of a route. Indeed, the foregoing makes clear that there is no inherent magic in the use of a corridor and that the Fairbanks Corridor is less preferable than the proposed coastal, route of Arctic Gas from an environmental, energy conservation, engineering, cost, timing and reliability standpoint.[71]

D. The Arctic Gas Project is Preferable to the El Paso Project from an Environmental Standpoint

As noted above, Arctic Gas has undertaken over five years of site specific environmental studies to assess the environment the impact of its project on the environment, and to assure that its proposed pipeline and related facilities are constructed and operated with minimal environmental impact. The cross-examination of Dr. R. Sage Murphy and Mr. Robert L. McCollum of Dames & Moore, and Dr. John M. Craig, El Paso's Director of Environmental Affairs, before the FPC in *El Paso Alaska Co., et al.*, Docket Nos. CP75-96, *et al.* (Vols. 59-64), demonstrates that, unlike Arctic Gas, El Paso has not conducted the site specific field work necessary to assess the environment along its proposed route or the impact of its project on the environment. It is important to recognize that the substantial field work required would not be undertaken until after a certificate is issued to El Paso should it be the preferred applicant (Vol. 61, Craig, T. 9689). In fact, El Paso has designated a period of two years after it receives a certificate for what it characterizes as "data accumulation" in order to undertake these field studies (Vol. 63, Craig, T. 9539-40). Therefore, a comprehensive interdisciplinary analysis of the environmental impact of the El Paso Project will not be known by the Government or the public if the project is authorized.

Whereas Arctic Gas could expeditiously proceed to construct its pipeline on the basis of the information it has gathered from its years of site specific study, El Paso would be required to undertake substantial detailed field work (Exh. AA-28) at a cost of millions of dollars (Vol. 62, Murphy, T. 9398) before it could proceed to construction. This is an important environmental consideration in assuring that the Arctic gas supplies promptly are brought to market.

In order to place the following discussion in its proper context, it is necessary to understand the location of El Paso's proposed pipeline, LNG plant and marine terminalling facilities in Alaska. For purposes of discussion, El Paso's proposal may be divided into: (1) the portion of it which generally parallels the Alyeska Oil Pipeline from Prudhoe Bay to the Thompson Pass in the Chugach Mountain Range, *i.e.*, the area North of Valdez; and (2) that portion from Thompson Pass to Gravina Point where the oil pipeline goes west to Valdez and the gas pipe-

---

[71] Some have argued that the Fairbanks Corridor should be preferred because it would permit the State of Alaska's royalty gas (assuming it is taken in kind by the State) to be made available for in-state usage. However, there has been no demonstration that high priority markets exist within the state for the volume of gas here involved having consideration for economics, etc. For a more complete analysis of this question see the Response to Question II.A.(2) in the "Responses of Alaskan Arctic Gas Pipeline Company to Questionnaire Prepared January 1976 for the Committees on Interior and Insular Affairs and Commerce, United States Senate" dated February 11, 1976, at pages 32-34.

line goes south and east to Gravina Point, which is located in the Chugach National Forest which the DOI–DEIS describes as a "wilderness type area" (Pt. VI, Vol. 2 of 2, p. VI–921), *i.e.*, the area South of Valdez.

With respect to the portion of the line North of Valdez, Dr. Murphy testified that Dames & Moore had not undertaken site specific field studies in order to locate critical habitat for mamals, birds or fish along the proposed pipeline route (Vol. 62, Murphy, T. 9397–98, 9401–02) and, therefore, could not determine the impact of the destruction of the habitat on the environment (*Id.* at T. 9403). Nor had any studies been undertaken to determine the "incremental impact" of such project on the environment, *supra*, and therefore, its impact had not been assessed in this connection.

With respect to the portion of the line South of Valdez, where the remainder of the pipeline, LNG plant and marine terminalling facilities would be located, Dr. Murphy testified that this area is the most biologically productive and diverse on a unit basis (Vol. 60, Murphy, T. 9140), and merits substantial biological concern (*Id.* at T. 9142). However, only preliminary reconnaissance work has been undertaken in this area by Dames & Moore. Indeed, in a document entitled, "El Paso Natural Gas Company, Trans-Alaska Gas Pipeline, LNG Project, Phase II Environmental Studies", by Dames & Moore, dated January 1974 (Exh. AA–28), that company recommended that El Paso undertake extensive studies in this region. This recommendation is consistent with Section 2.82 of the FPC's General Policy and Interpretations, 18 C.F.R. §2.82, which requires an Applicant to "[c]onduct any studies which are necessary to determine the impact of the proposed action on the human and natural resources . . .". Under the Section entitled, "Increment 5 Supplementary Environmental Studies—Mandatory", it is provided, inter alia, that this "Increment provides for a series of supplementary environmental studies that must be initiated and completed prior to FPC approval" (emphasis added). Dr. Murphy testified that Dames & Moore's purpose was that "we considered it absolutely mandatory to do certain studies if a complete environmental impact report without significant omissions were to be prepared for our client" (Vol. 62, Murphy, T. 9438, emphasis added). Dr. Craig admitted that Dames & Moore viewed such studies as necessary to obtain a certificate (Vol. 64, Craig, T. 9689–90). Cross-examination on the Report indicates that none of the mandatory studies had been completed although some had been initiated on a preliminary reconnaissance level (Vol. 62, Murphy, T. 9436–51).[72]

The DOI–DEIS provides in Part VI, Volume 2 of 2, with respect to its analysis of this system that: (1) "[m]ajor engineering, location, and construction uncertainties are associated with this pipeline system" (p. VI–840); (2) "a massive amount of field survey will need to be done. Because of the extreme variability of soil type, temperature, and ice (moisture) content, the available data are not adequate for analyses concerned with pipeline integrity" and further, that "vegetative, climatic, water and engineering studies will need to be made before pipeline construction starts" (p. VI–839) since, in part, "no comprehensive coverage of the vegetation in most of the area crossed by this route" (p. VI–605) has taken place; (3) the "portion of the route between the Lowe River and Gravina Point are not within the TAPS Corridor and no significant engineering or physical data has been assembled" (p. VI–563); and (4) "[t]he effect of heated effluents [from the proposed LNG plant] on marine organisms in sub-arctic areas is largely unknown. . . . There is no practical or experimental basis for analysis for the extent or kind of effect caused by the operation of the proposed LNG Plant" (p. VI–891–92). It is this type of fundamental information which would be required before this project could be implemented as El Paso and the FPC Environmental Staff frankly recognize (see e.g., FPC–DEIS, Vol. II, pp. II–274, 279, 286 and 290).

It is recognized that the El Paso pipeline in Alaska would be located for part of its length in the "utility corridor" in which Alyeska is located. Therefore, the

[72] In the area South of Valdez, spawning and overwintering areas have not been located (Vol. 60, Murphy, T. 9188–89), and no field studies on population or distribution of fish have been undertaken (*Id.* at T. 9191). Nor have any field studies been undertaken to determine numbers, types and diversity of terrestrial or marine species (*Id.* at T. 9193), abundance of mammals or birds, migration patterns of wildlife (*Id.* at T. 9195), or to locate critical habitat (*Id.* at T. 9195–96, 9200). Numerous important field studies were recommended by Dames & Moore on the biotic and abiotic components of the environment which were not undertaken by El Paso (*Id.*, at T. 9202–03, 07–08, 18, 19, 26, 28, 29–31, 33–34, 45–46). These studies will take from 6 to 15 months (*Id.* at T. 9203, 13, 18, 32, 37–38; Vol. 63, Craig T. 9538–41).

foregoing comments pertaining to the Fairbanks Corridor are equally applicable here.[73] But, it is important to emphasize: (1) that the El Paso Project would not be located on the same right-of-way as the Alyeska project within this corridor (Vol. 61, Murphy, T. 9309) ; (2) that the El Paso route would diverge from the Alyeska route by one mile or more for 28.8 percent of its length; and (3) that in areas where the gas pipeline is less than one mile from the oil pipeline, the two routes are frequently located in different terrain and habitat types.

In sum, the Arctic Gas Project is preferable to the El Paso Project: (1) Arctic Gas already has undertaken the necessary site specific work to assess the environment and the impact of its proposed project on the environment, and that impact is deemed to be small and acceptable; (2) the advantages of a "common corridor" have not been fully utilized by the El Paso proposal anyway; (3) Arctic Gas is the shortest route in Alaska, and is positioned to cause the least multiplication of gas pipelines later; (4) Arctic Gas is years ahead of El Paso in terms of environmental planning and can promptly proceed to construction of its proposed pipeline when authorized; and (5) unlike the lower 48 state participants in the Arctic Gas Project, El Paso has not yet supplied any environmental assessment of its proposed project east-of-California (Vol. 63, Craig, T. 9536–38) even though that would require an environmental assessment by the Government (FPC–DEIS, Vol. II, p. II–65). It has steadfastly refused to file with the DOI for the requisite right-of-way permits necessary to implement its project. Having consideration for the fact that it has been over two years since Arctic Gas filed for such authority (March 1974), and in light of the DOI's assessment of the work which would need to be done on this project, it is not unreasonable to assume a comparable time lag for the El Paso analysis by the Government.

E. Other Considerations Demonstrate the Environmental Acceptability of the Proposed Arctic Gas Project

Arctic Gas' Environmental Report, in accordance with the requirements of NEPA, and Section 2.82 of the FPC's General Policy and Interpretations, 18 C.F.R. §2.82, discusses: (1) the environmental impact of its proposed project; (2) alternatives to the proposed action; (3) any adverse environmental effects which cannot be avoided should the proposal be implemented; (4) the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity; and (5) any irreversible and irretrievable commitment of resources which would be involved in the proposed action should it be implemented. The previous section of this paper have discussed the first and second topics in considerable detail. Therefore, it is appropriate at this juncture to briefly discuss the other subjects outlined above. These are more fully discussed in Item Q, Chapters VII, VIII and IX.

With respect to the probable unavoidable adverse environmental effects associated with the proposed project, it is clear that the proposed coastal route of Arctic Gas will not have adverse effects on human beings (Item Q, Chapter VII, p. 1). On the contrary, there will be positive benefits in Alaska and in the lower 48 of the United States resulting from the employment opportunity, business activity, public revenues, etc., associated with this project (*Ibid.*). Without Alaskan gas, the United States could face annual losses of many billions of dollars in Gross National Product, and hundreds of thousands of jobs, with the attendant human suffering resulting therefrom. The gas supplies here involved are destined for the highest priority consumers all across our Nation and are desperately needed by such consumers.

Obviously in a project of this magnitude, some unavoidable adverse environmental effects will occur. However, as discussed above in Section A, mitigative and precautionary measures to be employed by Arctic Gas, *e.g.*, winter construction on snow roads, control of aircraft flight patterns, etc., will avoid most of the potentially adverse ecological effects associated with pipeline construction and operation. Those which do occur are expected to be largely of short duration and minor intensity and are considered to be acceptable.

An analysis of the relationship between short-term use of the environment and long-term productivity demonstrates that the environment will be greatly benefited by prompt access to this premium clean-burning fuel as opposed to other

---

[73] Of course the El Paso pipeline is not located in the "utility corridor" for its entire length (Vol. 63, Craig, T. 9553–55). For example, in the area South of Valdez no utility corridor, critical habitat has not been located on a site specific basis (*Id.* at T. 9557).

sources of energy, the benefits of which far outweigh the limited use of the land area involved. As noted above, in socio-economic terms, the project will promote and foster our National welfare (Item Q, Chapter IX).

In terms of irreversible and irretrievable commitment of resources, only about 900 acres of land in Alaska are anticipated to be permanently required for the project. Materials such as steel, gravel, concrete, fertilizers and seeds, among others, will be required. Some of these materials are subject to reclamation in the future, if found desirable, from an economic or environmental standpoint (Item Q, Chapter IX). However, it again should be emphasized that the resources to be committed to this project are small in comparison to the overall benefits to be obtained by the United States from its prompt implementation.

One final point requires emphasis in any consideration of the environmental impact of this project. Hundreds of thousands of miles of natural gas transmission systems have been constructed in the United States during the past 50 years, and the impact of pipeline construction and operation is, therefore, easily and reliably predictable.[74] Moreover, during those many years of experience in pipeline construction, methods have been developed to avoid or effectively mitigate any undersirable impacts. To illustrate the minimal nature of the physical impact of a pipeline, it is necessary only to look at a map of the hundreds of thousands of miles of natural gas and other pipelines which crisscross this country, and at the same time consider that the ordinary citizen is normally wholly unaware of their physical existence.

VIII. THE ARCTIC GAS PROJECT WILL PRODUCE VERY LARGE TRANSPORTATION COST SAVINGS, AS COMPARED TO A LIQUEFACTION-TANKER PROJECT

The Arctic Gas Project will save several hundreds of millions of dollars per year to United States consumers.

An all-land pipeline, constructed along the relatively short and level route selected by the Arctic Gas Project, is the most economical method for the transportation of northern Alaskan and Canadian gas: consumers will benefit directly from the use of that system.

The savings produced by comparison of costs for Arctic Gas and the liquefaction-tanker system proposed by El Paso Alaska are very large, for all parts of our nation and total in the hundreds of millions of dollars each year, based on 1975 cost comparisons. The precise amounts vary depending on the measure of comparison and volume levels chosen.

For example, Tables 1 and 2, which follow this page show total annual savings from the Arctic Gas Project in excess of $700,000,000 per year, based on 20 year average costs. That is over fourteen billion dollars, over 20 years.

Table 1 shows the savings in transportation costs for the Midwestern and Eastern areas of the United States, to be served through the Northern Border pipeline. Table 2 shows savings in the Northwestern and Western areas of the nation, to be served from the western delivery system.[75] The savings accrue to all areas.

The above comparisons are on the basis of the "low volume" case. If a case in which each system transports the higher volumes of gas, which El Paso has stated will be initially available, is used for comparison, the annual savings from the Arctic Gas Project can now be shown only for the Midwestern and Eastern areas, since the western figures are not yet available. Table 3 shows that those savings for the Midwest and East, again based on 20-year averages, would be over $620,000,000 per year (compare the $539,000,000 per year on Table 1 for the lower volume case).

Tables 1 through 3 set forth a cost savings in per unit costs and annually, for different years and delivery areas, and the rates behind such computations are set forth in the Tables at the end of the Appendix to this document. It will be seen that the costs of delivery by the Arctic Gas Project are much lower than for the liquefaction system for all areas, including west coast areas where the LNG would be first delivered.

It is likely that the savings shown on these tables discussed here are understated, for reasons described later.

---

[74] There were approximately 263,000 miles of natural gas transmission pipeline constructed in the United States as of December 31, 1974. There were an additional 67,000 miles of natural gas gathering and field lines and approximately 646,000 miles of distribution lines (American Gas Association 1974 Gas Facts, p. 50).

[75] The savings shown here and on the following tables are computed as described later in this section. They utilize preliminary calculations relative to the western delivery system and Northern Border, which have recently undergone system changes.

TABLE 1.—SAVINGS IN TRANSPORTATION COST—PER UNIT AND ANNUAL FOR DELIVERIES TO NORTHERN BORDER PIPELINE COMPANY SHIPPERS THROUGH ARCTIC GAS PIPELINE COMPARED WITH DELIVERIES BY THE CORRECTED EL PASO SYSTEM (INCLUDING FUEL AT $1 PER MILLION BTU)

	Savings in transportation cost							
	In cents per million Btu				Annual savings (in millions) on the basis of—			
	3d year costs	10-year average costs	15th year costs	20-year average costs	3d year costs	10-year average costs	15th year costs	20-year average costs
Deliveries to—								
Columbia Gas Transmission Corp., serving the District of Columbia, Kentucky, Maryland, New York, Ohio, Pennsylvania, Virginia, and West Virginia	78.8	86.6	90.1	88.3	$202.28	$222.30	$231.29	$226.67
Michigan-Wisconsin Pipe Line Co., serving Illinois, Indiana, Iowa, Kansas, Michigan, Missouri, Ohio, Tennessee, and Wisconsin	83.5	90.2	91.2	90.7	63.24	68.32	69.08	68.70
Natural Gas Pipeline Co. of America, serving Illinois, Indiana, Iowa, Kansas, Missouri, Nebraska, Oklahoma, Texas, and Wisconsin	64.2	72.0	77.0	74.6	39.35	44.13	47.20	45.73
Northern Natural Gas Co., serving Colorado, Illinois, Iowa, Kansas, Michigan, Nebraska, South Dakota, and Minnesota	76.1	82.4	83.4	83.0	58.06	62.86	63.63	63.32
Panhandle Eastern Pipe Line Co. serving Illinois, Indiana, Kansas, Michigan, Missouri, and Ohio	72.6	80.4	84.6	82.5	44.36	49.13	51.69	50.41
Texas Eastern Transmission Corp. serving Alabama, Arkansas, Illinois, Indiana, Kentucky, Loisiana, Mississippi, Missouri, New Jersey, New York, Ohio, Pennsylvania, Tennessee, and Texas	55.3	63.7	72.6	68.1	33.57	38.67	44.07	41.34
Savings per unit (average) and total annual savings for delivery points shown	74.5	82.0	85.7	83.8	440.86	485.41	506.96	496.17
Additional savings using shortened Northern Border Pipeline and displacement	10.2	9.0	5.7	7.4	60.30	53.37	34.06	43.72
Total savings per unit (average) and total annual savings for delivery points shown	84.7	91.0	91.4	91.2	501.16	538.78	541.02	539.89

TABLE 2.—SAVINGS IN TRANSPORTATION COSTS—PER UNIT AND ANNUAL FOR DELIVERIES TO WEST COAST SHIPPERS THROUGH ARCTIC GAS PIPELINE COMPARED WITH DELIVERIES BY THE CORRECTED LNG TANKER SYSTEM (INCLUDING FUEL AT $1 PER MILLION BTU)

	Savings in transportation cost							
	In cents per million Btu				Annual savings (in millions) on the basis of—			
Deliveries to—	3d year costs	10-year average costs	15th year costs	20-year average costs	3d year costs	10-year average costs	15th year costs	20-year average cost
Pacific Lighting System (Southern California)	58.3	63.6	63.6	64.0	$1 0.75	$109.91	$109.91	$110.60
Pacific Gas & Electric System (Northern California)	53.9	59.2	59.7	60.0	43.61	47.90	48.31	48.55
Northwest Pipeline System (Pacific Northwest area)	77.1	81.4	78.6	80.3	6.78	7.16	6.91	7.06
Savings per unit (average) and total annual savings for delivery points shown	57.6	62.8	62.9	63.3	151.14	164.97	165.13	166.21

TABLE 3.—SAVINGS IN TRANSPORTATION COSTS—PER UNIT AND ANNUAL FOR DELIVERIES TO NORTHERN BORDER PIPELINE CO. SHIPPERS THROUGH ARCTIC GAS PIPELINE COMPARED WITH DELIVERIES BY THE CORRECTED EL PASO SYSTEM (INCLUDING FUEL AT $1 PER MILLION BTU)

	Savings in transportation cost							
	In cents per million Btu				Annual savings (in millions) on the basis of—			
Deliveries to—	3d year costs	10-year average costs	15th year costs	20-year average costs	3d year costs	10-year average costs	15th year costs	20-year average costs
Columbia Gas Transmission Corp., serving the District of Columbia, Kentucky, Maryland, New York, Ohio, Pennsylvania, Virginia, and West Virginia	80. 5	83. 1	84. 5	82. 7	$282. 39	$291. 51	$296. 42	$290. 10
Michigan-Wisconsin Pipe Line Co., serving Illinois, Indiana, Iowa, Kansas, Michigan, Missouri, Ohio, Tennessee, and Wisconsin	77. 1	79. 0	80. 2	53. 9	80. 07	82. 04	83. 29	55. 97
Natural Gas Pipeline Co. of America, serving Illinois, Indiana, Iowa, Kansas, Missouri, Nebraska, Oklahoma, Texas, and Wisconsin	59. 3	62. 2	66. 4	63. 5	49. 79	52. 23	55. 76	53. 32
Northern Natural Gas Co., serving Colorado, Illinois, Iowa, Kansas, Michigan, Nebraska, South Dakota, and Minnesota	66. 0	67. 8	69. 5	67. 9	69. 40	71. 29	73. 08	71. 40
Panhandle Eastern Pipe Line Co., serving Illinois, Indiana, Kansas, Michigan, Missouri, and Ohio	67. 2	70. 1	74. 0	71. 0	56. 10	58. 52	61. 78	59. 27
Texas Eastern Transmission Corp., serving Alabama, Arkansas, Illinois, Indiana, Kentucky, Louisiana, Mississippi, Missouri, New Jersey, New York, Ohio, Pennsylvania, Tennessee, and Texas	48. 6	52. 8	60. 4	55. 5	39. 84	43. 28	49. 51	45. 49
Savings per unit (average) and total annual savings for delivery points shown	71. 4	74. 0	76. 6	71. 1	$577. 59	$598. 87	$619. 84	$575. 55
Additional savings using shortened Northern Border Pipeline and displacement	7. 4	6. 5	4. 3	5. 5	60. 02	52. 93	35. 37	44. 86
Total savings per unit (average) and total annual savings for delivery points shown	78. 8	80. 5	80. 9	76. 6	637. 61	651. 80	655. 21	620. 41

A. The Basis for the Cost Comparisons

To be meaningful, cost comparisons must show the relative costs for systems which are capable of delivering gas to common points relatively near the service areas for the gas in question. The Arctic Gas Project has filed applications which delineate such systems, by inclusion of Alaskan Arctic Gas Pipeline Company, Canadian Arctic Gas Pipeline Limited, Northern Border Pipeline Company, and the delivery system in the Western and Northwestern United States.

The liquefaction-tanker system, as presented by El Paso, is not complete. It includes only the costs, as computed by El Paso, of getting the gas only part way to market areas. For deliveries to the Midwest and East, they show costs only to the Anadarko Basin (generally, the Texas Panhandle) and to the Texas Gulf Coast. They make no showing of how the gas would get north and east from there, or of the cost of doing so.

In addition, examination shows that the costs presented El Paso are significantly less than those produced by a reasonable and comparable analysis.

Accordingly, Arctic Gas has, for about a year, had an analysis of the likely cost of the liquefaction-tanker project done by independent consultants. This was done independent consultants. This was done at 1974 cost levels in early 1975, and published in a report by the firm of Purvin & Gertz, Inc. Those costs were then compared to those of the Arctic Gas Project in a booklet entitled "The Arctic Gas Project," subtitle "A Description of the Project and Its Principal Advantages for the United States," dated May 1, 1975.

Since that time, the participants in the Arctic Gas Project secured options on Prudhoe Bay gas, (some of which have since been cancelled), so company delivery points in the West, Northwest, Middle West and East and option volumes of gas for each such point, could be substituted for the prior assumption of fully loaded pipelines in the United States, and even east-west volume splits in Canada. Those events have caused a change in the size of some Arctic Gas Project facilities, and resultant cost changes. Concurrently, the El Paso filings have been changed in several significant respects, requiring re-examination of the new allegations. Finally, El Paso's "base case" uses about 3.2 billion cubic feet per day from Alaska, while that of Arctic Gas assumes about 2.25 billion cubic feet per day, as noted above. This reflects estimates of initial gas availability, and does not indicate a difference in what volume will be transported: Arctic Gas can, and will be willing to, transport all there is. But the difference of volumes, and resultant facilities, means that to produce comparable showings for comparison, each system must be redesigned and recosted on the same volume basis.

Tables 1 through 3, preceding this page, show the results of comparing the per unit of delivery transportation costs (and resultant dollar annual savings in transportation costs) for Arctic Gas and the liquefaction-tanker system, for deliveries to the six United States' companies which secured options on Prudhoe Bay gas and which will take delivery from Northern Border in Midwest and East service areas, and to the three Western and Northwestern United States' companies which secured such options. Tables 1 and 2 relate to systems (Arctic Gas and liquefaction-tanker) each capable of carrying 2.25 billion cubic feet of gas per day from Prudhoe Bay (the Arctic Gas system would also carry its "base case" volumes of Canadian gas, and thus has a much larger overall system capacity). Table 3 is for systems each capable of carrying the "El Paso volume levels" (about 3.2 billion cubic feet per day) from Prudhoe Bay (the Arctic Gas system used would also carry about 1.25 billion cubic feet per day of Canadian gas).

A few words of explanation are appropriate relative to the work done with regard to the liquefaction-tanker system, in order to present these comparisons. The liquefaction-tanker system was developed by utilizing and completing the proposal of El Paso Natural Gas Company, and amending the costs for it where this was deemed necessary by the independent experts retained for this purpose. Accordingly, the costing of the Trans-Alaska pipeline, as proposed by the El Paso company, was done by use of the same costing standards as were utilized to develop the cost for the Arctic Gas pipeline, to the greatest extent possible, in order to make the two comparable. This gives the Trans-Alaska pipeline the benefits of technology developed by the Arctic Gas system research, and also the benefit of the doubt over whether similar economies can be achieved through the mountainous territory which its route traverses, as can be achieved by the non-mountain route proposed by Arctic Gas. The costing also takes into account the fact that in some places, the infrastructive developed by the Alyeska oil pipeline can be utilized for a Trans-Alaska pipeline. The cost would need to be higher than those used for the liquefaction system to produce the savings discussed here if such factor had not been taken into account where applicable. In the costing of the liquefaction plant, the El Paso proposals were examined and corrected to the extent necessary. In addition, El Paso proposes a presently unproven and totally unutilized method of achieving some fuel economies in the liquefaction process. The treatment of this proposal has been to accept that process for purposes of this study, even through the results claimed for it are subject to great doubt. With regard to the tankers, and allied port facilities, examination has been made by the J. McMullen firm, marine engineers of New York City. As a result, the costs shown by El Paso have been increased to reflect necessary corrections. What was done was a detailed examination of the various cost components of the liquefaction plant and the tankers, to correct the overall cost estimates on a detailed basis. Finally, it was necessary to examine not only the facilities proposed by El Paso but also to devise a full "displacement" scheme for delivery of gas to the lower 48 states, since the El Paso application is incomplete in this regard. This was done by the firm of Purvin & Gertz, Inc. in conjunction with the members of the Arctic Gas Project group whose facilities would be utilized as part of the liquefaction system. The per unit cost figures used here were developed by use of the same type of computer model as was used to calculate the Arctic Gas Project figures, so as to make the computations comparable. The exception is that the computations for the tanker portion of the liquefaction system were made by use of the formula proposed by El Paso Natural Gas Company, pursuant to the different form of tariff proposed for that segment of that system. (It should be noted that the rates for this shipping portion would also/not be regulated by the FPC, under FPC rulings. FPC certificate authority is also not exercised over LNG tanker operations.

An explanation of the Arctic Gas system is also desirable. Table 1 shows the transportation cost savings to the various companies served by the Northern Border pipeline sponsor companies, using the Arctic Gas 2.25 billion cubic feet per day volumes, split on the relative option amounts originally secured. However, the per million Btu and annual savings figures, by company, which are shown there are also based upon the Northern Border system formerly applied for. But Northern Border, as described earlier, has recently decided to terminate its line near Chicago and deliver gas east of there by exchange. This serves to reduce the cost of service and system average per Btu rates by significant amounts. The method for dividing that savings among delivery points is not finally determined, so the savings are shown in systemwide total on the second line from the bottom of Table 1, to the last line.

The configuration of the Western and Northwestern delivery systems for the Arctic Gas system has undergone recent change too, of an even more extensive nature, as described earlier. In the United States, this involves elimination of the Interstate Transmission Associates proposed facilities, with expansion of the Pacific Gas Transmission Company and Pacific Gas and Electric Company facilities to carry Alaskan gas from the Canadian border to the facilities of Northwest Pipeline Company in Oregon (for service to the multistate area in the Northwestern United States served by Northwest Pipeline), to the northern California areas served by Pacific Gas and Electric Company and to the southern California areas served by the Pacific Lighting Company system. In addition, a portion of the Pacific Lighting Company gas will be delivered from Oregon by use of existing facilities of Northwest Pipeline and the New Mexico and Arizona portions of the El Paso Natural Gas Company facilities. As a part of this consolidation of applications, Pacific Gas Transmission Company also proposes a high pressure line in Washington and Oregon, to be Oregon, to be used if conditions indicate it is more economic than expansion of existing lower pressure facilities there. Table 2, and its supporting per unit cost tables, are based upon the low pressure alternative, based on initial calculations for the revised system.

Table 3, referred to above, corresponds to Table I, above: Table 3 shows the large cost savings to the Northern Border areas, individually and in total, as described above for Table 1. There will be large savings to the Western and Northwestern areas shown too, when those calculations are available. Whereas Tables 1 and 2 compare the Arctic Gas and liquefaction-tanker systems designed to carry about 2.25 billion cubic feet per day from Prudhoe Bay, Table 3 compares those systems when designed to carry the approximately 3.2 billion cubic feet per day from Prudhoe Bay which El Paso states will be available.

As noted earlier, under either volume assumption, the per Btu and annual savings from the Arctic Gas Project are very large, as Tables 1 through 3 demonstrate.

It must also be noted that each of the comparisons shown in this document utilize costs for the Canadian Arctic part of the Arctic Gas Project which are overstated. The reason is that as part of the consolidation of western applications in the United States, Canadian Arctic will:

(a) Terminate its "western delivery leg" at the Alberta-British Columbia border, so that there will no longer be a duplication of facilities in British Columbia with those of Alberta Natural Gas Limited.

(b) Reduce the size of the remaining portion of the western delivery leg (from the "Caroline junction" to the Alberta-British Columbia border) from 36″ to 30″ pipe.

The cost reductions which will be achieved by the above changes have not yet been finally computed and are thus not yet reflected in the figures in this document. Accordingly, all of the cost savings from use of the Arctic Gas system are understated for this reason.

Finally, it should be noted that the cost computations for the liquefaction-tanker project in this document have all made two assumptions more favorable to that project than to the Arctic Gas Project. It has been assumed that when such a project began to operate, there would be very substantial amounts of unused capacity in presetntly existing pipeline systems, as indicated in Case II of an FPC staff study projection, rather than Case IV of that study, so that relatively few facilities would be needed north and east of Texas. Similarily, it is asumed that the facilities of Transwestern Pipeline Company will be available to carry Alaskan gas to the east, and not needed to carry natural gas or synthetic gas from coal to the west. If Case IV had been used, or an assumption of lesser Transwestern availability, the costs would be increased, and the annual savings from use of the Arctic Gas Project would be increased still further.

B. Claims of Low Levels of Mackenzie Delta Gas are not Accurate, but Would not Change the Arctic Gas Project Cost Advantages

Claims have been made that the Mackenzie Delta reserves will not develop by the 1980 to 1985 period sufficiently to allow the daily deliveries to increase to about 2.5 billion cubic feet per day. In fact, the past development, and the potential, of the area indicate that this is a modest growth and will be realized. (See earlier sections of this document relative to gas reserves and deliverability.)

However, even if the Mackenzie reserves did not develop as expected, it would not change the great annual cost savings of the Arctic Gas Project. This has already been demonstrated by the "high volume" cost case shown in Table 3, discussed above, because the computations to produce the costs underlying that table have used only 1.25 billion cubic feet of gas from the Mackenzie Delta (and about 3.2 billion cubic feet per day from Prudhoe Bay). Even using that low level of Canadian gas, without growth, the Arctic Gas Project produces the very large annual savings shown there.

SAVINGS IN TRANSPORTATION COST—PER UNIT AND ANNUAL FOR DELIVERIES TO NORTHERN BORDER PIPELINE COMPANY SHIPPERS THROUGH ARCTIC GAS PIPELINE (CANADIAN "NO-EXPANSION") COMPARED WITH DELIVERIES BY THE CORRECTED EL PASO SYSTEM (INCLUDING FUEL AT $1 PER MILLION BTU)

	Savings in transportation cost							
	In cents per million Btu				Annual savings (in millions) on the basis of—			
Deliveries to—	3d year costs	10-year average costs	15th year costs	20-year average costs	3d year costs	10-year average costs	15th year costs	20-year average costs
Columbia Gas Transmission Corp., serving the District of Columbia, Kentucky, Maryland, New York, Ohio, Pennsylvania, Virginia, and West Virginia	76.2	81.1	87.5	84.3	$199.09	$211.89	$228.61	$220.25
Michigan-Wisconsin Pipe Line Co., serving Illinois, Indiana, Iowa, Kansas, Michigan, Missouri, Ohio, Tennessee, and Wisconsin	80.7	84.4	88.5	86.5	62.21	65.06	68.22	66.68
Natural Gas Pipeline Co. of America, serving Illinois, Indiana, Iowa, Kansas, Missouri, Nebraska, Oklahoma, Texas, and Wisconsin	61.5	66.2	74.4	70.4	38.37	41.30	46.41	43.92
Northern Natural Gas Co., serving Colorado, Illinois, Iowa, Kansas, Michigan, Nebraska, South Dakota, and Minnesota	73.1	76.5	80.7	78.7	50.85	53.22	56.14	54.75
Panhandle Eastern Pipe Line Co., serving Illinois, Indiana, Kansas, Michigan, Missouri, and Ohio	70.0	74.8	82.1	78.4	43.53	46.52	51.05	48.75
Texas Eastern Transmission Corp., serving Alabama, Arkansas, Illinois, Indiana, Kentucky, Louisiana, Mississippi, Missouri, New Jersey, New York, Ohio, Pennsylvania, Tennessee, and Texas	52.9	58.2	70.1	64.2	37.01	35.96	43.31	45.85
Savings per unit (average) and total annual savings for delivery points shown	72.5	76.4	83.1	80.8	431.06	453.95	493.74	480.20
Additional savings using shortened Northern Border Pipeline and displacement	10.2	9.0	5.7	7.4	60.30	53.37	34.06	43.72
Total savings per unit (average) and total annual savings for delivery points shown	82.7	85.4	88.8	88.2	491.36	507.32	527.80	523.92

The same is also true at the "low volume case" level. The tables on the two pages which follow this page, show an over $679,000,000 per year savings, in total, even if it is assumed that no more than 1 billion cubic feet per day of gas is ever available from the Mackenzie Delta.[76]

Thus, even if low volumes are assumed from Canada, the Arctic Gas Project still produces large annual savings.

SAVINGS IN TRANSPORTATION COST—PER UNIT AND ANNUAL FOR DELIVERIES TO WEST COAST SHIPPERS THROUGH ARCTIC GAS PIPELINE COMPARED WITH CORRECTED EL PASO SYSTEM—NO EXPANSION CASE (INCLUDING FUEL AT $1 PER MILLION BTU)

	Savings in transportation costs							
	In cents per million Btu				Annual savings (in millions) on the basis of—			
Deliveries to—	3d year costs	10-year average costs	15th year costs	20-year average costs	3d year costs	10-year average costs	15th year costs	20-year average costs
Pacific Lighting System (Southern California)	55.6	58.1	61.0	59.9	$96.08	$100.40	$105.41	$103.51
Pacific Gas and Electric System (Northern California)	51.2	53.8	57.2	56.0	41.43	43.53	46.28	45.31
Northwest Pipeline System (Pacific Northwest area)	74.0	75.6	75.6	75.9	6.51	6.65	6.65	6.68
Savings per unit (average) and total annual savings for delivery points shown	54.9	57.3	60.3	59.2	144.02	150.58	158.34	155.50

Conclusion

A variety of comparisons have been presented in the above discussions and tables to show that irrespective of the assumptions made about volumes of gas available from Prudhoe Bay or from Canada, the years used for comparison, the Arctic Gas Project all-land pipeline produces very large annual savings, of several hundred million dollars, as compared to the liquefaction method.[77] These savings will help ease the energy cost burden on United States' consumers.

IX. THE ALL-LAND PIPELINE SYSTEM OF THE ARCTIC GAS PROJECT USES MUCH LESS ENERGY THAN A LIQUEFACTION-TANKER PROJECT

Any system used to transport anything—including energy producing materials—must use energy in the transportation process. A natural gas pipeline transportation system operates by using a portion of the natural gas transported to power the compressor engines which pump the gas through the pipeline. The Arctic Gas pipeline also will use gas to power the refrigeration facilities which will chill the gas in arctic areas to protect the permafrost soil.

A pipeline-liquefaction-tanker-regasification project, such as that proposed by El Paso Alaska to carry Prudhoe Bay gas, uses more energy, and in more different ways. The pipeline portions of that project would use natural gas in the same way as the Arctic Gas Project. However, a very large amount of gas is consumed in the process of liquefying the gas: dropping its temperature to 460 degrees below zero F. Operating the liquefaction plant and Alaska marine terminal, loading the liquefied gas on board tankers, operating the oceangoing tankers, unloading the liquefield gas, and operating the California marine terminal and regasification plants also all use energy, some of it natural gas and some in the form of electricity and oil. Finally, the process of vaporizing the liquefied gas consumes still additional gas.

In view of the value and scarcity of natural gas and other forms of energy, the greater energy usage of a liquefaction-tanker project is a major disadvantage.

---

[76] Those tables are based on a "no-expansion" assumption for the Arctic Gas system, in which Prudhoe Bay gas stays at 2 billion cubic feet per day (lower than the 2.25 assumed for the liquefaction system) and a constant 1.25 billion cubic feet per day is assumed from Mackenzie Delta. This is basically the same as if it were assumed there were 2.25 billion from Prudhoe Bay and 1 billion from the Delta.

[77] All computations are on an incremental basis, relative to new facilities required. Savings are computed by use of Arctic Gas system delivered volumes.

The amount of that excess over the usage of the Arctic Gas Project differs depending upon the assumptions as to the gas volumes available. The table or the following page shows that just at the initial 2.25 Bcf/d level, the Arctic Gas Project will permit very substantial savings of natural gas and total energy. It shows that the use of the Arctic Gas all pipeline system, instead of the liquefaction-tanker project, would save total energy of 159.6 billion BTU each day. That is a very large saving. It is more than the residential usage of each of 30 of the States of the United States. That savings in energy will be more than twice the amount of the total natural gas usage in the District of Columbia; it is more than the combined residential natural gas requirements of Maine, New Hampshire, Rhode Island, Vermont, Delaware, the District of Columbia, South Dakota and Alaska.[78] Moreover, the foregoing savings in energy will substantially increase, as the potential volumes of natural gas from the North Slope are developed. (In a provious comparison, Arctic Gas used the higher total input volume proposed by El Paso and thus had higher usage figures. Savings at that level are not yet available on the revised systems. The figures on the accompanying table also are based on an Arctic Gas system which has ben revised, with reduced usage, and also accepts, arguendo, for purposes of this showing only, the claims by El Paso of improved fuel efficiency on its system.)

COMPARISON OF NATURAL GAS AND TOTAL ENERGY USAGE OF COMPETING ARCTIC GAS AND EL PASO ALASKA PROJECTS AT 2.25 Bcf/d LEVEL

[In billions of British thermal units per day]

	Inlet volume at Prudhoe	Weighted average deliveries to all delivery points[1]	Natural gas required	Additional energy required	Total energy	Percent energy used for Transportation
El Paso Alaska	2,542.8	2,243.8	299.0	39.9	338.9	13.3
Arctic Gas	2,542.8	2,363.5	179.3		179.3	7.1
Savings			119.7	39.9	159.6	6.2

[1] Assumes deliveries to Northern Border companies, Pacific Gas & Electric Co., Southern California Gas Co., Transwestern Pipeline Co., and Northwest Pipeline Co.

In an effort to offset the waste of energy that would result from its project, El Paso Alaska asserts that some of this energy loss may be reclaimed at the regasification terminal by using the "cold" created. However, an analysis of current liquefaction technology indicates that of the total energy input to liquefaction, approximately 50 percent is irretrievably lost to the atmosphere in the form of heat, because of inefficiencies in energy conversion. Therefore, the maximum possible energy recovery from the LNG, even theoretically, is approximately 50 percent of the energy required for liquefaction, or less than 25 percent of the sytem usage. But that figure also is speculative. For example, if the cold energy could be used for refrigeration (the most efficient and commercially feasible method of utilization), it might be theoretically possible to recover up to 80 percent of the available energy, which is equal to about 3 percent of the Prudhoe Bay input. But from experience in the actual application of cold energy, it is determinable that it is actually feasible to recover only a small portion of that energy.

Further, the quantity of cold energy that the El Paso Alaska LNG project would produce in the course of the vaporization phase is so large that no more than a small portion of it conceivably could be utilized. For example, such a project would produce far more than the annual liquid air production in the entire United States, or roughly equivalent to the annual amount used by the entire U.S. cold storage industry in recent years. Accordingly, centralizing enough demand to utilize an appreciable amount of the cold energy plainly is not feasible.

It also should be pointed out that the application to the FPC of Western LNG Terminal Company to construct three regasification plants, one of which

[78] These comparisons are obtained by multiplying the total energy savings of 159.6 Bbtu times 365.25 and comparing the total annual savings with the annual sales set forth on Table 65 (p. 80) of the American Gas Association's 1974 Gas Facts.

El Paso proposes to use, provides that Western LNG will use conventional seawater LNG vaporizers, which do not allow "could reclamation."

In short, the liquefaction-tanker proposal would waste very large amounts of fuel as compared to the Arctic Gas Project, and the theoretical methods advanced for recovery of some of this energy are not feasible and could, in any event, recover only a fraction of the energy wasted.

X. FINANCIAL ASPECTS OF THE ARCTIC GAS PROJECT

The basic financial feasibility of any project, including the Arctic Gas Project, rests upon its economic viability. This in turn is dependent on the technical ability to provide a needed service at economic cost, for which creditworthy parties stand ready to contract at a price that will cover all costs, including a return on equity.

In the case of arctic gas, those elements are clearly present. There is a very substantial supply of Alaskan gas at Prudhoe Bay. There is no doubt that it can be produced and that a pipeline to deliver it to buyers can be built. Finally, a significant part of the natural gas transmission and distribution industry in the United States has examined the likely costs of transportation; has considered the likely cost of the Alaskan gas itself at the "wellhead"; and in light of those facts, have indicated willingness to purchase that gas and contract for the Arctic Gas transportation service to move such gas to market. The same situation is true in Canada relative to Mackenzie Delta gas, which will be transported jointly with Alaskan gas in the facilities of Canadian Arctic Gas Pipeline Limited.

The Alaskan Arctic and Canadian Arctic pipelines will be transporters of gas, not buyers and sellers. The companion Northern Border Pipeline Company will also be a transporter to the Midwest and East, and companion pipeline facilities in the West will transport gas for shippers in California and the Pacific northwest.

The use of these transporting facilities will not be limited to members of the present sponsoring group, or to parties who become equity owners in the enterprises. Instead, service will be open to all shippers which agree to purchase service, on the basis of the non-discriminatory tariff of the transportation companies.

The Arctic Gas Project was structured as a transporter only, so as to allow the Prudhoe Bay gas to be distributed in the normal manner for the natural gas industry, i.e., by individual transmission companies and, in some cases, distribution companies bargaining with individual producers of gas and the successful buyers then contracting with the Arctic Gas Project companies to have the gas transported to their marketing areas. It was deemed undesirable, as a matter of policy, for Alaskan Arctic Gas Pipeline Company to be a purchaser of Prudhoe Bay gas.

The Arctic Gas Project companies propose to charge the individual shippers which contract for their transportation service on the basis of a "cost of service" tariff. This means that the cost which will be paid for any month will be the actual costs of the company for that month. Therefore, consumers will pay only actual costs, receiving the results of economies and cost decreases, and of cost increases, alike. The two cost elements which do not directly represent amounts fixed by the amount due to others—depreciation and return an equity capital—will be set from time to time by the governmental agency with jurisdiction, which is the Federal Power Commission in the United States and the National Energy Board in Canada.

The result of charges on the basis of a regulatory rate structure is that if the costs of the enterprise are increased—such as by use of an uneconomic route which is lengthly and costly to build and operate—the increased cost burden would be passed on directly to consumers assuming, arguendo, any proponents or investors would exist for such a project. Conversely, use of economical routes and practices directly reduce the charges to consumers.

The Arctic Gas pipeline companies have structured the financing of the enterprise as a private project financing: that is, all funds necessary to construct the facilities will be raised in private sector capital markets and the securities issued are designed to be serviced on a self-liquidation basis from the revenues which the project is expected to generate. It is planned that approximately 75% of the required capital will be secured in the form of debt, both long and intermediate term, and 25% in the form of equity. It is believed that it will be necessary for the sponsor companies of the Arctic Gas Project to furnish the bulk of the equity funds, but equity will be available to others who desire to purchase it. Debt capital will be raised in the capital markets and banking systems of the United States and Canada, as well as in the international capital market and through supplier credit.

In addition to the financial personnel of the Arctic Gas pipeline companies, and the sponsor companies, financial planning for the Arctic Gas Project has had the participation of:

Morgan, Stanley & Co., Inc.—United States and Europe.
Dillion Reed and Co., Inc.—United States.
First City National Bank of New York—United States and Europe.
Wood, Gundy, Ltd.—Canada and Europe.
Royal Bank of Canada—Canada and Europe.
Toronto Dominion Bank—Canada and Europe.

Forecasts of the capacity of world capital markets have been made by the above financial experts. The conclusions reached are that there will be sufficient capacity available in the private markets to meet the capital requirements of the Arctic Gas Project, including adequate provision for cost escalation and contingencies. Although it is anticipated that the cost of the Project will, because of inflation between now and the time it is authorized and built, increase over estimated cost in 1975 dollars, the surveys of capital markets show that such higher amounts will be available to the Project. In addition, the Project plans to arrange for additional financing of up to 25% as a standby contingency against possible cost overruns.

The fact that the Arctic Gas Project involves pipelines in Canada, as well as the United States, gives an increased opportunity to draw upon Canadian capital markets, in addition to United States and other sources. The forecasts of Canadian capital capacity have provided the basis for the amounts of Canadian capital planned to be secured in the Canadian capital markets. Such amounts are clearly attainable, including a substantial portion of the equity capital for the Canadian part of the pipeline system.

The ability of the Arctic Gas Project, or of any proposed project of comparable size, such as the pipeline-liquefaction plant-tanker-regasification plant-pipeline project proposed by El Paso Alaska, to raise sufficient capital depends on both the intrinsic feasibility of the proposed project and the ability to provide security considered adequate by prospective lenders. Since the basic factors of transportation cost, energy use and thus delivery efficiency, and reliability of service all are less favorable for a liquefaction-tanker system, its intrinsic feasibility is substantially less than that of the Arctic Gas Project.

The manner in which adequate arrangements will be provided that will be satisfactory to lenders and equity investors cannot be determined definitely at this time. What is certain, however, is that lenders will require undoubted assurances in respect of the Project's competition and revenue needs. Such assurances will be required for either the El Paso Alaska or Arctic Gas projects. Innovative regulatory decisions concerning tariff arrangements have been suggested by the United States Department of the Treasury, and others, in order to provide required security for project debt. They might also deal with the financial exposure of sponsoring companies in respect of completion commitments. Both Arctic Gas and El Paso Alaska propose all-events cost of service tariffs, with El Paso Alaska proposing to commence collection of revenues during the construction period. It also has been suggested that regulatory action at state levels might be required to insure full "tracking" of costs to consumers, and that regulatory approvals might need to be supported by legislation to make such arrangements credible to lenders for project financing purposes.

In order to expedite financing arrangements and avoid the delay and uncertainty of successfully obtaining the above regulatory and/or legislative actions, it has been suggested that it may prove desirable to explore means whereby federal governments (Canada and the United States) could provide contingent "backstopping" support for amounts required for completion, if any, above the level of commitments of private sponsors, including the private overrun commitments. Similarly, through provision of business interruption insurance for which a premium would be paid, governments might assist shippers in assuming the financial burden of the all-events tariff in the event of a service interruption so prolonged as to exhaust private insurance. As set forth earlier in Part XI, while such an interruption would be extremely unlikely on the Arctic Gas System, it is a very real consideration for the El Paso Alaska system.

The liquefaction-tanker proposal of El Paso proposes to make use of loan guarantees, and resultant reduced interest rates, under the Merchant Marine Act, relative to the up to two billion dollar tanker portion of the project.

XI. TRANSPORTATION OF NATURAL GAS BY MEANS OF THE ARCTIC GAS SYSTEM RATHER THAN THE LIQUEFACTION-TANKER SYSTEM WOULD BE FAR MORE DEPENDABLE AND INVOLVE SUBSTANTIALLY LESS RISK TO CONSUMERS, INVESTORS AND THE NATIONAL INTEREST

Analysis of the competing transportation systems from the standpoint of operational reliability and the risk of lengthy interruptions is critically important in view of the very large volumes of natural gas to be transported, both from the presently proven Prudhoe Bay reserves and from the vast potential natural gas supplies of the North Slope. It is, therefore, important to consider:

(1) The comparative experience of the natural gas industry's half century of transportation of natural gas via pipeline, as compared to the relatively new technology involving liquefaction, ocean transportation by LNG tanker, and regasification.

(2) The length and extent of outage that reasonably could be anticipated in the event of a pipeline rupture, or loss of a compressor station or unit on a pipeline system, as compared to the loss of an LNG plant or a train of the plant, a marine terminal, an LNG tanker, a vaporization facility, or any critical part of the foregoing.

(3) The comparative possibility of severe natural catastrophes, such as earthquakes, occurring along the route of either of the competing transportation systems.

(4) The vulnerability of the competing transportation systems to sabotage or, in wartime, enemy attack.

A. Pipeline Transportation Versus Liquefaction and LNG Transportation

The Arctic Gas Project solely involves transportation of natural gas by pipeline. The natural gas industry has had approximately fifty years of experience in constructing and operating pipelines, so that their dependability cannot be seriously questioned. As noted earlier, over 263,000 miles of natural gas transmission pipeline had been constructed in the United States as of December 31, 1974, with a record of safety and reliability unmatched by any other mode of transportation. Virtually the entire lower 48 of the United States is dependent in some measure upon these pipeline systems, and this experience has fully justified consumer confidence in their reliability.

The Arctic Gas Project differs from a conventional natural gas pipeline only in the fact that a portion of it traverses Arctic permafrost regions, which requires the cooling of the gas. For this reason, and as discussed earlier. Arctic Gas has spent many years pioneering the development of the technology required to insure the integrity of the pipeline, technology upon which the competing project would have to rely as well, although the record before the FPC is clear that little work, and no field work or experimental test model efforts have been undertaken by El Paso Alaska.[79] As a result of the Arctic Gas studies, there is no reasonable doubt that a natural gas pipeline can be constructed, operated and maintained in permafrost and semi-continuous permfrost conditions.[80]

In sharp contrast to the largely conventional pipeline technology upon which Arctic Gas depends, the El Paso Alaska project would employ not only a pipeline across Alaska, but also the relatively new technology of liquefying the natural gas and its ocean transportation to California terminalling facilities, where it would be vaporized and again transported by pipeline to markets.

The liquefaction process now proposed to be utilized by El Paso Alaska is the Phillips Cascade process, utilized in only one other facility now operating;

[79] See, *e.g.*, Wright T. 6279–86.
[80] See Exh. AA–12, Clark, p. 25; Purcell, p. 29; Hurd, pp. 5–7.

the Phillips-Marathon plant on the Kenai peninsula.[81] However, the El Paso Alaska facility would involve utilization of much larger components, including different turbine-compressor units. More importantly, no liquefaction facility of the size proposed by El Paso Alaska has ever been undertaken or even planned. The liquefaction trains proposed for the Gravina Point facilities would be more than twice as large as any previous trains utilizing this process, and are the largest ever planned. The Phillips-Marathon plant at Kenai uses one train; the El Paso Alaska project involves the use of six to eight trains.[82] In addition, the economic studies of El Paso Alaska are predicated on a theoretical fuel usage of less than half the fuel usage for the Phillips-Marathon plant and approximately 40% lower than the fuel usage per volume liquefied at any other LNG plant.[83] The proposed tankers are approximately twice as large as LNG tankers presently in commercial operation and approximately 33% larger than other LNG tankers presently planned for operation.[84] The liquefaction plant will have to process a volume of gas initially approximately 12 times greater than the Phillips Kenai plant, and the LNG tanker fleet will have to transport such liquefied gas to the southern California terminal.

Whereas an outage on a natural gas pipeline is relatively easy to repair by replacing a section of line or a compressor unit, and those outages may be measured in hours or days, the loss of liquefaction plant or component thereof, or of an LNG tanker has to be measured in many, many months and perhaps years. Spare LNG trains and tankers are not maintained. The construction time for the components of the El Paso Alaska system at the 2.4 Bcf/d level of operations is set forth in Exhibit EP–217. The construction time for the LNG trains is over three years exclusive of site preparation; the same is true for the marine terminal and the LNG tankers. With respect to the volume of gas here involved, length outages could not be reasonably tolerated.

B. Risk of Earthquakes and Tidal Waves in Prince William Sound Area

In the event of a natural catastrophe such as an earthquake or tidal wave, it should be realized that there is no dispersion of the liquefaction facilities; all the trains are located at the one plant of Gravina Point, and all the ships must tie up at the adjacent marine terminal. This site is in one of the most active and intense seismic areas in the world, an area that has been subject to earthquakes measuring more than a magnitude of 8 on the Richter scale. Prince William Sound, where Gravina Point is located, is central to the area of most intense seismic energy release in southern Alaska. The report on the 1964 earthquake prepared by the National Academy of Sciences describes the effect of that earthquake as follows:

"South central Alaska (Figure 1), including Prince William Sound and the Aleutian area, is one of the world's most active seismic regions. On March 27, 1964, at about 5:36 p.m. local time (0336, or 3:36 a.m. GMT, March 28), an earthquake of unusual severity struck the Prince William Sound area. * * * Not only was this earthquake of large magnitude (between 8.3 and 8.6 on the Richter scale, on which the greatest known earthquake is 8.9), but its duration (3 to 4 minutes) and the area of its damage zone (50,000 mi^2) were extraordinary. Probably twice as much energy was released by the Alaska earthquake as by the one that rocked San Francisco in 1906.

* * * * * * *

"The shock was felt over 500,000 mi^2. A tsunami (a train of long waves impulsively generated, in this case by movement of the sea floor), or 'tidal wave' swept from the Gulf of Alaska across the length of the Pacific and lapped against Antarctica. Water levels in wells as far away as South Africa jumped abruptly, and shock-induced waves were generated in the Gulf of Mexico. An atmospheric pressure wave caused by the earthquake was recorded at LaJolla, California, more than 2,000 mi away. Seismic surface waves, with periods of

---

[81] In general, other liquefaction processes are being used or planned for use in other new liquefaction plants. Pasek, T. 6864–72; Tseklenis, T. 6531–34.

[82] The one liquefaction train at the Phillips-Marathon, Kenai plant has a capacity of approximately 180,000 Mcf/d, while the proposed El Paso Alaska liquefaction trains are estimated to have a capacity of approximately 400,000 Mcf/d. Tseklenis, T. 6534–35; Pasek, T. 6870–71.

[83] Pasek, T. 6927–29.

[84] Exh. EP–100, Hunsaker, pp. 8–9.

many seconds, moved the ground surface of most of the North American continent by as much as 2 in.

"The magnitude of the earthquake can be calculated only from teleseismic records, and its duration can be estimated only from eyewitness accounts, because no seismic instruments capable of recording strong ground motion were in Alaska at the time. The range of uncertainty in the magnitude calculations (8.3 to 8.6) is far greater in terms of energy release, it can be calculated that the magnitude 8.6 represents approximately twice the energy release of magnitude 8.3.

"Measured crustal deformation was more extensive than the deformation related to any known previous earthquake. Areas of uplift and subsidence were separated by a line of zero land-level change trending both southwestward and eastward from the vicinity of the epicenter, about 80 mi east-southeast of Anchorage; this line parallels the major tectonic features of the region. Areas north and northwest of the zero line subsided as much as 7.5 ft.; areas south and southeast rose, over wide areas, as much as 6 ft. Locally the uplift was much greater: 38 ft on Montague Island and more than 50 ft on the sea floor southwest of the island. The zone of uplift was along the continental margin of the Aleutian Trench. Not only was the earth's crust displaced vertically, but horizontal movements of tens of feet took place, in which the landmass moved southeastward relative to the ocean floor. The area of crustal deformation was more than 100,000 mi^2.

* * * * * * *

"The strong ground motion induced many snowslides, rockfalls, and landslides, both subaerial and submarine. The submarine landslides created local sea waves or tsunamis, which, together with the major tsunami generated by the crustal deformation, smashed port and harbor facilities, covered sessile organisms and salmon-spawning beds with silt, disturbed and killed salmon fry, leveled forests, and caused saltwater invasion of many coastal freshwater lakes.

* * * * * * *

"The number of lives lost in Alaska, 115, was very small for an earthquake of this magnitude. Factors that contributed to the light loss of life were the sparse population, the fortuitous timing of the earthquake, a low tide, the absence of fire in residential and business areas, the generally clement weather, and the fact that the earthquake occurred during the off-season for fishing. The earthquake came on the evening of a holiday, when the schools were empty and most offices deserted, but when most people were still wearing their warm clothing. The low tide and the absence of fishermen and cannery workers mitigated the destruction and loss of life from tsunamis.

"Public and private property loss was over $300 million. Hundreds of homes were destroyed. A multistory apartment building (fortunately not occupied), a department store, and other buildings in Anchorage collapsed. Oil storage tanks at Valdez, Seward, and Whittier ruptured and burned. Many other structures were destroyed or damaged. Most of downtown Kodiak was inundated by the major tsunami.

"Damage to surface transportation facilities was extensive. The Alaska Railroad lost its port facility at Whittier, its docks at Seward, and numerous bridges on the Kenai Peninsula. Many highway bridges, especially on the Seward and Copper River highways, were damaged. Many port and harbor facilities, especially at Seward, Valdez, Kodiak, Whittier, Cordova, and Homer, were destroyed." [85]

At the present time no definitive earthquake design has been undertaken by El Paso Alaska. The El Paso Alaska engineering consultants have testified that in the final design the facility would be designed for an 8.5 magnitude earthquake and that such criteria would include protection against a bedrock acceleration of 0.6 g. or an acceleration of approximately 19 feet per second in one second's time; this for liquefaction facility comprised of LNG trains, storage tanks, marine terminal and interconnecting piping.[86] While it can be assumed that engineering would be employed to design these facilities to the extent possible against earthquakes, there simply is no fail-safe means of determining when a large magnitude earthquake will occur or what will happen to the pipeline or

[85] The Great Alaska Earthquake of 1964, National Academy of Sciences, 1972, Preface, pp. (IX)–(XI).

[86] Tseklenis, T. 6599–610, 6652–60.

the complex of LNG trains, tanks, terminal, connecting piping and tankers during such earthquake, even assuming the plant and terminal can effect a timely shut-down of their operations. Moreover, there also is the possibility that an earthquake more powerful than a magnitude of 8.5 will strike during the life of the LNG plant.[87]

While an oil pipeline or terminalling facility may suffer an outage, it is possible that it could commence pumping oil again to tankers in a relatively brief period. But if a liquefaction plant or a portion thereof is destroyed or severely damaged, it could be years before the capacity to liquefy the natural gas could be re-established. There is no comparability between the exposure to lengthy outages from an LNG project and the relatively brief interruptions that might be anticipated for an oil system, much less the all-pipeline Arctic Gas Project. That conclusion is based on the difference in facilities only. In addition, the pipelines of neither Alaskan Arctic nor Canadian Arctic pass through any major seismic zone.

The El Paso Alaska marine terminal will also be subject to large tidal waves or tsunamis. However, El Paso Alaska has not prepared the definitive design for such facility at this time. Therefore, it cannot be reviewed for structural integrity given the occurrence of a tsunami. In fact, the FPC record is wholly unclear concerning the adequacy of the wave and seismic assumptions upon which such design would be based.[88]

Significantly, whereas El Paso Alaska proposes to concentrate all its liquefaction facilities at one plant, Western LNG Terminal Company, which would handle the marine terminalling and vaporization in California, has applied for three such facilities to handle LNG from Alaska and Indonesia into California. A principal executive for the company testified in the FPC hearing that it would not be prudent for the company to put its reliance on just one such facility stating:

"Putting that much gas, then 3½ to 4 billion cubic feet per day, in one facility means that the total gas supply of Southern California in effect would be dependent upon the weather at that marine location, any mechanical failure at that marine location. So you end up with what I consider an impossible reliance upon one geographic location, the vagaries of weather at that geographic location, and the mechanical—any mechanical difficulty that would completely negate all the history of reliable service that has been set down in Southern California Gas Company and the other gas companies of the area." [89]

Despite that wise judgment, El Paso proposes to put the entire north Alaskan supply in one facility at one Alaskan location.

C. National Defense Considerations

If the El Paso Alaska project were to be approved, all of the energy (both oil and natural gas) from Alaska, upon which this country will become increasingly and substantially dependent in the 1980's and 1990's, will traverse the same routing to the lower 48, thus concentrating a substantial part of the transportation of this country's energy supplies. With the development of natural gas in the more southerly area of Alaska (e.g., the Gulf of Alaska and lower Cook Inlet), it is probable that because of their geographic location and the cost of the very circuitous and mountainous terrain that a pipeline would have to traverse to the lower 48 states, any gas supplies from these areas would be transported to the lower 48 by LNG tanker from a liquefaction plant or plants in southern Alaska. If a liquefaction-tanker project were to be approved for transportation of North Slope gas to the lower 48, it is clear the United States would have concentrated a very substantial portion of the transportation of its total energy. Not only would the oil and gas from Cook Inlet, the Gulf of Alaska and other southern Alaska areas be routed from terminals in southern Alaska via tanker to West Coast ports, but the oil and gas supplies from the North Slope likewise would be routed in the same manner. As a result, all of such oil and gas supplies would lie in close proximity to each other and would be vulnerable not only to earthquakes and tidal waves but to sabotage and both enemy air and sea attack. In addition to the vulnerability of the LNG plant in the foregoing respects, it is notable that El Paso Alaska plans its proposed pipeline cross the same Yukon River bridge as the Alyeska oil pipeline.

---

[87] Gibson, T. 14,505–06.
[88] Harris, T. 7402–72; Gibson, T. 14,422–470.
[89] T. 10,404.

The serious national vulnerability to such concentration insofar as sabotage or enemy attack are concerned is obvious.

In light of the probability an LNG plant or terminal outage would be lengthy, as more fully discussed above, and the crucial dependence of high priority markets in the lower 48 on the continuity of these large supplies, responsible assessment of the risks of interruption argues forcefully not only for reasonable diversity in the transportation of the vast hydrocarbon resources of Alaska, but for approval of the substantially greater dependability of the all-pipeline Arctic Gas Project.

XII. THE ARCTIC GAS SYSTEM CAN BE CONSTRUCTED AND IN OPERATION BEFORE THE EL PASO ALASKA SYSTEM

As shown in the discussion of the Arctic Gas construction planning in an earlier section of this document, the Arctic Gas delivery system is planned to commence delivery of Mackenzie Delta gas about three and one half years after receipt of necessary governmental approvals and financing, and delivery of Prudhoe Bay gas a year later. Under such schedule Mackenzie Delta gas supplies would have a beneficial impact upon the level of Canadian exports to the United States within three and one half years (an advantage the liquefaction process will never have), and the Arctic Gas system would commence transporting the available Prudhoe Bay volumes a year later.

In its initial filings with the FPC, the El Paso Alaska project schedule showed very low levels of deliveries from Prudhoe Bay to begin five years and ten months after approvals and financing would allow a significant financial commitment, with buildup to the full initial volumes over the next year. Under that schedule initial volumes would not flow until over a year after full volume flow on the Arctic Gas system, and full volumes would be about two years behind.

Now, El Paso Alaska has filed a compressed schedule for its 2.4 Bcf/d case which presently shows the startup of the liquefaction trains being completed by November of the sixth year of construction, and the seventh and eighth LNG tankers becoming available at the same time.[90] Under this claimed schedule, full deliveries would be made when initial deliveries were formerly scheduled, but still well behind Arctic Gas full deliveries.

However, the new El Paso Alaska schedule is not only later, but also subject to substantial doubt. First, under such schedule, the completion of the LNG plant is on the critical path for the timely completion of the El Paso Alaska project. This is significant, since the El Paso Alaska schedule assumes that both the engineering design contractor and the construction contractor for the LNG plant will have been selected prior to January 1 of year one of the estimated schedule (T. 14,136). The same is true with respect to the Alaskan marine terminal (T. 14,131). If such contractor were not selected, additional time would be required to permit such contractors to study the project so as to be adequately informed for any competitive bidding process. The problem for the liquefaction project is that it is clear that no such contractors could be selected until an equity group had been formed to sponsor the project which only El Paso Alaska now promotes, and this would not even commence until after requisite authorization for the El Paso Alaska project. For the foregoing reason alone, the El Paso Alaska project schedule is seriously understated.

It also should be realized that there is substantial additional geotechnical and engineering work to be undertaken by El Paso Alaska respecting the routing and design of its Trans-Alaska pipeline and the design of its LNG plant. The testimony of the El Paso Alaska engineering witnesses for the Trans-Alaska pipeline, LNG plant and marine terminal is replete with acknowledgements concerning the additional work required. In fact, at this point time, the State of Alaska is suggesting a substantially different route for the Trans-Alaskan pipeline more closely paralleling the Alyeska facilities.[91] If this routing were to be adopted still additional engineering design work would have to be performed, in particular respecting the positioning of the natural gas line in relation to the oil line. Likewise, it should be noted that no seismic design work has been undertaken respecting either the pipeline or the LNG plant, even though southern Alaska, and, in particular the Prince William Sound area, is one of

---

[90] See Exh. EP–217. As pointed out in this section, such schedule was developed on assumptions that have no realistic basis.

[91] Exh. ALA–12.

the most active, volatile seismic areas in the world. Finally, the engineer who testified concerning the Trans-Alaska pipeline has admitted that the refrigeration systems at certain of the compressor stations will be to be redesigned.[92]

In light of the comprehensive geotechnical studies an engineering design work already undertaken by Arctic Gas, far greater confidence can be placed on the Arctic Gas construction schedule than on that of El Paso Alaska. In addition, El Paso Alaska has undertaken to construct LNG trains twice the size of any other trains now in existence, and plans to utilize LNG tankers much larger than any tankers previously constructed. There is, therefore, a substantial likelihood of serious problems developing in the startup of the LNG plant and in the construction or sea trials of the tankers. Moreover, the pipeline construction proposed by Arctic Gas, whose route does not traverse any significant mountain ranges, sharply contrasts with the proposed Trans-Alaskan pipeline, which must cross several formidable mountain areas, including the Brooks Range.

It also is important to recognize that the Arctic Gas Project involves existing organizations capable of implementing requisite authorizations immedately, whereas approval of the El Paso Alaska project would result in lengthy negotiations in which the ownership of the Trans-Alaska pipeline, the Alaskan LNG plant and the marine terminal and each of the LNG tankers would have to be determined. And once the ownership of the components of the El Paso Alaska project had been determined, further negotiations would have to be held with respect to the contracting for the design and construction of the facilities. In addition, the complex El Paso Alaska lower 48 delivery scheme would have to be negotiated after certification.

Finally, it should be recognized that, unlike Arctic Gas, El Paso Alaska has not filed for a right-of-way permit with the Department of Interior pursuant to the Mineral Leasing Act, and such a filing would be prepared and acted upon after certification. In addition, no certificate or right-of-way permit application has been filed, or environmental assessment prepared, for El Paso's east of California construction, which would involve substantial new pipeline facilities. These matters would cause substantial additional delays for the El Paso Alaska project.

In light of the foregoing, it is clear the El Paso Alaska project could be years behind the Arctic Gas Project in delivering Prudhoe Bay gas, a wholly unacceptable circumstance in view of the nation's serious gas supply shortage.

XIII. IN COMPARISON WITH EL PASO ALASKA, THE ARCTIC GAS PROJECT IS PREFERABLY SITUATED IN RELATION TO THE ATTACHMENT OF NEW GAS SUPPLIES IN THE NORTH

The western arctic, e.g., Alaska's North Slope, the Mackenzie River Delta, and the Beaufort Sea, are looked upon as having substantial hydrocarbon potential. Even a cursory analysis of the location of the Arctic Gas system, as compared with the El Paso system, demonstrates that Arctic Gas is best located (traversing the arctic coastal plain), and best suited (conventional natural gas pipeline system, with ability to tailor expansion), to transport the additional gas supplies which will become available, at the least cost and with the least environmental impact.

The Arctic Gas system, with a design capacity of 4.5 Bcf/d (and expandable beyond that point through compression and/or looping), is best situated to obtain the additional gas supplies which may be developed in these potentially prolific gas producing areas. This "cheap expansibility" has economic benefits for consumers in the lower 48 of the United States. This benefit is compounded when it is recognized what would need to be done when gas is developed east of Prudhoe Bay along the North Slope, if a pipeline along the Slope, such as the Arctic Gas Project, has not been built. In that case, a new pipeline could be built along the coast, to Prudhoe Bay. The other choice, apart from leaving the new gas in the ground, if a pipeline along a more southerly route such as that proposed by El Paso, had been constructed instead of the Arctic Gas Project, would be to build new pipelines south from the coastal areas to attach to the more southerly trunkline somewhere in the interior of Alaska. This is in contrast to the Arctic Gas system, under which additional gas supplies could be attached at or near the coast. This difference obviously constitutes a substantial additional economic advantage over future years for the Arctic Gas Project. But it is also a substantial environmental advantage, as discussed earlier, since it avoids proliferation and duplication of pipelines.

---

[92] T. 15,668–70.

Naval Petroleum Reserve No. 4, which lies to the west of Prudhoe Bay, is expected to be the site of gas production. That production could be transported to Prudhoe Bay for transportation beyond there by whatever project provides transportation from Prudhoe Bay.

XIV. THE ARCTIC GAS PROJECT WILL BE FAR EASIER TO EXPAND TO MEET ADDITIONAL TRANSPORTATION REQUIREMENTS FOR NORTH SLOPE GAS THAN THE MULTI-MODE EL PASO PROJECT

In view of the certainty that the vast potential natural gas supplies on the North Slope of Alaska and in the Mackenzie Delta-Beaufort Sea area will result in gas for transportation well in excess of initial volumes, another important advantage the Arctic Gas Project enjoys in comparison to the El Paso Alaska project is that its all-pipeline system can be readily expanded to transport additional increments of gas. The Arctic Gas system can be expanded by increments designed to meet the volumes of additional gas, by adding compressor units, or parallel pipeline known as looping, or a combination of both. This can be expeditiously and economically accomplished for virtually any reasonable increment of additional gas supply.

In contrast, and wholly apart from the much greater lead time required for components of LNG trains and tankers, where a multi-mode system is involved, the problem of trying to economically tailor additional pipeline facilities with additional LNG trains and storage, with additional LNG tankers, and with additional vaporization and storage facilities, is far more complex and difficult. It is more difficult for two principal reasons: (1) the volume involved can result in very high incremental transportation costs, where pipeline expansion must reconcile with additional liquefaction modules, terminal facilities, tankers, vaporization and storage facilities; and (2) tankers and liquefaction trains in particular are uits of given sizes, and are not amenable to precise tailoring to fit supply.

There can be no real question of the substantial advantage an overland pipeline transportation system enjoys over a multi-mode transportation system in terms of expeditious expansion to meet the transportation requirements for the vast potential supplies of the North Slope of Alaska and the Mackenzie Delta-Beaufort Sea area.

XV. THE FAIRBANKS-ALASKA HIGHWAY PIPELINE ROUTE IS NOT A REASONABLE ALTERNATIVE TO THE ARCTIC GAS PROJECT

The proposed route of the Arctic Gas Project runs east from Prudhoe Bay along the north coast of Alaska into Canada, and on to the Mackenzie River Dalta where Canadian gas produced there enters the system. It then turns southeast, parallels the Mackenzie River and proceeds into Alberta to the "Caroline Junction" north of Calgary, from where two branches run into the United States.

Suggestions have been made by some persons that the Arctic Gas Project use a different route, which will be here called the "Fairbanks-Alaska Highway Route". That route is quite circuitous. The portion of the system which would carry only Alaskan gas would run south from Prudhoe Bay along the general route of the oil pipeline. Near Fairbanks, Alaska, it would swing east into Canada and run to a point in the Yukon Territory near Whitehorse. The portion of this system which would carry only Canadian gas would run generally south from the Mackenzie Delta to the same point near Whitehorse. From that point, a single line would run southeast to the Caroline Junction. South of there, the route would be the same as that proposed by the Arctic Gas Project.

As can be seen from the following table, the Fairbanks-Alaska Highway route is substantially longer—about 1045 miles, or about 57% longer— than the proposed route, to the Caroline Junction. About 550 of the extra miles would be in Alaska and almost 500 extra miles in Canada. Extra mileage has environmental impact, serves to greatly increase cost, and requires more gas for extra fuel to power the compressors which move the gas over the longer route. Construction time is also affected.

The Arctic Gas Project originally studied several alternative routes before making its final choice, and the Fairbanks-Alaska Highway route was one of them. An analysis of that route, and the others, formed the first part of the bulky volume entitled Environmental Report, Chapter V, which was filed with the Federal Power Commission and Department of the Interior. Copies have been provided to the Senate Interior and Commerce Committees.

Line segments	Miles to Carolina Junction		Difference
	Arctic gas	Fairbanks-Alcan Highway Route	
In Alaska	195	745	550
In Canada	1,620	2,115	495
Total	1,815	2,860	1,045

The reasons for the rejection of the Fairbanks-Alaska Highway route are set forth in that volume, and are quite clear. First, that route is, on balance, less desirable from an environmental standpoint than the proposed Arctic Gas route. In part this is because of the nature of the terrain crossed by the two routes. The Arctic Gas route runs along the flat coastal areas, and then in the flat Mackenzie River Valley, as compared to the mountainous areas of the Brooks Range in Alaska and the Yukon Territory in Canada. This, in turn, affects the types and numbers of wildlife in those areas. Mountainous terrain also requires use of summer construction, when wildlife is present in the area, and requires use of permanent roads.

The environmental judgment is also affected by the much longer length of the Fairbanks-Alaska Highway Route, since more territory is affected. In Canada, a new 735 mile line from the Mackenzie Delta would be required, crossing basically uninhabited territory. Further, whereas the Arctic Gas proposed route runs along the coastal area which is expected to be the source of future oil and gas development in both Alaska and Canda, the Fairbanks-Alaska Highway route runs south from only one coastal areas in each nation. Thus, when new reserves are found in other areas, lines to those areas along the coast will be required, with the net result that pipelines both along the coast, and also over the longer Fairbanks route, will be required, with increased environmental impact.

The above kinds of factors, as explained more fully in an earlier section of this document, outweigh the alleged desirability of use of the general oil pipelines and Alaska Highway "corridors", and the fact that Arctic Gas proposes to cross the coastal plain of the Arctic National Wildlife Range. Thus, there is not a net environmental advantage for the Fairbanks route: the expert environmental advisors to the Arctic Gas Project have concluded that on balance, the proposed Arctic Gas route is not only acceptable, but also environmentally preferable to the Fairbanks route.

The extra length and more difficult terrain of the Fairbanks-Alcan Highway route also mean that construction would be more lengthy, difficult and dangerous. It is questionable whether a pipeline over such route could be constructed over the same period as a pipeline over the proposed Arctic Gas route, and an increase in schedule would increase the cost of the pipeline, as well as delay the time when the benefits of pipeline operations can begin.

However, even if it is assumed that the same construction schedule could be followed as for the Arctic Gas proposal, the greater length and more difficult terrain of the Fairbanks Corridor would cause a hugely increased cost: about three billion dollars more than for the Arctic Gas route. The comparison is shown in the following table in mid-1975 costs:

	Fairbanks route	Arctic gas route	Difference
Alaska	$2,598,941,000	$644,901,000	$1,954,040,000
Canada	7,137,413,000	6,145,456,000	991,957,000
Total	9,736,354,000	6,790,357,000	2,945,997,000

The details of such capital costs are set forth in the Appendix.

The operating costs of a pipeline over the longer Fairbanks route would also be higher than for the Arctic Gas Project route, and the results are a very substantial increase in the "cost of service", and thus in the cost per BTU of transportation. Those increases would be a direct extra burden on consumers. The amount of the increase for the Northwestern, Western, Midwestern and Eastern areas is about $253,000,000, per year, on a twenty-year average, and higher in earlier years. See the totals on the two Tables following this page for the calculation of such extra costs. The detail rates underlying those costs are shown in the Appendix.

SAVINGS IN TRANSPORTATION COST—PER UNIT AND ANNUAL—FOR DELIVERIES TO NORTHERN BORDER PIPELINE COMPANY SHIPPERS THROUGH ARCTIC GAS PIPELINE COMPARED WITH DELIVERIES BY ARCTIC GAS PIPELINE WITH FAIRBANKS CORRIDORS, 48" DESIGN (WITH DELTA LEG)

Deliveries to—	Savings in transportation cost							
	In cents per million Btu				Annual savings (in millions) on the basis of—			
	3d year costs	10-year average costs	15th year costs	20-year average costs	3d year costs	10-year average costs	15th year costs	20-year average costs
Columbia Gas Transmission Corp., serving the District of Columbia, Kentucky, Maryland, New York, Ohio, Pennsylvania, Virginia, and West Virginia	42.1	38.8	21.3	29.5	$111.55	$102.91	$56.80	$78.41
Michigan-Wisconsin Pipe Line Co., serving Illinois, Indiana, Iowa Kansas, Michigan, Missouri, Ohio, Tennessee, and Wisconsin	41.8	38.7	21.1	29.4	32.66	30.16	16.60	22.96
Natural Gas Pipeline Co. of America, serving Illinois, Indiana, Iowa, Kansas, Missouri, Nebraska, Oklahoma, Texas, and Wisconsin	41.8	38.7	21.1	29.4	26.44	24.44	13.44	18.60
Northern Natural Gas Co., serving Colorado, Illinois, Iowa, Kansas, Michigan, Minnesota, Nebraska, and South Dakota	41.6	38.4	21.0	29.2	32.61	30.12	16.58	22.95
Panhandle Eastern Pipe Line Co., serving Illinois, Indiana, Kansas, Michigan, Missouri, and Ohio	41.9	38.7	21.2	29.4	26.43	24.40	13.42	18.60
Texas Eastern Transmission Corp., serving Alabama, Arkansas, Illinois, Indiana, Kentucky, Louisiana, Mississippi, Missouri, New Jersey, New York, Ohio, Pennsylvania, Tennessee, and Texas	42.1	38.9	21.3	29.6	26.43	24.43	13.44	18.60
Savings per unit (average) and total annual savings for delivery points shown	42.0	38.7	21.0	29.4	256.12	236.46	130.28	180.12

SAVINGS IN TRANSPORTATION COST—PER COST AND ANNUAL FOR DELIVERIES TO WEST COAST SHIPPERS THROUGH ARCTIC GAS PIPELINE COMPARED WITH ARCTIC GAS PIPELINE FAIRBANKS 48" (INCLUDING FUEL AT $1 PER MILLION BTU)

Deliveries to—	Savings in transportation cost							
	In cents per million Btu				Annual savings (in millions) on the basis of—			
	3d year costs	10-year average costs	15th year costs	20-year average costs	3d year costs	10-year average costs	15th year costs	20-year average costs
Pacific Lighting System (Southern California)	40.6	37.2	19.8	28.0	$70.16	$64.29	$34.22	$48.39
Pacific Gas and Electric System (Northern California)	39.7	36.4	19.3	27.4	32.12	29.45	15.62	22.17
Northwest Pipeline System (Pacific Northwest area)	40.3	36.9	19.7	27.8	3.54	3.25	1.73	2.45
Savings per unit (average) and total annual savings for delivery points shown	40.3	36.9	19.6	27.8	105.82	96.99	51.57	73.01

In addition, Canadian consumers also would suffer very large cost increases, which raises the question of why Canada would allow such a route to be used. Alternatively, Canada might simply take the position that *all* extra costs of use of this lengthy route should fall on the United States, since it would be the United States which would be choosing and advocating that circuitous route. In that case, the cost penalties and rates to United States consumers shown in the above discussed table would be greatly increased.

In view of the lack of environmental or construction advantage, it is difficult to understand why the burden of such increased costs should be placed upon the consumers. In addition, the Fairbanks-Alcan Highway route would require the use of much more gas per year for fuel than would the Arctic Gas route, which is also a loss to the consumers, in terms of both cost and increased energy dependence.

Prudhoe Gas Only—Fairbanks Route

Some proposals for use of a Fairbanks-Alaska Highway route have attempted to avoid the cost disadvantage described above by eliminating from the system, the 735 mile pipeline from the Mackenzie River Delta to the "Whitehorse Junction": this is the portion of the system which would carry only Canadian gas. Elimination of that line would mean, of course, that the system could not transport Canadian gas, which has substantial disadvantages to the United States.

Without the Arctic Gas Project, Canada would not have access to its arctic gas for several more years, as is discussed in another section of this document, with the likelihood of a resultant decrease, or elimination, of the approximately one trillion cubic feet of gas exports by Canada to the United States. That would be a substantial loss in terms of both cost, and a higher degree of dependence on the OPEC nations.

Even more basically, it does not seem at all certain, to put it mildly, that Canada would agree to allow construction of a pipeline through Canada, along a route which has been designed so as to make it impossible to transport gas from the Canadian Arctic gas which Canada needs. This would be particularly true if the choice of such route were forced by the United States, under circumstances in which an alternative route—the Arctic Gas Project route—could have been chosen which would have allowed transport of Canadian gas, would have saved cost, time and energy for United States consumers, and would have been environmentally preferable.

However, even if it is assumed that Canada would ignore those matters, and allow the route and not cut exports to the United States, the fact is that the elimination of the portion of the Fairbanks-Alaska Highway route system from the Mackenzie Delta to Whitehorse would not help the United States in terms of transportation costs. It obviously would reduce the overall capital cost, but the cost per Btu of transportation of the lower volumes of gas remaining to be carried would be even higher than if that portion had not been eliminated. The increase occurs because there is a lesser reduction of volumes of gas available to be carried. Therefore, unit costs are increased.

Thus, the transportation cost of a Fairbanks system without a Delta leg would be higher than if there were a Delta leg, which in turn is much higher than for the Arctic Gas route. And all of the costs of the Alaska gas only system would fall on United States consumers.

Specifically, elimination of the Mackenzie Delta pipeline lateral reduces the capital cost of the Fairbanks route system described above by $2,250,000,000, but that leaves that system still about $700,000,000 more expensive than the Arctic Gas Project system.

And that higher cost, spread over only Prudhoe Bay gas volumes, would produce even higher rates, and even more excess costs, than those shown in the earlier part of this section for the Fairbanks route.

The above discussion has been in terms of a pipeline system using 48-inch pipe. To conclusively prove the point that eliminating the Mackenzie Delta pipeline leg from the Fairbanks-Alaskan route does not aid the economics of that route, Arctic Gas developed the costs (shown in the Appendix) of a reduced size 42-inch pipeline along the Fairbanks-Alcan Highway route. The reduction of 48-inch pipe to 42-inch would sacrifice inexpensive expansibility, when volumes of gas from Prudhoe Bay expand enough, but would decrease costs initially. Nevertheless, the cost of transportation per Btu is much higher than for the Arctic Gas Project route, and higher than for the Fairbanks-Alcan Highway route with 48-inch pipe, including the pipeline to the Mackenzie Delta. This is shown on the two tables on the following page, which set forth the savings for the Northern Border shippers resulting from the Arctic Gas

Project route, as compared to the 42-inch Fairbanks route without the Mackenzie Delta line. On this basis, the savings to just those shippers is over $340,000,000 per year, on the basis of twenty-year averages, and higher in earlier years.

SAVINGS IN TRANSPORTATION COST—PER UNIT AND ANNUAL FOR DELIVERIES TO NORTHERN BORDER PIPELINE COMPANY SHIPPERS THROUGH ARCTIC GAS PIPELINE COMPARED WITH DELIVERIES BY ARCTIC GAS PIPELINE WITH 42-INCH,FAIRBANKS CORRIDOR (NO DELTA LEG) (INCLUDING FUEL AT $1 PER MILLION BTU)

	Savings in transportation cost							
	In cents per million Btu				Annual savings (in millions) on the basis of—			
Deliveries to—	3d year costs	10-year average costs	15th year costs	20-year average costs	3d year costs	10-year average costs	15th year costs	20-year average costs
Columbia Gas Transmission Corp., serving the District of Columbia, Kentucky, Maryland, New York, Ohio, Pennsylvania, Virginia, and West Virginia	43.2	44.8	25.7	34.7	$141.37	$143.20	$85.19	$112.60
Michigan-Wisconsin Pipe Line Co., serving Illinois, Indiana, Iowa, Kansas, Michigan, Missouri, Ohio, Tennessee, and Wisconsin	43.8	45.3	26.0	35.1	41.39	41.96	24.91	32.97
Natural Gas Pipeline Co. of America, serving Illinois, Indiana, Iowa, Kansas, Missouri, Nebraska, Oklahoma, Texas, and Wisconsin	43.7	45.2	25.9	35.0	33.51	34.00	20.17	26.71
Northern Natural Gas Co., serving Colorado, Illinois, Iowa, Kansas Michigan, Nebraska, South Dakota, and Minnesota	44.0	45.4	26.1	35.2	41.34	41.91	24.89	32.96
Panhalnde Eastern Pipe Line Co., serving Illinois, Indiana, Kansas, Michigan, Missouri, and Ohio	43.4	44.9	25.8	34.8	33.50	33.96	20.16	26.72
Texas Eastern Transmission Corp., serving Alabama, Arkansas, Illinois, Indiana, Kentucky, Louisiana, Mississippi, Missouri, New Jersey, New York, Ohio, Pennsylvania, Tennessee, and Texas	42.7	44.4	25.4	34.3	33.50	33.98	20.18	26.71
Savings per unit (average) and total annual savings for delivery points shown	43.5	44.9	25.6	34.8	324.61	329.01	195.50	258.6

SAVINGS IN TRANSPORTATION COST—PER UNIT AND ANNUAL FOR DELIVERIES TO WEST COAST SHIPPERS THROUGH ARCTIC GAS PIPELINE COMPARED WITH ARCTIC GAS PIPELINE FAIRBANKS 42" (INCLUDING FUEL AT $1 PER MILLION BTU)

	Savings in transportation costs							
	In cents per million Btu				Annual savings (in millions) on the basis of—			
Deliveries to—	3d year costs	10-year average costs	15th year costs	20-year average costs	3d year costs	10-year average costs	15th year costs	20-year average costs
Pacific Lighting System (Southern California)	39.4	40.8	22.6	31.2	$68.09	$70.51	$39.06	$53.92
Pacific Gas and Electric System (Northern California)	38.7	40.1	22.2	30.7	31.31	32.45	17.96	24.84
Northwest Pipeline System (Pacific Northwest area)	40.3	41.6	23.4	32.0	3.54	3.66	2.06	2.81
Savings per unit (average) and total annual savings for delivery points shown	39.2	40.6	22.5	31.0	102.94	106.62	59.08	81.57

Since the savings from Arctic Gas, as compared to the "no Delta leg", 42-inch Fairbanks system are larger than the savings from Arctic Gas, as compared to the 48-inch Fairbanks system, with the "Delta leg", (which were set forth earlier in this chapter), it is again clear that elimination of the Delta leg increases costs. And with or without the Delta leg, the Fairbanks route is far more expensive to the consumers than the Arctic Gas Project.

In summary, the Fairbanks-Alaska Highway route is less desirable than the Arctic Gas Project route from every standpoint. And elimination of the pipeline to the Mackenzie Delta gas fields from the Fairbanks route further increases the superiority of the Arctic Gas route.

XVI. THE UNITED STATES WILL BENEFIT BECAUSE THE ARCTIC GAS PROJECT WILL CROSS CANADA

The Arctic Gas Project, because it is an all pipeline system which can deliver natural gas directly to markets by a land route, is the most advantageous method to transport northern Alaskan gas.

In an effort to offset that fact, opponents have alleged that the fact that a land pipeline system from Alaska to the contiguous United States must cross Canada is a disadvantage to the United States.

In fact, however, there are advantages which accrue to the United States because the pipeline will cross Canada, and the alleged disadvantages are in error.

A. The Benefits

The most elementary fact is that the crossing of Canada is required if an all pipeline system is to be used. An all pipeline system: (a) is environmentally preferable; (b) is the most economical system for consumers; (c) conserves more energy than any other transportation system; (d) is the most safe and reliable method of transportation; (e) can be put into operation earlier than any other system.

Those advantages are discussed in other sections of this document.

There are also other advantages to the United States, from the Arctic Gas Project, which result from the fact that Canada has discovered naural gas reserves in the Mackenzie River Delta area of the Northwest Territories of Canada.

The first of these advantages is the cost savings attributable to economies of scale: the Arctic Gas Project will transport higher volumes of gas because it will carry Canadian gas as well as Alaskan gas. This allows the use of very large diameter pipe, at high pressures, which produces great economies of transportation costs, with resultant benefits to consumers in both countries.

The second advantage unique to Canada is that the Arctic Gas Project will make Canadian arctic gas available to augment Canadian gas supply, by transporting that gas. This is important to the United States, because the timely availabiliy, to Canadian markets, of Canadian gas from the Mackenzie Delta producing area is essential if current levels of exports of Canadian gas to the United States are to continue, and if there is to be hope of increase later.

Currently, Canada exports approximately 1 trillion cubic feet per annum of gas to the United States, or almost five percent of total usage.

Canada is now experiencing shortages in natural gas, as supplies from the traditional producing areas of western Canada lag behind growing demand. The National Energy Board has indicated that significant curtailment of exports may occur in the early 1980's, unless Canada is able to secure its arctic gas.

National Energy Board figures indicate that by 1985, total Canadian demand, including presently authorized exports, is expected to exceed supply by approximately one trillion feet: an amount equal to the present level of exports.

Arctic Gas anticipates deliveries of Mackenzie Delata gas, at full compression, of about 2.25 billion cubic feet of gas a day, or 820 billion cubic feet per year. Clearly, this goes a long way toward making up the anticipated shortfall in supply.

Arctic Gas is the only project that can make this gas available in a timely fashion. The foothills project (Delta gas only) in Canada cannot do so, since discovered reserves in the Mackenzie Delta are substantial, but not nearly enough to support a Canadian only line. It is estimated that approximately 15 to 20 trillion feet are needed to finance a Delta-only project. It will likely take an additional several years to prove up this amount.

It is not necessary, however, to wait for those reserves to develop, because the Arctic Gas Project, carrying both Alaskan and Mackenzie Delta reserves, can make the reserves available to the Canadian, gas supply soon, with benefits to United States, as well as Canadian, consumers.

B. The Erroneous Claims of Canadian Problems

The two basic claims made against the Arctic Gas Project are: (1) that even after the Project is approved by Canada and operating, Canada will take some action which will injure the United States, and (2) that Canada will not approve the Project soon enough.

Neither of these claims are correct.

1. Canada Will Not Injure the United States

A wide variety of claims have been made about ways in which, it is alleged, Canada would injure the United States interests after the pipeline is operating. It is most convenient to divide these erroneous claims, for discussion, between allegations about Canadian federal government action and about Provincial government action, as will be done below.

First, however, it must be recognized that the important subject under consideration is the transportation of Alaskan gas. Each nation exercises control over the export of its own products when they are in short supply: the United States does this with a variety of products.

The treatment of the products of another country which have been authorized to cross the "nation of transit", however, is quite a different subject. Interference with those products is not normal policy of nations: it would be quite abnormal, and particularly between the United States and Canada. In recognition of this, negotiators for the United States and Canada have initialed an agreed text of treaty which prohibits action against transhipped hydrocarbons of the other nation. This will be discussed below.

In that context, this discussion will now consider specific claims made.

a. *Canadian Federal Matters.*—It has been alleged that United States gas from Alaska, moving in bond across Canada, will not be safe from interference or discriminatory treatment by the federal government of Canada. These allegations are contrary to, and go right to the heart of, long-standing and sound relationships between the United States and Canada.

In this connection, it is useful to first note a few aspects of Canadian-American trade, which illustrate the interdependence of the two nations. Canada's world trade comprises about twenty-five percent (25%) of its gross national product. About seventy percent (70%) of that trade is with the United States.

United States imports from Canada are increasing a a relatively steady rate of about 15% per year, while U.S. exports to Canada have grown at a rate of around 11 percent per year over the last fifteen years. It is interesting to note that fuels provide only about 2.6 percent of U.S. exports to Canada and about 10.9 percent of imports from Canada, while corresponding automotive figures are about 31.0 percent and 35 percent, respectively, or about 476,000 and 862,000 units. This trade, under the Bilateral Automotive Agreement of 1965 is vital to Canada; the exports amount to 70 percent of Canadian auto production. Finally, the United States' direct investment in Canada has been estimated at approximately $40 billion. Thus, the two nations are highly interdependent.

To discuss more specifically the allegations of El Paso, it is necessary to separate (i) the flow across Canada of United States gas from Alaska, and (ii) the sale of Canadian gas to United States purchasers.

i. *Transit of Alaskan Gas.*—The Arctic Gas Project, as it relates to the United States, is a means of transportation of Alaskan gas to the contiguous forty-eight states. Before the project can be constructed, it must receive approval not only from several government agencies in the United States, but also from the government of Canada. Such approval by the government of Canada is based upon recommendation of the National Energy Board and the Department of Indian and Northern Affairs, other Departments and inter-departmental groups. Such approvals and reviews will be on the basis of applications for the throughput of Alaskan—as well as Canadian—gas. Such approvals must explicitly authorize the throughput of Alaskan gas, and any conditions put upon such approvals will be known before the sponsors of Arctic Gas or prospective shippers take implementing action. The line would not be built if there were unacceptable conditions.

The Canadian government, moreover, has officially stated its willingness to guarantee the transportation of American hydrocarbons through Canada. At the highest levels of that government, they have proposed that questions of security of, and discrimination relative to, the transit of petroleum products through our respective countries, taxation of such products, and related questions, be made the subject of an international agreement. On December 6, 1973, Prime Minister Trudeau stated in the House of Commons:

". . . I can see no reason why Canada could not give suitable undertakings as to the movement, without any discriminatory impediment, of Alaskan gas through the pipeline across Canada to U.S. markets, provided all public interest and regulatory conditions are met in the building and operation of the pipeline. An undertaking of this sort would, of course, be reciprocal, with the same assurance being given Canada regarding our oil and gas shipments through the United States."

This offer was reiterated by several Ministers of the Canadian government. Since that time, discussions have been conducted and now concluded, between representatives of the United States and Canadian governments, looking toward an agreement with regard to the treatment of hydrocarbons of one country passing through the other.

Those discussions have now resulted in the agreement of negotiators of the Department of State and the Canadian Department of External Affairs on the text of a Treaty. That document was initialed by the negotiators for the two governments in January, 1976. It will presumably be sent to the Senate of the United States for ratification shortly.

The text of the agreement has not been made public, but a State Department official has testified before Committees of the Congress that the agreement provides, among other things: guarantees that the oil and gas going from either country through the other will not be impeded or interfered with; that the pipeline transporting the hydrocarbons will not be discriminated against; "in bond", untaxed treatment for the hydrocarbons; and equitable sharing of pipeline capacity in the event of emergencies on a pre-determined basis (in normal situations, capacity for all hydrocarbons of both countries is constructed).

Such a treaty should lay to rest any U.S. concerns over treatment by the Canadian Federal government. The natural gas from Alaska will not be interfered with or taxed. There will be no discrimination against the pipeline which will transport the gas through Canada, either in taxation or regulation. (in that context, it is important to remember that such pipeline will have heavy Canadian ownership and will carry gas from the Canadian arctic too. Thus, burdensome treatment of the line would injure Canadians too).

Expansions of pipelines are a matter of course, to meet increased gas supply. That has occurred repeatedly over the years, and in Canada. Trans-Canada pipeline, for example, has expanded from one pipeline to several, as the demand for gas in Canada and the United States has grown, with the line expanding to accommodate the need. But in the event of emergency, the treaty is said to provide for equitable sharing of capacity between the nations until the situation is corrected.

Despite the above agreement, however, and despite the fact that the Arctic Gas Project will have received specific approval by the Canadian government, the opponents of the Arctic Gas Project continue their claims. Some claim that the Canadian government will nevertheless violate its own approvals of the pipeline project, and even violate a treaty. It is claimed that this might be done by intercepting and taking some United States gas for Canada. Or, they assert, Canada will discriminate against United States gas or the pipeline carrying it.

There is no justification in history, law, or current evidence for such allegation and suspicions. First, one nation's interception of another nation's gas, in transit, after approval of uninterrupted throughput, would be unconscionable. It would be a very serious act of international violation. The allegation that Canada would engage in such activity, just as a matter of Canadian principles of fair dealing, is entirely without justification. (But in addition, it would also not be in Canada's self-interest, as discussed below.)

As to discrimination, it must be recalled that in the Arctic Gas Project, Canadian gas will be carried in the same pipeline with Alaskan gas. Therefore, if that pipeline were taxed more heavily, for example, than other Canadian pipelines, not only would Canadian law be violated, but Canadian gas would also be burdened. Again, there is no support for such allegation.

The present trade relations between the two nations attest to a history of fair dealing. In the case of existing oil and gas pipelines, there is a history of uninterrupted transit and fairness without any international agreement having been necessary. The existence of such trade means that Canada also has a vital interest in maintaining the integrity of arrangements covering the transportation of Canadian oil and gas "in bond" through the United States. Indeed, the following are examples of facilities located in the United States which are used to transport Canadian-owned oil and gas into Canada:

1) The pipeline system of Lakehead Pipeline Company which transports approximately 500,000 Bbls of Canadian oil daily from Manitoba-Minnesota international boundary through the United States into Canada at a point near Sarnia, Ontario.

(2) The pipeline system of Great Lakes Transmission Company which transports approximately 300 Bcf of Canadian gas annually from the Manitoba-Minnesota international boundary through the United States and into Canada at a point near Sarnia, Ontario. This represents some 40 percent of populous eastern Canada's present natural gas requirements!

(3) The pipeline system of Portland Pipe Line Corporation which transports from Portland, Maine to Quebec, oil purchased abroad by Canada.

Thus, through neither nation looks at these present examples of mutual benefit in such a way, it is nevertheless true that existing pipelines provide a deterrent, if any were needed, to the impropriety by Canada which critics of the Arctic Gas Project allege would occur.

It is also vital to recognize that the El Paso claim that the United States should deny itself the benefits of the Arctic Gas Project, in terms of cost and direct access to the market areas, because the transportation channel would run through Canada, flies directly in the face of established United States policy. Gas produced in Montana now flows through Canada and back into the United States, without interference or discrimination. This is also true of the approximately 50,000 barrels of oil which daily is carried from Chicago to Buffalo through Canada in the Interprovincial Pipeline.

But another more obvious example is the St. Lawrence Seaway, which is a vital part of the United States transportation system. Thousands of ships each year pass up the St. Lawrence to Great Lakes cities in the Unied States, carrying millions of tons of needed products. The land transportation system of a large part of the United States has been adjusted to be compatible with, and is dependent upon, the St. Lawrence Seaway.

The United States has done this despite the fact that the first several hundred miles of the St. Lawrence Seaway requires the ships to pass down the Canadian river, solely through Canadian controlled territory. Even after the Great Lakes are entered, passage is frequently through Canadian waters, Canadian canals and Canadian locks. This confidence has not been misplaced. Canada and the United States have both kept their agreements. The two nations have cooperated to the mutual benefit of their citizens. U.S. transit has never been interrupted or discrimininated against.

The Arctic Gas Project is proposed as another example of mutually beneficial cooperation between the United States and Canada. There is no merit in arguments that both nations should be penalized, so that need for international cooperation can be avoided.

ii. *Sale of Gas from the Canadian Arctic to the United States.*—The claimants of "political insecurity" of gas transported across Canada do not distinguish the transportation of United States gas, which is discussed above, from the matter of United States purchase of Canadian gas. But the two subjects are entirely different.

There are two major points to be made. First, provincial governments in Canada have authority over gas produced in their Provinces; the British Columbia government which was just recently defeated in elections and put out of power, for example, was active in limiting export of gas produced in its province. But that is irrelevant to the Arctic Gas Project, which will be carrying gas produced in Canadian federal territory—not in any province. Provincial authority over gas produced outside the Province, or over "interprovincial commerce", is quite limited, generally similar to state authority relative to interstate commerce in the United States.

Second, whereas all Alaskan gas carried by the Arctic Gas Project across Canada will be delivered for United States consumption, only that Canadian gas which is found to be surplus to Canadian needs will be available for export to the United States. This is pursuant to the long standing duty of the National Energy Board and Canadian government to assure conservation of gas to meet Canadian demand. The Arctic Gas pipeline will also carry gas from Canadian arctic to Canadian markets. That gas, plus Alaskan gas, plus export gas, if any, will make up the throughput of the line.

But if, as might be the case, the Arctic Gas Project is never able to carry any Canadian gas for export to the United States, because all gas from the Canadian Arctic is needed in Canada, the joint pipeline is still the best choice for the United States, because it is the most economical way to transport Alaskan gas to the contiguous United States, and has the other benefits described in this paper, including the fact that it will help maintain existing exports to the United States. Therefore, the question of whether there will be new Canadian exports of Arctic gas, how much, and for how long—all of which will not be known until purchasers of arctic gas from Canada have applied for export licenses and those applications have been acted upon by the National Energy Board and the Canadian government—are not essential to the Arctic Gas Project, or to a beneficial effect upon imports.

b. *Canadian Provincial Matters.*—The Arctic Gas Project opponents, in addition to claims that the Canadian federal government is unreliable, have alleged that the Arctic Gas Project could be disrupted by one or more provincial governments. In making that claim, they not only cite the irrelevant matter of provincial gas, described above, but also the fact that the provinces of Canada would not be bound by an international agreement, unless signatories to it, and would therefore not be barred from activities prohibited by such agreement.

These allegations then go on incorrectly to assert that this means disruption by a provincial government could take place. As pointed out above, such an argument mistakenly disregards the provisions of Canadian law which limit provincial action with regard to transactions affecting more than one province.

There is no credible evidence to suggest that Canadian provinces even would attempt to interfere with or unfairly tax an "inter-provincial" pipeline. However, in light of assertions made, we specifically treat those two allegations below.

The short answer is that it is the provisions of Canadian law, relative to inter-provincial and international activities, which mean that Canadian Provinces cannot injure users of Alaskan gas—even assuming the Provincial governments would desire to do so. Specifically, Canadian law provides that:

1. Canadian Provinces cannot interfere with, reduce the amounts of, or tax, the flow of gas in an "inter-provincial" or international pipeline, such as the Arctic Gas Project.

2. Canadian Provinces cannot regulate the rates or terms of service or other operations of such a pipeline.

3. In exercising the authority to levy such direct taxes as real estate and income tax, as do states of the United States, Canadian Provinces cannot do so in such way as to interfere with or prevent the interprovincial or international flow, or discriminate against such flow or against interprovincial or international pipelines, as compared to intra-provincial pipelines. It should be noted that the Northwest and Yukon Territories are federal areas, not Provinces, and the three Provinces which the Arctic Gas Project will traverse each have several intra-provincial pipelines, so that burdensome non-discriminatory taxes on the Arctic Gas Project would fall much more heavily on Canadians. This is because the pipelines in Canada will carry all of Canada's gas, but only a significant, but relatively small part of the United States supply, and all must be treated alike.

i. *Taxation and Regulation.*—The Canadian constitution confers only limited taxation powers upon the provinces. A province may impose direct taxation within its borders to raise revenue for provincial purposes. Provinces also have power to license, for fees, certain activities in the province.

The courts have construed the provincial taxation powers in such a way as to make clear that provincial taxes could not unduly interfere with the Canadian Arctic Gas corporation. Specifically, a province could not impose a tax on the throughput of gas, for this would be an indirect tax. Further, it could not interfere with interprovincial trade by imposing taxes on the import of gas into or the export of gas out of the province. A province can impose an income tax on the pipeline corporation, and a tax on its real or personal property within the province, which are allowed for in our cost estimates, but these taxes could not be imposed on a discriminatory basis: they can only be imposed by general direct tax legislation which applies to all taxpayers in similar circumstances. Finally, a province could require the pipeline company to obtain a license, but the license could not be refused nor the license fee be discriminatory. Nor can regulations be discriminatory.

In summary, the taxation and regulatory powers of a province relating to the Arctic Gas Project, an interprovincial pipeline, are limited. They are quite similar to those of a State of the United States relating to an interstate pipeline, and would not interfere with the Arctic Gas Project.

ii. *Service Interruption.*—Obviously, the Canadian portion of the Arctic Gas System will be subject to Canadian federal jurisdiction and, therefore, no province will have the power to interfere with the volume of gas which passes through the province. This is quite different from the situation in which gas is produced in a province. In a producing situation, as noted above, some Canadian provinces have asserted jurisdiction and limited removals of gas from the province. Whether such assertion of power will withstand legal challenge under Canadian law—which is denied by many Canadian legal authorities—is irrelevant to the Arctic Gas Project. The gas which will be transported by the Arctic Gas Project is not produced in any province. No province has the authority, nor has any even claimed to have the authority, to interfere with the throughput of Alaskan and Northwest Territories gas in a federally authorized pipeline.

To show that the above description of Canadian law, and the way it binds the Provinces, is correct, legal opinions from two outstanding Canadian attorneys have been prepared. One is prepared by Mr. John Robinnette, Q.C. of the firm of McCarthy and McCarthy of Toronto, Ontario, Canada. Mr. Robinnette is an outstanding leader of the Canadian trial bar, and a leading constitutional authority. The second opinion is by the firm of Campbell, Godfrey and Lewtas of Toronto, financial counsel to the Arctic Gas Project. They must be satisfied with the viability of the Project, in order to render legal opinions required for financing of this massive project. Those opinions are contained in the appendices to this document.

The allegations concerning Canadian dangers are inaccurate and self-serving. There is no basis for claiming that the mature relationship between the United States and Canada is in danger. The welfare of both countries is advanced by continuing sound economic and political relations. There is no reason for the United States to give up the economic benefits of pipeline transmission for Alaska gas, and the allied advantages of a line across Canada, simply because a Canadian route is involved. The allegtions that the Canadian government will not honor its pledges and obligations are a slur without foundation or factual support.

2. The Interest of Canada Indicate Canadian Approval of the Arctic Gas Project, and Earlier than the United States Would Normally Decide

As described earlier, the Arctic Gas Project will provide substantial benefits to Canada, as well as the United States. This is true in terms of gas supply, because that Project is the only feasible way for Canada to secure access to its gas reserves in the Mackenzie Delta-Beaufort Sea area: there is not enough gas now, and will not be for several years, to support a "Canadian-only" pipeline, such as that suggested by the "Foothills" proposal. Canada needs its arctic reserves to meet its worsening gas shortage domestically, as well as to meet its export commitments to the United States.

The suggestion that Mackenzie Delta gas could be transported by a United State liquefction-tanker system are difficult to comprehend. Apparently, it is a suggestion that Canadian gas from the Mackenzie Delta could be transported several hundred miles westward from the Delta to Prudhoe Bay, be there combined with Alaska Prudhoe Bay volumes, and then moved over 800 miles to southern Alaska. There the gas would be liquefied, shipped 2,100 miles to California via LNG tanker, regasified and then delivered back to Canada in some fashion. If the redelivery to Canada were by direct delivery, the cost would be very high: if it were by exchange, it would involve asking Canada to exchange its dwindling Alberta reserves for its new Mackenzie Delta reserves. And all this would be on top of a liquefaction-tanker system which is not even competitive for deliveries to the port of landing in California, much less Canada. The liquefaction1tanker proposal is expensive and inefficient for Alaskan gas: it is completely impractical for Canadian gas.

The Arctic Gas Project will also provide economic benefits to Canada, as well as the United States, in addition to gas supply. One is that the cost of transportation in the large volume, high pressure pipeline of the Arctic Gas Project will be substantially lower than a Canada-only line could provide, even after the Canadian gas reserves develop enough to allow such a line to be built.

The large joint line of the rctic Gas Project will also provide more economic stimulus and employment to Canada, as well as the United States, and this will occur sooner than it could for a Canada-only line, as explained earlier.

For these kinds of reasons, it is apparent that the interests of Canada indicate that the Government of Canada will approve the Arctic Gas Project near the end of 1976, as has been suggested by Canadian officials. This is an achievable goal, since Canadian regulatory processes are normally faster than those of the United States. In part this is because of procedural practices of the National Energy Board which allow less stages of evidence, use panels of the Board itself to hear evidence and decide the case, and limit written submissions. In part the difference relates to the almost complete absence of court appeals.

The proceedings of the Department of Indian and Northern Affairs relative to developing recommendations for the terms and conditions for the right-of-way permit for the pipeline, have progressed to a late stage and are expected to be completed by fall, 1976. The National Energy Board proceedings, although delayed by change of the composition of the panel, are expected to be completed by late 1976. Canadian Government Cabinet decision will complete the process, and is anticipated in late 1976 or early 1977.

Despite the above facts, it has been alleged that Canadian action will be delayed. The allegation most often made is that the existence of land claims by native peoples relative to the Canadian north will delay the approval of the pipeline. There is no basis for that allegation, as the following discussion shows.

Aboriginal peoples in Canada, both Eskimo and Indian, have asserted claims to lands of Canada which are now held by the government in the name of the Crown. These claims to federally-owned land, and in some cases to provincially-owned land, have taken various forms. In certain cases, this has been an assertion of an interest which is sometimes referred to as usafructory, which is used to mean that the claimant has the right to use of theland, but not legal title.

Unlike the native claim situation in Alaska at he ime of he Trans Alaska oil pipeline decision, it is y no means certain that the native claimants have any legal clams to lands in Canada. This is because the question of aboriginal rights has not been definitively settled in Canada, and accordingly, it has not been held by court decision or by legislation that such rights exist. Further, if litigtion were to result, it is possible that there would be a holding that acts performed by the government of Canada in the past have "extinguished" native claims.

The Canadian government has responded to these claims, however, by indicating a willingness to negotiate a mutually agreeable settlement. Negotiations have begun between the government and the Yukon Native Brotherhood, and the Inuit Tapirasit, and initial steps towards negotiations have been taken with the Northwest Territory Brotherhood.

The claims are expected to be settled, probably by negotiation, but if not, then by litigation, or by legislation. The net result of such settlements will probably result in some benefits to the claimant aborginal organizations and their membership. It is possible that such benefits would be totally cash compensation or totally land compensation (whether title or use rights), but more likely will be a combination of each.

The Canadian Government has the legal authority to grant the necessary right-of-way permit to the Arctic Gas Project, irrespective of native land claims, and can safeguard any rights of the native claimants as well. The technical method, under any set of circumstances, is explained below.

The government of Canada has issued statements which show that it is fully prepared to move ahead with the necessary steps to grant the right of way for the pipeline prior to the termination of the native claims question, if that is necessary.

For example, the Minister of Indian Affairs and Northern Development stated, at the opening of the Northwest Territorial Council, that the government was not prepared to wait for the land claims settlement if the pipeline receives other necessary approvals, since that would indicate that the pipeline is in the public interest, and it can go ahead without prejudice to the native claims.

Accordingly, whether or not the native claims are settled in timely fashion, the pipeline can secure the necessary right-of-way permit.

The method the Canadian government would use to grant the Arctic Gas Project the necessary right of way, while protecting native land claimants too, differs according to the time of the action and claims settlement.

The first possibility is that the claims of all of the relevant native organizations will be terminated and settled, whether by agreements, legislation or litigation, prior to the time that the pipeline is approved. In that case, it is likely that certain of the lands which the pipeline will cross which are now owned by the federal government will have, by that time, been determined to be free from native claims and the pipeline will deal with those lands the way it has proposed to do all along: that is, present applications for right-of-way permits from the federal government will stand and the federal government will grant the right-of-way permit, subject to appropriate terms and conditions. One of those terms will be an appropriate fee for the right-of-way permit, much as pipelines and other utilities now pay fees to federal or state governments for right-of-way permits across their land in the United States. Other lands to be crossed by the pipeline may have been granted to native claimants. If the grant was of full ownership (fee simple title), then the pipeline, under federal certification, will achieve the right of expropriation (condemnation under eminent domain, in U.S. terminology). Thus, the pipeline will negotiate with the Indian holders of title, and if negotiations cannot result in an acceptable arrangement, the power of expropriation can be exercised, subject only to payment of appropriate compensation. This is like the law in the United States. The same provisions would apply if the rights recognized in the claimants were less than a fee simple title, but the compensation would presumably be less, since it would be a lesser right which would be encumbered by the pipeline.

The second possibility is that the claims of the native claimants would not have been settled or otherwise terminated by the time that the pipeline is certificated. In that case, the Canadian federal government is fully empowered to grant the necessary right-of-way permits. This would clear the title to the permits for the pipeline, and the pipeline would be required to pay to the government, compensation as described in the first situation discussed above. The government would, of course, be free to utilize the funds paid for the right-of-way permit as partial payment of any cash payments made to native claimants, but since the native claims are dealing with the huge territories of the Northwest and Yukon areas, the link between the two amounts would be minimal. As discussed above, the Canadian government has shown that it is willing, if timing makes it necessary, to use this method of granting Arctic Gas its right of way.

It is thus clear that there is no reason to believe that Canadian government approvals will be delayed.

But the final point on alleged Canadian government delay is a pragmatic one. The United States can accelerate its approval processes, and see if Canada responds reasonably. Nothing will be lost, and much can be gained, by such steps. Arctic Gas is confident that Canada will respond, promptly.

XVII. EVALUATIONS BY RAND AND PURSUANT TO PUBLIC LAW 93–153

Two reports which have been prepared, relative to the transportation of northern Alaskan gas, by groups not parties to the FPC proceedings, will be discussed here briefly.

One evaluation was done by RAND, the independent consulting organization, prepared for and under the sponsorship of the California State Assembly, December, 1975. The full report is entitled "Energy Alternatives For California: Paths To The Future," and Chapter 7 deals with "Gas Transportation From the North Slope of Alaska."

The report is prepared in the context of evaluating what is best for the interests of California, and California is where liquefied natural gas from Alaska would be delivered at least cost under a system such as proposed by El Paso Alaska, which has the port and regasification facilities in California.

Nevertheless, RAND finds the Arctic Gas Project superior for California. Taking each of the five RAND criteria in order:

(a) Arctic Gas is found to have "both lower direct and lower indirect costs than the Trans-Alaska Gas system."

(b) Preliminary evidence suggests the "Arctic Gas system would be more reliable and that coping with the possible disruptions associated with it would be easier for California consumers, distributing companies, and regulatory agencies."

(c) Relative to the time when the systems could initiate deliveries, "the Arctic Gas system appears to be advantageous."

(d) The disussion of safety favors the all pipeline system. Modern high pressure pipelines have "a good record of safe operations."

(e) "The adverse environmental effects associated with each system in California are local, typically minor, and often temporary."

A "feasibility study" prepared under the "lead supervision" of Department of the Interior personnel, with private consultants, was submitted to the Congress on December 8, 1975, accompanying a letter report by the Secretary submitted pursuant to Public Law 93–153, the "Trans-Alaskan Oil Pipeline Authorization Act." This study, entitled "Alaskan Natural Gas Transportation Systems," contains chapters prepared by the Department of State on "United States-Canada Foreign Policy," the Department of the Treasury on "Financing Problems and Issues," and the Department of Defense on "National Security." The report is long and complex, and only a few comments will be offered here.

Included in the study is a section on what is called "Net National Economic Benefits," and almost all of the quantitative evaluations and conclusions are based on figures developed in calculating such "benefits." While the study shows that the "benefits" of an "Alaska-Canada" transportation system are greater than an "Alaskan LNG" system, without including any amounts for the very substantial additional benefits of the Alaska-Canada system in terms of the greater available natural gas imports from Canada, it nonetheless should be made clear from the outset that Arctic Gas believes the economic advantages of its proposed system over the proposed El Paso Alaska system are actually much greater than shown in the study. In considering that point while analyzing the study, it must be recognized that:

(1) The methods used to calculate "benefits" numbers are very specialized: they are not the methods normally used in the analysis of gas transmission systems, and contain many judgmental factors. They omit some entire categories of costs, including United States taxes.

(2) The benefit figures are all expressed in "present value terms" a dollar of benefits in a future year is not expressed as a dollar. Instead, it is "discounted back" to January 1, 1976, using a discount rate of 10%. Thus, all benefits appear numerically as very much smaller than they would on an actual year by year basis, either individually or in total.

(3) The study does not purport to be based on, or compare, the same pipeline systems proposed by the Arctic Gas Project and El Paso Alaska. Instead, different facilities were utilized.

The results of the above factors, plus the costing standards used, which Arctic Gas believes to be incorrect in substantial areas, produce some results which must be read with caution. The "base case" prepared in the study shows that the "Alaska-Canada" pipeline system in the study would have net national economic benefits of over $900,000,000 more than the "Alaska LNG" system in the study, which is more than 12% difference. But that is $900,000,000 as calculated on the discounted present value basis, which makes the figures much less than when expressed as year to year benefits. (In addition, the study also states that if the factor of greater availability of gas from Canada were added, using a price competitive with world oil at about $2 per Mcf. the net benefits of the "Alaska-Canada" system would be increased by approximately $2,350,000,000.[93]

In addition, as explained in the study, some items which are costs to the companies rendering transportation service and are thus costs to the consumer, are not included in the analysis, which decreases the costs of the LNG project.

A full cost to consumers calculation must utilize cost of service calculations. In Chapter VIII of this document, Arctic Gas has shown its cost of service savings to consumers to be several hundred millions of dollars per year, or several billion dollars over twenty years.

The DOI study presents a cost of service calculation, using its costs for its proposed system, and shows lower costs for the "Alaska-Canada" system deliveries to Chicago than for the "Alaska LNG" system deliveries to California. Those figures are thus not comparable, but the principal of the great difference

---

[93] In this respect, it should be noted that the present export price for natural gas from Canada is approximately $1.60 per Mcf rather than $2.00 and the DOI NNEB analysis discounts benefits and costs back to January 1, 1976. If the $1.60 export price had been used, the present additional benefit of the Alaska-Canada system would increase approximately another $1.5 billion.

between the amount of cost of service to consumers on a year to year basis, versus the discounted present value of the "benefits" calculated as the study does, can be illustrated by noting that the difference between the two transportation rates, at the 3.5 Bcf/d level of gas flow from Alaska shown in the study, amounts to a transportation cost for the "Alaska-Canada" system which is over $345,000,000 per year less than for the "Alaska LNG" system.[94] That is almost seven billion dollars over a twenty year period. This type of calculation would indicate a far greater economic advantage for "Alaska-Canada" than do the numbers in the "economic" benefit" analysis.

XVIII. THE ARCTIC GAS PROJECT GAVES BALANCE OF PAYMENT AND OTHER ECONOMIC BENEFITS TO THE UNITED STATES

The subject of the United States trade balance has been of increasing concern over recent years—particularly as the price of foreign oil has multiplied with incredible speed. The Arctic Gas Project will help the United States balance of trade in two ways.

First, the United States energy needs and supply status make it clear that the "balancing" source of energy which fills the gap left by deficiencies in domestic supply, is OPEC oil. Thus, a project to give the United States access to Alaskan gas will not only reduce our dependence upon a potentially unstable source, but will also cut the outflow of funds for foreign purchases.

To illustrate the magnitude of this effect, note that 3 billion cubic feet of gas per day from Alaska would be equivalent to about 500,000 barrels of oil per day. At $12 per barrel, this would amount to a reduction in imports of over $2 billion a year, with obvious beneficial results to our balance of trade and energy independence.

This advantage is shared by the Arctic Gas Project with other means of transporting Alaskan gas to American morkets, including an LNG tanker system. But the benefit from the Arctic Gas Project will be significantly higher, since it wastes less of the gas, and thus puts more energy on the market with which to displace OPEC oil.

There is another balance of payment benefit from the Arctic Gas Project which is not shared by other proposals. It is modest, compared to the first benefit discussed above, but Arctic Gas is moved to discuss it because it has incorrectly been claimed that the Arctic Gas Project would injure the United States in this regard.

This benefit relates to the direct and indirect balance of payments effects of expenditures for the construction and operation of the Arctic Gas Project itself (as opposed to the replacement of foreign energy discussed above). The key point is the inclusion of the indirect, as well as direct effects.

In summary, it is true that because the Arctic Gas Project includes a Canadian pipeline, a portion of the transportation cost paid by United States shippers, and thus consumers, will be paid to the Canadian company. This causes a balance of payments outflow. But to stop there is to be misleading in the extreme. The Canadian line will use United States goods, services and capital, which produce both positive and negative direct flows. And because Canada is such a large importer from the United States generally, the increase in overall Canadian economic activity which this project will cause will increase Canadian imports from the United States, with resultant positive balance of payment flows for the United States.

In a study made for Arctic Gas, the overall positive balance of payments effect of the Arctic Gas Project was estimated to be over three billion dollars over ten years. Although relatively small, in comparison to the huge United States economy, it is helpful, and completely refutes the claims that the Arctic Gas Project will hurt the United States balance of paymens picture.

Finally, not only will the greater gas deliveries by the Arctic Gas Project give the United States and additional balance of payments advantage over an LNG tanker project, but the effect of the Arctic Gas Project in producing and allowing more Canadian gas for the United States is also likely to be beneficial relative to balance of payments too.

The Arctic Gas Project will also produce a favorable overall economic impact on employment and output in the United States economy. The four United

---

[94] This amount was obtained by multiplying the difference between $1.09 and $1.33 per million Btu's or $0.24 x (3.5 Bcf/d multiplied by 1124.5 Btu per cu. ft.) x 365.25.

States components of the Arctic Gas Project, plus the United States portion of the Canadian segment, are estimated at several billion dollars. To this is added the induced results from the effect on the Canadian economy. Clearly then, the Project will produce a substantial stimulus to the United States economy through increased business activity and employment in Alaska and in the contiguous 48 States.

On balance, it is clear that the Arctic Gas Project will provide great benefits to the United States economy.

XIX. THE DESIRABILITY OF PROMPT APPROVAL OF THE ARCTIC GAS PROJECT

The critical need of the United States for the available supplies of Alaskan natural gas is described in other sections of this document, as are the substantial benefits to the economy of the nation which will results not only from the increased domestic energy supplies, but also from the employment and other economic stimulation resulting from the construction and operation of the huge pipeline project. It is obvious that it is desirable to secure these benefits as promptly as possible.

The amounts of Alaskan gas initially to be made available to the United States will allow importation of about two billion dollars per year of OPEC oil less than would be needed without that gas, and the opportunity to reduce that dependence on OPEC is also needed by the nation as soon as possible.

Finally, the history of inflation has been clear; costs have increased substantially over the years. Accordingly, each delay in the construction of the Arctic Gas Project means an increase in the cost of constructing that Project. And increased capital costs mean a substantial increase each year in the cost of transportation service to the consumer. Translated into total dollars, that means that if a year delay in the Project saw an inflationary increase, of say, about an 8% increase in total cost, there would be a capital cost increase of about $700,000,000, with resultant increased cost of transportation to consumers each year.

For the above reasons, the Arctic Gas Project believes that it is in the national interest to expedite the governmental approvals of its project as much as is possible, especially since such a large construction project cannot be put into operation instantly after approvals (albeit more promptly than a liquefaction-tanker system). After receipt of the major necessary governmental approvals and financing, it will take approximately four and one half years to complete construction to the Prudhoe Bay gas field, with completion to the Mackenzie Delta gas fields scheduled for a year earlier.

Under existing law, the two major governmental approvals required in advance by the Arctic Gas Project are those of the Federal Power Commission and the United States Department of the Interior (a liquefaction-tanker project must secure such approvals, and also those associated with maritime activities, including the location of installations on the Alaska and California coasts, for the liquefaction and regasification of the gas and for marine terminal activities).

The Arctic Gas Project has made the required application to the Department of the Interior. The Department has completed a Draft Environmental Impact Statement relative to the Project and has been expected to issue its Final Environmental Impact Statement in March, 1976. Thus, the Secretary of the Interior could render a decision, on the Arctic Gas Project application for right-of-way permits to cross Federal lands, by mid 1976. (In contrast, the liquefaction-tanker project has not filed an application with the Department of the Interior and declines to do so until, and if, it receives a Federal Power Commission certificate).

The Federal Power Commission comparative hearings have been under way since May, 1975 (following the Arctic Gas application of March, 1974.) Predictions as to when a Commission decision can be expected differ, from a December 1, 1976, prediction by the Commission to the latter part of 1977, or later. The former date was based on a schedule which did not include provision for some evidentiary steps in the process, and did not include time for petitions for rehearing and Commission action relative to such petitions. It also involved unprecedented short periods for the preparation of the decisions of the Administrative Law Judge and Commission (45 and 40 days respectively), and short periods for preparation of briefs.

Neither the late 1976 nor latter part of 1977 dates include time for court appeals. Appeals to the first level will take about 12 to 18 months, while 5 to 8 months will be added if Supreme Court review is sought and denied, or 12 to 18 months if Supreme Court review were granted.

Accordingly, it seems unlikely that approvals can be assured until 1979, or later, under present law.

S.2950, if enacted into law, would cause the issuance of all necessary Federal government authorizations to the Arctic Gas Project, within 60 days after enactment. It would also limit the basis for, and expedite, appeals. Accordingly, if such Bill were to be enacted by late summer, 1976, authorizations would be issued well before the end of 1976. Appeals might well be avoided, and if not, might be completed by mid-1977. Thus, an acceleration of two, to as much as four, years, as compared to present law, could be achieved by S.2950.

There has recently been introduced by request a bill (S.3167) which would change existing law, relative to a system to transport northern Alaskan gas, in a different way. That bill would direct the Federal Power Commission to "transmit a determination" on the pending proposals for the transportation of northern Alaska gas to the President by January 1, 1977. That, as noted above, would be a substantial acceleration of normal schedules. Other agencies selected by the President would be required to transmit to him, reports regarding the "alternative methods for delivering" such gas, by February 1, 1977. The President would then be empowered and directed to issue a decision, by August 1, 1977, as to "which system for transportation of Alaskan Natural gas, if any" shall be approved. Unless the Presidential decision does not become final "because of Congressional action" (type of action required is not specified) within 60 days after the decision is transmitted to the Congress, the Federal Power Commission then has 30 days to issue all necessary approvals, including the terms and conditions directed by the President. Other Federal officers and agents are directed to take other necessary action to authorize the transportation system, subject to later amendment; no time for such action is specified. If Congress were to disapprove the Presidential decision, submittal of the same or new decision is authorized.

On the basis of the above provisions, Federal Power Commission approvals would be anticipated by November, 1977, assuming no Congressional disapproval of the Presidential decision. Other agency approvals seems to be contemplated, but not mandated, by such date.

However, as noted earlier, a Federal Power Commission decision is expected under existing law by November, 1977 or earlier, and other agencies can act well before that. Thus, it is quite possible—perhaps likely—that S.3167 would not accelerate, but would somewhat slow, the expected schedule for decision under existing law. It would also be well over a year longer than that achievable under S.2950.

COMPARATIVE POTENTIAL SCHEDULES FOR APPROVAL OF A NORTH ALASKAN GAS TRANSPORTATION SYSTEM

[Assumes enactment of S. 2950 or Administration Bill on Aug. 1, 1976]

	Federal Power Commission decision	Department of Interior and other agency action	Presidential decision	Congressional action	Subsequent FPC and other agency action	Court Appeals completion [1]
Under existing law.	July 1977	Late 1976 and after.	None	None	None—was completed July 1977.	Late 1978 to late 1979.
Under administration bill.	Initially Jan. 1, 1977.	Initially Feb. 1, 1977.	Aug. 1, 1977.	Oct. 1, 1977	Nov. 1, 1977 (but much later if there were congressional disapproval of presidential decision).	Greater possibility of no appeal—if any, early to mid 1978.
Under S. 2950	Oct. 1, 1976	Oct. 1, 1976, or earlier.	None	None—was completed in 1976.	None—was completed October 1976.	Greater possibility of no appeal—if any, early to mid 1977.

[1] Later if Supreme Court grants review.

Those conclusions do not include consideration of the time required for appeal. S.3167 contains a review provision generally similar to that of S.2950, which would consolidate, limit the grounds for, and accelerate, appeals. Such provisions would shorten the time for appeals, as compared to present law, and would possibly eliminate appeal.

Accordingly, the overall scheduling summary of S.3167 is that it would probably shorten the overall time schedule, as compared to existing law, but only because the appeal provisions of the bill are more likely to shorten the time more than the Presidential decision provisions would lengthen it. S.2950, on the other hand, would achieve the same appeal benefits, and could also shorten the pre-appeal time by about a year.

APPENDIX A -- DESCRIPTION OF ARCTIC TEST FACILITIES AND ASSOCIATED RESEARCH PROGRAMS, AND ENVIRONMENTAL FIELD PROGRAMS

ENVIRONMENTAL FIELD PROGRAMS

Since 1971, Northern Engineering Services, Ltd. has, at the request of the Applicant, managed a wide variety of continuing environmental programs designed to provide the information necessary for a valid environmental assessment of the proposed gas pipeline in northeastern Alaska and northwestern Canada. As no specific route had been determined when the programs began, the studies were designed to provide a maximum amount of information over several possible alternatives. The scope of this work was necessarily very large, due to the lack of previous study in the area, in many fields, and the limited nature of previous study in all fields.

The following sections identify and describe many of the studies which have been initiated during this period.

Results of these studies, plus the literature available prior to and during the time of the studies, were used in the planning of the proposed pipeline and in the environmental assessment represented by this report.

Vegetation

The main thrust of the preliminary field effort in this area has been to classify the landscape of the Arctic Slope of Alaska into ecologically significant vegetation-terrain units.

The specific objectives of this research were:

(1) To establish a framework of vegetation patterns and relationships from which impact considerations could be evaluated.

(2) To characterize terrain types according to present plant cover and associated terrain features, which can be important in revegetation programs.

(3) To indicate some of the problem areas on the pipeline route and, where possible, make recommendations regarding terrain stability.

(4) To determine the growth characteristics of plant communities in order to predict their response to natural disturbance.

(5) To provide zoologists with a vegetation classification for purposes of identifying animal habitats.

BASELINE STUDIES

Both extensive and intensive sampling programs were conducted during the 1972 and 1973 growing season within each of the physiographic regions of the Arctic Slope, the Arctic Coastal Plain, Arctic Foothills, Brooks Range and Porcupine Plateau physiographic provinces of Alaska (Appendix Figure 1). Extensive sampling involved those characteristics that do not change dramatically during the year and included site characteristics, vegetation composition and attributes, and soil profile descriptions. For this reason, the study did not begin in each year until the deciduous components of the vegetation had reached maximum leaf size and was terminated when the leaves fell. Sampling began in the southern part of the study area, at low elevations in the riparian vegetation. From there, the study progressed to the higher mountains and north-facing slopes as the season progressed.

The intensive studies were conducted in late July and August in areas of representative plant communities, within each of the physiographic regions. Measurements of parameters that were known to change during each season, including active layer depth and percent soil moisture, were taken during these periods, to make valid comparisons among community types.

These studies also serve to gather and organize some pertinent data, such as notes on fire and fire effects on terrain stability, rate and character of succession following disturbances, and characteristics and extent of ice-rich organic terrain.

REVEGETATION

A major objective of the vegetation studies has been to prepare a program for the revegetation of all land surfaces disturbed by pipeline construction and related activities. The native vegetative cover in the north is an important factor in maintaining soil stability and soil temperature regimes. In order to maintain terrain stability, to prevent soil erosion and to protect the pipeline, a plant cover must be quickly restored when disturbed or removed. This program has tested the feasibility of restoring a binding plant cover on simulated pipeline test sections in northern Alaska and Canada.

The basic approach to solving the problem of revegetation was to establish experimental plots at five different locations in the north. These test areas were established at Prudhoe Bay, Alaska, and at Norman Wells, Sans Sault Rapids, Inuvik and Tuktoyaktuk (Appendix Figure 2) in the Northwest Territories, to determine the suitability of available agricultural grass, cereal or legume varieties for revegetation. The findings of these studies form the basis of restoration programs specified for the proposed alignment. Twenty-seven species were tested at Norman Wells, Inuvik and Tuktoyaktuk. Twenty-three species were tested in revegetation trials at Sans Sault Rapids; many species were also tested at the Prudhoe Bay Test Facility. The major trials at San Sault Rapids were established on the backfill mound of four fully buried, chilled test sections of 48' gas pipeline. Test plots were also established on a disturbed winter road and on an eroding seismic line.

This research is continuing in Alaska and Canada. An example of the continuing research is the program started in 1973 to determine the feasibility of increasing the seed of the native grasses bluejoint (Calamagrostis canadensis) and polargrass (Arctogrostis latifolia) on an agricultural scale for inclusion in the seed mix.

In order to grow the various species, it was necessary to determine the fertilizer requirements for successful establishment and continued healthy growth of the grass cover. These studies are continuing, since additional long-term growth data are important.

The general findings of the revegetation studies include a determination of the varieties of available agronomic grasses, cereals and legumes which will successfully grow in Arctic ahd sub-Arctic regions, and their fertilizer requirements. As these studies have been underway since 1970 and 1971, the overwintering ability of these species has also been determined.

IMPACT STUDIES

TEST FACILITIES

As a portion of the engineering and biological testing which was undertaken at the test facilities, extensive studies were made concerning the effects of various ditching and backfilling techniques on the natural environment of the facility. The objective of these studies was to investigate, in a comprehensive and systematic way, the environmental and ecological changes that occur in association with simulated construction and operation of a gas-pipeline facility in the far north. In addition to the identification and characterization of the sources of impacts, studies emphasized the following categories of environmental components likely to respond to construction and operational influences:

(1) Physical and chemical characteristics of soil and water.
(2) Biological conditions in the adjacent terrestrial and aquatic environments.
(3) Environmental utilization by birds and mammals.
(4) The suitability of newly created environments to vegetative trials and establishment by [illegible] and soil organisms.
(5) The effect of local alternatives to the above.

Mammals

CARIBOU BASELINE STUDIES

The primary objective of the Alaskan Caribou studies was to gather baseline information on the numbers, distribution and movements of caribou associated with the pipeline route alternatives. Additionally, concurrent studies of the Porcupine Herd in Alaska with those in Canada would enable monitoring of this herd throughout its range. Specific objectives of the study were:

(1) To determine the population size of the Porcupine Caribou Herd in Alaska.
(2) To delineate winter ranges of the caribou in northeastern Alaska.
(3) To determine migratory routes used during the spring and fall by the Porcupine Caribou Herd in Alaska, the timing of migration and the approximate numbers of animals using various migratory routes.
(4) To locate and delineate calving area(s).
(5) To determine summer movements and summering areas utilized by the Porcupine Caribou Herd in Alaska.
(6) To obtain data, whenever possible, on other major mammal species within the study area which may be affected by a pipeline.

MOOSE-SHEEP-MUSKOX BASELINE STUDIES

During the course of the Alaskan caribou surveys, other ungulate species were often observed. These species include moose (*Alces alces*), Dall sheep (*Ovis dalli*) and muskox (*Ovibos moschatus*). Since the primary objectives of the survey flights were to locate caribou and monitor caribou movements, distribution data on other species are often irregular and generally biased by caribou distribution.

Data were obtained from survey flights in fixed-wing aircraft. During survey flights, individual animals or small aggregations were undoubtedly missed. However if moose, sheep, or their sign were readily evident in a given area, time was often taken to explore the immediate locale.

In the case of moose, observations were usually obtained while flying surveys along drainage systems. Some attempts were made to census moose along rivers or creeks where fresh sign was evident and observation conditions were optimum, due to snow conditions and lack of dense vegetation. In areas where vegetation was dense, particularly spruce forests in the valleys south of the Brooks Range, no effort was made to thoroughly search for moose. Stratification of habitat and a system of quadrat flying would be required in those areas.

Many sheep observations were made on clear days during overflights of the Brooks Range. Sheep were often encountered while flying mountain valleys and slopes, looking for caribou wintering or migrating at high altitudes. In areas where sheep appeared to be concentrated, an effort was made to fly along the valley sides at higher altitudes to census them.

In early spring surveys, all observations of moose and sheep were recorded. During the summers, caribou aggregations and movements were of major concern and the nature of the survey flight limited the number of observations of moose and sheep. However, because previous information showed a scarcity of moose on the North Slope between the Canning River and the Alaskan border, all moose sighted in this area during the summer months were noted. During fall seasons all moose and sheep observations were again recorded.

Muskox, recently re-introduced to Alaska's North Slope, were constantly watched for during survey flights. These animals were carefully noted throughout the study period.

Additional data were obtained from other biological survey teams operating in northern Alaska. Observations of moose, sheep and muskox were contributed by personnel of the Alaska Department of Fish and Game, the United States Bureau of Sport Fisheries and Wildlife and other survey crews employed by the Applicant in other environmental disciplines. Those data were compiled, and have been added to those collected during the caribou surveys.

FURBEARER BASELINE STUDIES

Known terrestrial species of northeast Alaska include Arctic fox (*Alopex lagopus*), coloured fox (*Vulpes fulba*), timber wolf (*Canis lupus*), wolverine (*Gulo luscus*), marten (*Martes americana*), lynx (*Lynx canadensis*) and ermine (*Mustela erminea*). Black bear (*Euarctos americanus*) and grizzly bear (*Ursus arctos*) were also included in the study. Aquatic and semi-aquatic furbearers included beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), otter (*Lutra canadensis*) and mink (*Mustela vison*).

Throughout the study, emphasis was placed on distribution of habitat and populations upon which the various aspects of pipeline construction, such as alignment, timing and methods might impinge. Emphasis was also placed on key species, such as fox and grizzly bear, which were assumed to be most sensitive to disturbance because of denning habits and behaviour. Observations of other furbearer species were, however, recorded. Field investigations which continued throughout the growing season included aerial and ground surveys of various species and habitats.

Basic objectives of the study of furbearers include:

(1) To delineate and evaluate furbearer habitat associated with the proposed pipeline route and the alternatives.
(2) To describe and assess the status, distribution and values of key furbearer species associated with the proposed and alternative routes.
(3) To obtain additional baseline ecological data concerning furbearer species.
(4) To assess potential impacts of pipeline construction and maintenance on furbearer habitat

and populations.
(5) To identify means by which impacts may be avoided, minimized or ameliorated.

MAMMAL DISTURBANCE STUDIES

The transportation of gas through the proposed Arctic pipeline requires compressor stations at approximately 50-mile intervals along the route, when the line is made capable of carrying its full capacity. This is not expected to occur soon in Alaska, and authorization to construct compressor stations in Alaska is not now sought. However, the Applicant may seek such authorization later, in which case there could be several compressor station sites in the range of the Porcupine Caribou Herd, in Alaska. In addition, there will be compressor stations in Canada, initially, with more to be built when the line expands. Caribou could potentially encounter every proposed compressor station site in Alaska and the Yukon, and a number in the Northwest Territories, during each stage of their annual activity cycle.

One characteristic of compressor stations which prompts environmental concern is the noise generated by the gas turbines and flowing gas. Accordingly, studies of disturbance of caribou and Dall sheep by sound sources simulating compressor stations were conducted. The scope of these studies included only the consideration of the effects of the maximum sound produced by a gas compressor station, since the apparatus used to simulate sound of a compressor station reproduced the noise made by a compressor which does not have sound attenuation equipment.

Five separate experiments were carried out on caribou and one on the Mount Goodenough (Yukon) Dall sheep population.

The objectives of the study were:

(1) To assess qualitatively the nature of responses of caribou and Dall sheep to simulated gas compressor station noise. This involved consideration of how this noise affects movements, habitat utilization, daily activity patterns and social interactions, if at all.

(2) To determine quantitatively the extent of deviation within the aforementioned behavioural patterns that occurs between experimental and control conditions. The determination of a threshold for disturbance behaviour in terms of distance from the sound source was included in this objective.

(3) To assess the effect of variables which may influence the expression of disturbance behaviour. These include:
- (a) changes in season and seasonal activity;
- (b) climatic variables;
- (c) size of caribou groups;
- (d) sex and age of animals;
- (e) activity of animals;
- (f) activity of groups;
- (g) physical habitat types;
- (h) predators and parasites;
- (i) extraneous disturbance;

(4) To determine the significance, if any, of noise disturbance on individual animals, and the population, through analysis of the results of the study.

(5) To apply the above objectives to animals other than Dall sheep and caribou, when these were found in the study area.

(6) To make recommendations concerning the location of compressor station sites, and sound attenuation requirements at compressor stations.

In addition to the compressor station simulation studies, it was deemed necessary to study the possibility of deflection of caribou along a pipeline right-of-way.

Several indications that caribou are prone to deflection have been documented. The tendency of caribou to follow natural corridors, such as rivers, lakes and ridges, coupled with observations in 1971 of caribou making extensive use of cutlines and winter roads, suggested that this area should be studied. As a result, an experimental program was designed to establish means of discouraging such a deflection, and to investigate factors relating to deflection.

The objectives of the deflection study were as follows:

(1) To obtain information on the extent of use of cutlines and winter roads, and deflection along them.
(2) To identify differences between corridors followed, and those not followed, by caribou.
(3) If necessary, to test methods of preventing deflection along corridors.

The first two objectives were pursued in March, 1971, while animals were still on winter range, and in May, when the spring migration was under way. The accomplishment of the third objective constituted a separate study, which consisted of observations of effects of 100 ft. of standard snow-fencing erected so that it was oriented perpendicularly to the direction of caribou movement.

Additional mammalian disturbance studies included the reaction of major species to both fixed and rotary winged aircraft. Experiments varied the altitude, distance and duration of the stresses, recording the behavioural reaction of the test species. Many of these experiments were carried out as a part of the bird disturbance studies.

Birds

BIRD BASELINE STUDIES

The information obtained from the ornithological studies can be classified into three major types: (a) inventory of birdlife found along the pipeline route, (b) bird habitat, and (c) reactions of birds to disturbances. Studies of birds resulted in information about basic life histories of species along the pipeline route. Data were collected concerning the timing, location and numbers of birds involved in the life processes of breeding, nesting, moulting and pre-migratory staging.

Observations of spring and fall migrations provided data on the timing of north-south and east-west movements of a variety of bird species. These studies indicated the distribution of birds during the movement, as well as the areas where staging or concentration occur. This information is useful in planning the location of project facilities and in scheduling construction and operating and maintenace activities to avoid areas of intensive use as much as possible.

The surveys provided information on the distribution as well as the use and importance of various habitats in the life cycles of various species, particularly waterfowl. These data are useful in forecasting the effects of habitat loss on the overall population of a species. Particular emphasis was given to prime waterfowl habitat.

Transects through various habitat types along the pipeline route provided a habitat classification, as well as an index of the number of birds using that type. From these data, the relative importance of the various habitats, in terms of numbers and kinds of birds they support, may be assessed. These quantitative baseline data are the basis upon which a long-term monitoring program could be developed to assess changes caused by pipeline construction and operation.

BIRD DISTURBANCE STUDIES

Experimental studies were designed to simulate actual disturbances associated with pipeline development. Locations of studies are indicated on Appendix Figure 3. These included the use of aircraft and the simulation of the sound of a gas compressor station. Other studies involved disturbances caused by human presence. Birds were subjected to these disturbances and their reactions or behaviour documented. The results were used in predicting the impact of activities, and providing information for project planning to limit disturbance to the lowest possible level.

GAS STATION SIMULATOR DISTURBANCE TO TERRESTRIAL BREEDING BIRDS

A machine built to electronically simulate the noise of a 40,000 hp gas compressor station was set up at the Babbage River in the Yukon, close to the proposed right-of-way, for six weeks beginning the first of June, 1972. Three experimental and three control plots, each measuring 250 x 500 yards, were established and the birdlife on each was censused throughout the breeding season. The machine was left running near the experimental plots.

Factors such as population, number of nests, number of young, prenatal and postnatal mortality, and fledgling success were tallied and compared on the experimental and control plots. Although data were collected on all species on the plots, only the Lapland longspur was sufficiently numerous to allow statistical analysis of the results.

COMPRESSOR SIMULATOR DISTURBANCE TO SNOW GEESE.

This experiment was designed to test the effects that gas compressor station noise would have on the movements and behaviour of snow geese in pre-migratory staging area. The noise simulator was set up in an experimental area on the North Slope, and a similar control area (with no simulator) was established nearby. Decoys were placed on both areas and the behaviour of snow geese approaching the decoys was noted on each area. The experimental plot was sampled with the simulator both on (producing noise) and off.

DISTURBANCE STUDIES OF TERRESTRIAL BREEDING BIRD POPULATIONS

These studies attempted to assess the disturbances to tundra-breeding birds created by a camp and aircraft (helicopters).

A tent camp was established near MacNeish Lake on the Yukon North Slope. Three experimental and three control plots were established; the experimental plots were near the camp while the control plots were in similar habitat, but away from the camp disturbance zone.

The aircraft disturbance plots were set up similarly: three of the plots were disturbed periodically by low-flying helicopters. Species and numbers, numbers of nests, numbers of young, prenatal and postnatal mortality, and fledgling success were counted throughout the breeding season on both experimental and control plots. The Lapland longspur was the principal species. This, and the preceding experiments, provided information about the short-term effects of disturbances upon reproductive activities of birds in these areas.

DISTURBANCE STUDIES OF COLONIALLY BREEDING BIRDS ALONG THE NORTH COAST BARRIER BEACHES

This study was carried out in the vicinity of Nunaluk Spit and Phillip's Bay, Yukon Territory, at small nesting colonies of common eiders, Arctic terns, glaucous gulls and Pacific brant, located on coastal islands. These breeding colonies are in the path of coastal aircraft traffic, which is expected to increase with the inception of pipeline activities.

The purpose of the study was to assess the effects of aircraft overflights on the nesting behaviour of the four species involved, and to determine flight altitudes which would not disturb the birds.

The procedure involved marking individual nests, observing undisturbed bird behaviour and then flying over the nesting birds at varying altitudes. Both helicopters and fixed-wing aircraft (Cessna 185) were used. Behaviour of birds and egg-hatching success were recorded.

EFFECTS OF DISTURBANCE BY AIRCRAFT ON WATERFOWL ON COASTAL PLAIN LAKES

This study was designed to test the effects of float-equipped aircraft on populations of waterfowl occupying the small ponds and thaw lakes of the coastal plain during the breeding season. These small bodies of water are the only suitable habitats for many species and are important as breeding and moulting areas.

Two control lakes (one large and one small), two experimental lakes (one large and one small) and one intermediate-sized lake, were chosen for the study. Baseline data of species, numbers and behaviour of birds present on each lake were first obtained. The experimental lakes were then disturbed at hourly intervals on four consecutive days by a Cessna 185 aircraft landing, taxiing for 5 minutes, and taking off. The reactions of birds to each disturbance were recorded.

AIRCRAFT DISTURBANCE ON MOLTING SEA DUCKS

Large numbers of waterfowl (especially sea ducks) undergo their flightless molting stage on the North Slope and in adjacent coastal areas.

This is an important phase of their life history, requiring an area safe from predators and with a dependable food supply. The coastal estuaries provide both.

To study the effects of a helicopter on these ducks, observers were positioned on Herschel Island to record, on the first day, the species, numbers and behaviour of birds in undisturbed conditions. On the second day, the birds were disturbed by successively lower overflights by a helicopter to determine the altitude of 100 percent disturbance. On the third day the birds were subjected to intense overflights at a low altitude in an attempt to drive them from the area. The birds' reactions to these disturbances were recorded.

TEST FACILITIES

AIRCRAFT DISTURBANCE ON SNOW GEESE

The Arctic Coastal Plain is an important pre-migratory feeding area for snow geese. The effects on these birds of disturbance by aircraft were studied in two ways. The first was designed to assess the reaction of snow geese to overflights of light aircraft at varying altitudes, while the second was designed to determine whether snow geese could be driven from an area by hazing with an aircraft.

The reaction of geese to overflights was measured by flying a Cessna 185 at varying altitudes over flocks of resting geese and recording their behaviour.

To determine if geese could be driven from an area by hazing, an experimental area and a control area were selected. The number of flocks and the number of geese were counted on each area and then the experimental area was intensely hazed by a low-flying Cessna 185. Finally the number of flocks, and number of geese were again counted on both the control and experimental areas.

Aquatic Biology

BASELINE STUDIES

Fisheries work related to the construction and operation of the proposed route and the alternative Interior corridor began in April, 1972 and is continuing. Baseline studies have and will continue to emphasize:

(1) species composition and distribution
(2) life history studies, including growth rates, age at maturation, fecundity, spawning period and food habits
(3) seasonal movements of Arctic char and grayling
(4) location of spawning and overwintering areas
(5) systematics of Arctic fish population.

Species composition and distribution of fish were determined by a variety of sampling methods: seine, gillnet, dipnet, angling, ice-jigging, electro-shocking and fish weir. Emphasis was placed on (a) those lakes and stream sections in the vicinity of the pipeline routes and (b) distributions in entire drainages, crossed by the proposed or alternative corridors. These surveys will be continued in 1974.

Life history information was gathered for most fish species. These studies have provided important information about arctic fish that was not previously available. For example age determinations were made to characterize the age structure of the population, growth rates and age at maturation. Dissection data provide information about seasonal food habits, spawning periods and fecundities.

Fish weirs were established on tributaries of the Kavik and Canning Rivers to study seasonal movements and abundance of Arctic char and grayling. The weirs were maintained from June to September in 1973. Additional information about the movements of these species has been obtained through tagging programs.

In view of the proposed winter construction schedule for the pipeline, the spawning and overwintering habitats of Arctic char have been investigated in detail. During the early and late winter months, aerial and ground surveys were conducted along the streams traversed by the pipeline route to locate those areas which are critical for the maintenance of arctic fish populations.

Studies of the systematics of arctic fishes, primarily Arctic char, have also been carried out. Analysis of meristic and electrophoretic characteristics of anadromous, stream-resident and lake-resident char have aided taxonomic and life history studies.

As part of the baseline aquatic biology program, studies of stream-dwelling benthic invertebrates were also initiated. There are two important reasons for these studies: first, these organisms form a major portion of the foods eaten by fish, and second, they may provide an additional and more immediate assessment of environmental disturbance in the aquatic habitat than do fish. General surveys have been conducted as well as more detailed studies of seasonal variation and selected sampling locations.

Chemical and physical parameters of arctic waters were routinely analyzed during general surveys and at selected sites where more detailed studies were conducted.

IMPACT STUDIES

Several studies are underway which are designed to indicate the tolerance of important fish species to various stresses.

Investigations have been conducted to establish the tolerance of Arctic char and Arctic grayling to methanol and reduced dissolved oxygen concentrations. These data are appropriate due to the possibility that (a) methanol will be used as an antifreeze during hydrostatic testing, and (b) reduced dissolved oxygen levels in fish habitats may be coincident with siltation and/or fertilizer influx.

TEST FACILITIES

ARCTIC TEST FACILITIES AND ASSOCIATED RESEARCH PROGRAMS

1. Introduction

It was recognized at an early stage in the planning of a gas pipeline from the Arctic coast through the permafrost areas of Alaska and Canada that the development, refinement and substantiation of the proposed design, construction and operation methods required the construction and operation of extensive pipeline test facilities in the continuous and discontinuous permafrost zones. It was further realized at this early stage that ground temperature and meteorological data were required from as many sites as possible along the proposed route in the permafrost zone.

The overall objective of the research programs at the test facilities and remote ground temperature measurement sites was to develop information necessary for the engineering design of a safe, reliable pipeline through permafrost areas, with minimal change to the environment. As far as possible, these facilities were constructed using established pipeline construction methods so that the experimental test sections represented pipeline performance and environmental influence.

Three locations were selected for construction of the pipeline test facilities: Prudhoe Bay in Alaska and Sans Sault Rapids and Norman Wells, N.W.T., in Canada. Since the results of tests and studies at the Canadian site are valid for parts of the pipeline in Alaska, description of that site is included in this exhibit. The Alaskan facility is in the continuous permafrost zone: the Canadian sites are in the discontinuous zone. In addition, temperature sensor strings were installed at over one hundred sites along the pipeline route.

The test facility sites were carefully selected to provide ground conditions which were representative of considerable lengths of the proposed route. It was recognized, however, that the pipeline would encounter terrain, weather, soil and ecological conditions which would differ from those represented by a selected test-site location. Since it was not possible to study all the various thermal conditions anticipated directly, a thermal prediction computer program was developed and another purchased, and both tested to permit evaluation of virtually any combination of conditions. Thermal data obtained from the test facilities and at the ground temperature measurement sites provided the major input during development and verification of these computer programs.

A pipeline and associated facilities in the Arctic and sub-Arctic permafrost regions will influence the thermal regime. The thermal balance between the ground surface and atmosphere is affected by disturbance of the soil surface. Disturbance will be both direct, in the form of removal, displacement, or compaction of the organic cover at the ground surface, and indirect in alteration of characteristics such as snow cover, snow drifting, or drainage patterns.

The disturbance of the ground thermal regime in permafrost areas by pipeline construction and operation will not cause problems in the more stable granular soils which do not contain excess ice. In ice-rich fine-grained soils, thawing can, depending on drainage conditions, lead to settlement or instability of the backfill or right-of-way, particularly on slopes. The integrity of the pipeline, is thus dependent upon the mechanical properties of the soils encountered and especially on the changes in these properties caused by the altered thermal regime, which results from pipeline construction and operation.

Analyses of the conditions resulting from pipeline construction and operation under Arctic and sub-Arctic conditions were therefore considered essential to provide information upon which a safe, reliable, and environmentally acceptable pipeline design could be developed. Various construction techniques and pipeline designs were incorporated into the facilites to assess their performance and acceptability for the actual pipeline.

This section deals mainly with the engineering aspects of the test facilities. Comment on environmental aspects of the studies has been limited to those parts of the vegetation and revegetation studies which are most closely related to engineering design.

In addition to the test facility studies, other field programs were initiated at an early stage to survey the Arctic areas in order to assess, characterize, and obtain data on soil conditions, terrain, weather, and environmental conditions along the projected pipeline route. These programs complemented the research work conducted at the test facilities. The results are discussed elsewhere in the exhibit.

2. Objectives, Results and Applications

As previously stated, the overall objective of the research programs at the pipeline test facilites and remote ground temperature measurement sites was to develop information necessary for the engineering design of a safe, reliable pipeline through permafrost areas with minimal envrironmental disruption.

A more detailed description of the program objectives, results and applications follows. Most of these objectives were common to all three test facilities, but where a particular type of study was not carried out at a facility, this has been noted.

Most of the objectives of the studies carried out at the test facilities have been grouped under the heading of geotechnical.

The pipeline geotechnical interaction with permafrost a result of geothermal changes, strongly influences the design, operating temperatures and maintenance procedures adopted. The actual construction techniques used for excavation of the ditch and placing the pipe in permafrost areas are relatively conventional, so that such construction studies formed a small part of the work carried out at the test facilities. Snow and ice road construction techniques were studied in some detail, but this is reported under the geotechnical studies.

Environmental studies formed a very important part of the work carried out at the test facilities.

The research programs are summarized below.

Geothermal and Meteorological Studies

a) Objectives

The primary objective of these studies was to obtain and analyze surface and subsurface thermal data and meteorological data for development and/or verification of the two computerized thermal programs used to predict the ground thermal regime for any given conditions of construction and operation of the pipeline.

Results and Applications

The two computerized thermal programs used have been verified by comparing their predictions with the ground temperature measurements obtained throughout the operation of the three test facilities, together with those measurements obtained from some seventy of the remote sites for ground temperature measurement.

The predictions of overall temperature characteristics in the region of influence of the pipes, for both steady conditions and for the tests where the pipe temperature was cycled, are within the accuracy required for design. The active layer depths, pipe heat flux and temperature trends were also adequately predicted.

These successful thermal predictions utilized available regional meteorological data, such as that acquired at the test facilities, to establish the energy exchange between the atmosphere and ground surface. The other data required for geothermal prediction are ground information. These data are obtained through terrain typing, borehole information and the literature. Also, selected samples from the test sites were tested in the laboratory to provide additional data on the thermal properties of permafrost soils.

It is therefore confirmed that the thermal programs are viable tools and that the input parameters are realistic for use in the design of a safe, reliable pipeline system.

b) Objectives

Other important objectives were to obtain and analyze thermal and meteorological data in order to assist in developing and using a computerized program to predict the pipeline temperature profile required for system analysis.

Results and Application

The data obtained on ground temperatures, air temperatures and energy exchange between the air and ground and the pipe and ground provided basic input data to the computerized program to predict the pipeline temperature profile.

Geotechnical Studies

DITCH, BACKFILL AND PIPE STABILITY

Conventional and new design and operation methods were used for the test pipes. Both full ditch and grade construction were evaluated, and chilled and warm pipe temperatures were used. Data were obtained in the vicinity of the ditch.

a) Objective

To evaluate the stability of the pipe, backfill (both in the ditch and mounded over the pipe) and permafrost during the inactive period following construction and prior to pipeline operation.

Results and Application

Ground temperature measurements and surface probing showed that the depth of thaw in the ditch during the period (late winter and summer) prior to the pipes going into operation did not extend much below the top of the pipes at Prudhoe Bay or Sans Sault. At Norman Wells, which was constructed in late winter, thawing to the bottom of the ditch occurred. Spring run-off became locally concentrated and flowed into some of the ditches at Norman Wells.

These results indicated that with the colder ground temperatures in the continuous permafrost zone (Prudhoe Bay), the combined effects of late winter construction and spring run-off did not necessarily result in deep thawing in the ditch. At Sans Sault, which is in the discontinuous permafrost zone, even with the relatively warmer ground temperatures, mid-winter construction did not result in deep thawing in the ditch prior to operation of the facility in early summer. In contrast, late winter construction in the discontinuous permafrost zone (Norman Wells) can cause deep thawing, which may result in buoyancy of the pipe under certain spring run-off conditions.

No significant movement of any of the buried active pipes prior to operation or during chilled operation has occurred, except one active section at Norman Wells where buoyancy due to uplift on the plenum chamber attached to the pipe occurred prior to pipe operation during spring run-off. No instability of any buried inactive test pipes, some of which were located in particularly wet areas, occurred. The depth of cover was 2.5 feet at Prudhoe Bay and Norman Wells and between 3 and 3.5 feet at Sans Sault.

Controlled partial flooding of the ditch to inhibit buoyancy was carried out at Sans Sault during winter construction. Since the lower part of the ditch remained frozen prior to pipeline operation and thus the pipe remained stable, this is a viable technique which could be used in the continuous and in the northern part of the discontinuous permafrost zones.

Two of the seven inactive test pipes were installed on ice-rich slopes at Sans Sault (see Appendix Figure 1). One section is on a 28 percent slope. A shallow flow slide centred around the lower half of the section occurred after a heavy rainfall in July of the first summer after installation. The maximum depth of the slide was six feet. Erosion subsequently considerably worsened the condition. Another section is on a 12 percent slope. Some erosion occured after the backfill had thawed and settled the first summer. No pipe movements were recorded at either site. This illustrates the importance of the drainage and erosion control measures, which would have prevented instability.

Considerable slumping of ice-rich backfill (particularly on south-facing slopes of above ground backfill) occurred prior to the pipes going into operation although there was a tendency to form a surface crust on the ice-rich fill above ground, which assisted its stability. Thus, any design configuration built in winter, particularly those using ice-rich soils, requires the placement of sufficient material to provide the design minimum depth of cover after thawing. Gravel backfill was stable on thawing.

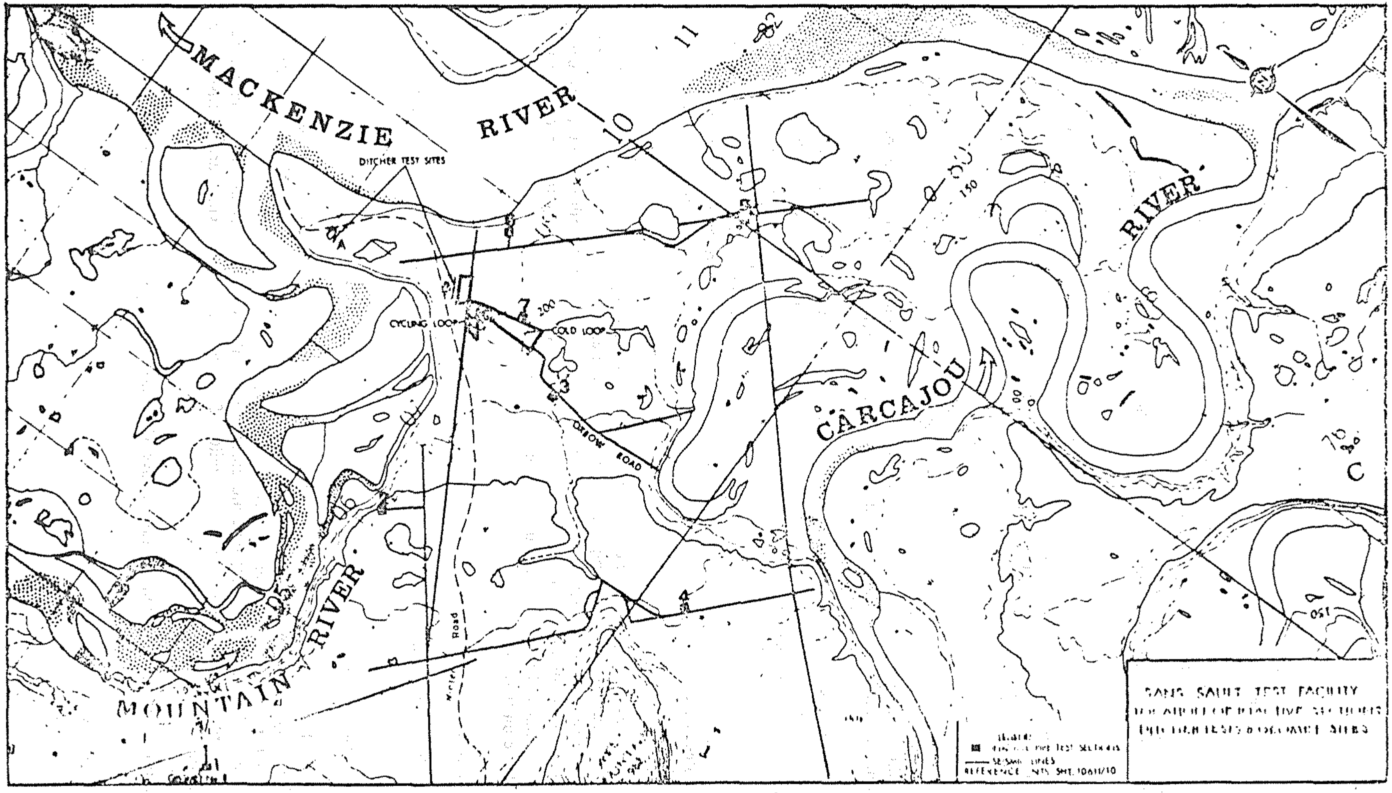
b) Objective

To evaluate the geotechnical behaviour of the backfill materials and permafrost for various operating pipe temperatures.

Results and Applications

Analysis of the thermal data in the vicinity of the chilled pipes during operation showed that the backfill around the pipes remained frozen and attached to the permafrost in the ditch walls. In an actual gas pipeline, chilling the gas to below 32F will maintain the design integrity of the pipeline-soil system and prevent pipe movement. The stability of the backfill mound surface was increased by the chilled pipe, but the stability of the backfill mound with buried construction configuration was affected to a lesser degree.

Operation of the pipes at temperatures above 32F (maximum 65F) resulted in increased instability



APPENDIX FIGURE 1

of ice-rich backfill. Granular backfill (Prudhoe Bay) was more stable on thawing.

All the results confirmed the necessity of operating a chilled pipeline on ice-rich permafrost. The advantages of using more stable granular backfill was demonstrated, although granular fill causes somewhat deeper thawing.

At Norman Wells, particular attention was paid to verifying some of the geotechnical analysis methods used for design. It was found that:

- The rate of settlement on thawing was approximately proportional to the square root of time. One-dimensional thaw consolidation theory predicts this relationship.

- The modified Berggren equation for predicting the rate of movement of the thaw front below a warm pipeline is applicable.

- A reasonable first order settlement calculation can be made, based on field estimates of excess ice content. This estimate was generally conservative. It was very important that experienced personnel and good soil sampling techniques were used.

c) Objective

To determine the best pipeline operating and testing procedures by observing the effects on the permafrost and pipe of various operating temperatures, i.e. line temperature constant above or below 32F or effects of hot-cycling tests around a normally chilled pipeline.

Results and Applications

The hot cycling tests carried out on the active sections at all three test facilities, for periods between 2 and 24 days, demonstrated that thawing of the permafrost adjacent to the pipe will occur within a few hours if the temperature of the gas rises above 32F. For these tests a flowing air temperature of 41F to 44F was maintained. Thawing was most rapid during the summer but also occurred during the winter. Where the ice-rich backfill around and above the pipe thawed, and the water produced could not escape, the pipes became buoyant and moved upward. The amount of movement was limited either by mechanical restraints or by the frozen backfill over the pipes.

These tests confirmed that it is undesirable to allow the temperature of the chilled portion of the pipeline system to rise above 32F in permafrost areas for even short periods unless the backfill or applied restraints can resist buoyancy. The present design of the system is such that, if one or more refrigeration stations are temporarily out of service, the temperature of the pipeline will be maintained at less than 32F.

d) Objective

To determine the suitability of different techniques and plant species for use in revegetating disturbed land surfaces.

Results and Applications

Extensive revegetation studies were carried out at all facilities. Various types of vegetation, fertilizer and other techniques were employed on both buried and grade construction. Results were most encouraging over both active and inactive pipe sections.

The preservation of the insulating moss cover in sod form ahead of the ditching operation and subsequent replacement after backfilling was found to be very difficult at Sans Sault.

At Prudhoe Bay the wet sedge peat surface layer was used to cover backfill. The insulating qualities were demonstrated to be better than other types of fill, although revegetation by seeding was apparently inhibited.

RIGHT-OF-WAY AND WINTER ROADS

Objectives

In order to develop construction techniques, with particular emphasis on minimizing surface disturbance, various types of right-of-way preparation and snow and ice road construction were carried out. These methods were evaluated for their geothermal, geotechnical and environmental effects on surface and subsurface conditions.

Results and Applications

Methods of snow or snow-and-ice road construction and their effect on surface and subsurface conditions were investigated at all three test facilities during their construction. In addition, at Norman Wells a winter road test site was built and tested in March and April, 1973.

The general conclusion was that, with reasonably careful construction techniques to minimize disturbance to the organic cover, the effect of snow or ice roads on deepening the active layer was insignificant compared with normal variations in partially disturbed areas. The depth of the active layer was slightly increased at the two more southern test facilities, but no appreciable differences in thaw depth were measured at Prudhoe Bay.

At Norman Wells the total tonnage anticipated on a pipeline spread was simulated in the 1973 work. Lower limits of density for winter roads that would be structurally and environmentally acceptable were investigated. It was further concluded that on properly constructed winter roads the effect on the terrain is limited to that due to winter clearing and that the effect of winter clearing on the active layer is small.

At both Prudhoe Bay and Norman Wells it was found that the ice-capped snow road is the most easily constructed winter road that can withstand simulated pipeline construction traffic. Overall performance of this type of road was better than an ice road. This was supported by snow road construction at Sans Sault, where the vegetation was adequately protected, but there were construction problems due to hummocky terrain and the quality and quantity of snow required.

It was found that visual inspection is a practical method of regulating the use of a winter road in the spring.

OTHER STUDIES

Objectives

In order to obtain data on the installation and performance of piles in permafrost, stability of some 550 steel pipe piles was monitored at the Sans Sault facility.

TEST FACILITIES

A number of minor studies to investigate a variety of design aspects were carried out. At Norman Wells these studies included:

- tests to evaluate the capacity of grouted rod anchors in permafrost soils; and
- tests to determine the magnitude of adfreeze shear strength between frozen soil and a variety of pipe coatings.

At Prudhoe Bay and Sans Sault, studies to determine the necessity and feasibility of cathodic protection in permafrost were undertaken.

Results and Applications

At the Sans Sault facility the installation techniques used for the 550 closed end pipe piles were found to be generally satisfactory. Minor movements have been measured on some of those piles supporting elevated pipe and buildings.

At Norman Wells the capacity of grouted rod anchors in permafrost soils was evaluated. Performance of the Ciment Fondu anchors was not significantly different from those anchors where a soil-water slurry was used. Design loads on anchors constructed with high early strength Portland cement were found to be slightly greater than the other types. The slurry-filled anchors were found to be a realistic alternative to conventional grouted rod anchors in cold permafrost regions where it is assured that average ground temperatures will not exceed 30F.

In conjunction with the anchor tests, a small program was carried out to evaluate the magnitude of the adfreeze strength between frozen soil and a variety of pipe coatings and to assess the damage to the pipe coating. Values obtained, in conjunction with laboratory test results, have been used in design development.

The results of the cathodic protection studies at two of the test sites, in conjunction with other laboratory testing, indicate that cathodic protection can be provided sucessfully in permafrost areas.

Construction Studies

Objectives

The main objectives of these studies were to evaluate various methods of excavation in permafrost such as blasting with backhoe cleanout and the use of ditching machine or ripper and backhoe, and to compare and assess methods of clearing, by hand or by bulldozer.

Results and Applications

At the Sans Sault site a ditching machine was used. The results indicated that ditching can be economically accomplished in areas of fine-grained permafrost soils by a suitably designed wheel-type ditching machine.

Blasting with backhoe excavation was used successfully at the other two facilities. It was demonstrated that care in spacing and loading of charges can minimize disturbance in the vicinity of the ditch. At Prudhoe Bay a ripper followed by a backhoe was used successfully for the shallow grade construction. In addition, closely spaced auger holes with blasting between the holes, followed by backhoe cleanout was used.

Both hand clearing and bulldozer clearing were used and compared at the Sans Sault and Norman Wells facilities. Although surface disturbance is more perceptible with bulldozer clearing, the amount of surface disturbace, if done carefully, was considered to be within predictable limits. Bulldozer clearing in areas of ice-rich permafrost should not be carried out when the ground surface is unfrozen and there is inadequate snow cover. Right-of-way clearing between April and November when the ground surface is unfrozen can be done by hand.

Pipe Stress Studies

Objective

The objective of these studies was to monitor the stress levels which develop in the pipe during operation of chilled and cooled pipelines in permafrost (Prudhoe Bay and Sans Sault).

Results and Applications

At Sans Sault strain gauge readings were taken during both continuous operation and the four hot-cycle tests. Reliable stress-strain measurements in the pipe were not obtained during the first six months of operation. Subsequent data indicate that the test sections have not been subjected to any abrupt or seasonal stress factors of sufficient magnitude to cause concern.

At Prudhoe Bay the secondary stresses and deflections of the long legs of the pipe test loop, both for buried and grade construction, were of sufficiently low magnitude so as to be negligible. Stresses and deflections for the grade construction were less than those for the ditch section.

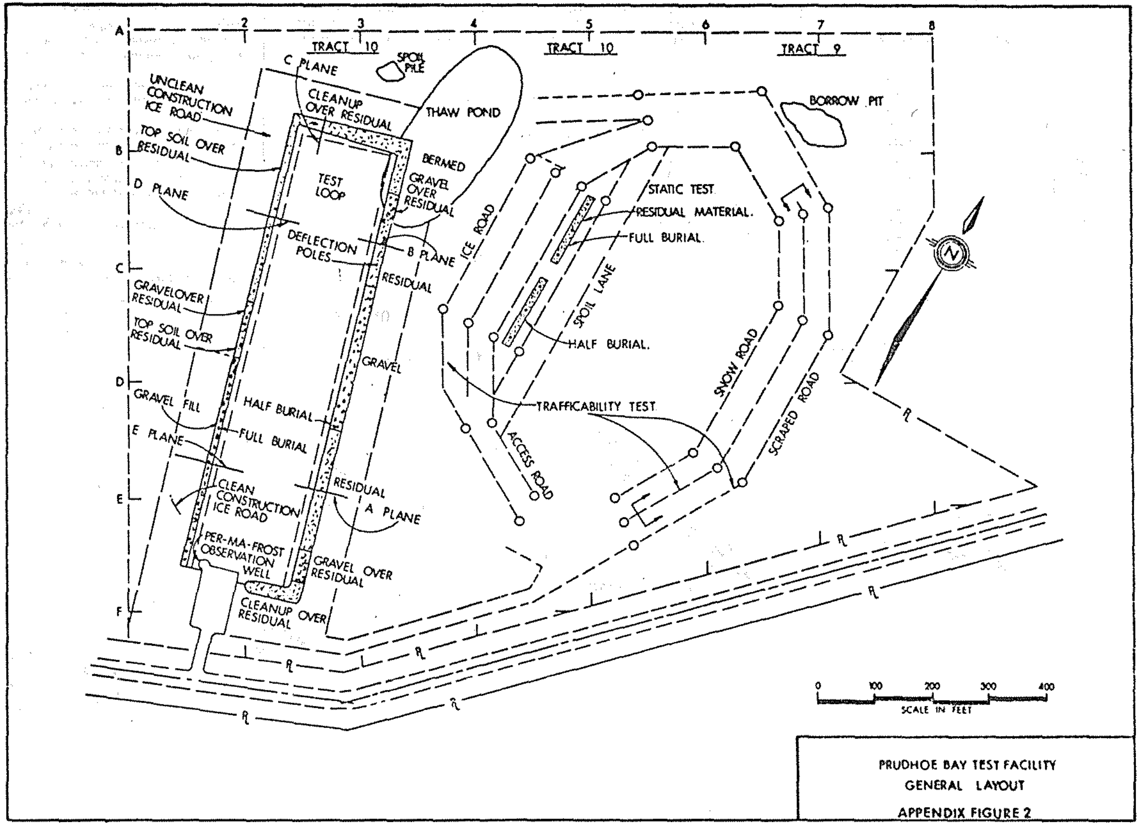
3. Prudhoe Bay Test Facility

Facilities Description

The test site, located N 70 degrees 13' Latitude and E 148 degrees 25' 30" Longitude, occupies leases 9, 10 and 11 from the State of Alaska The site lies approximately two miles north-northeast from the Deadhorse camp and airfield and approximately six miles south of Prudhoe Bay. The elevation ranges between 60 and 75 feet above sea level, decreasing toward the Arctic Ocean and gradually increasing toward the foothills.

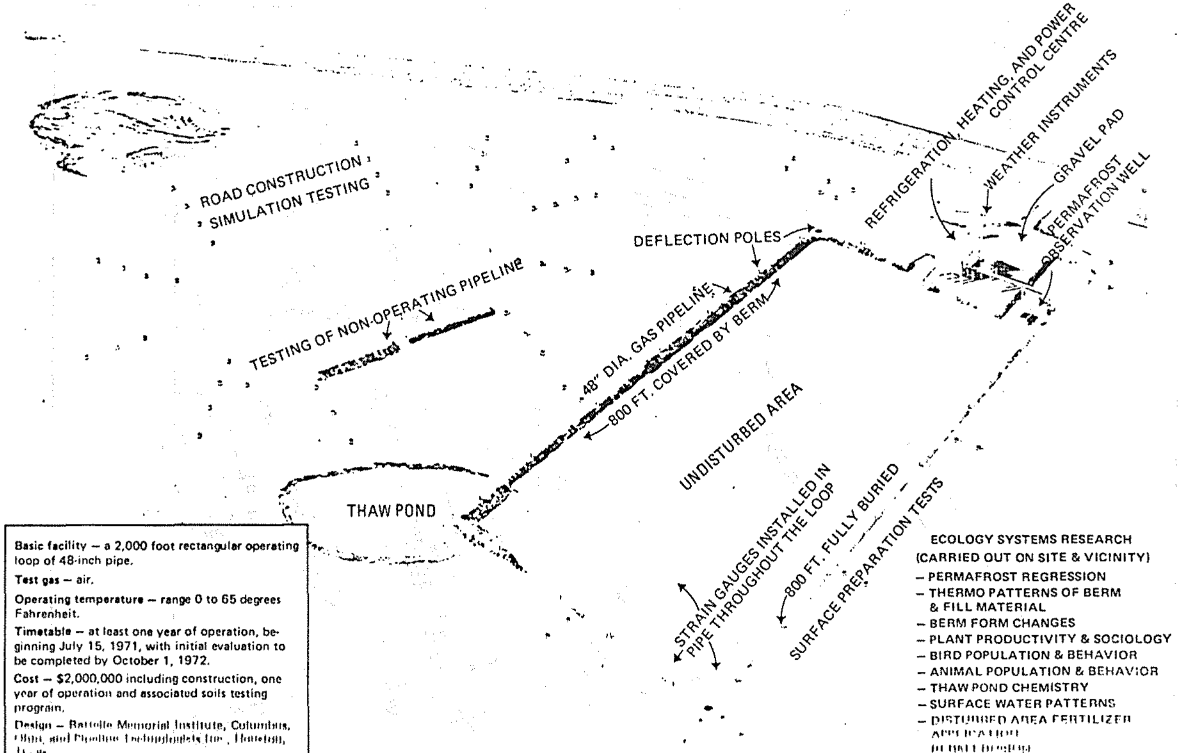
The operating facility includes a single rectangular pipeline loop of 48-inch-diameter pipe. The loop consists of two 800-foot legs with 200-foot end sections. The 800-foot sections were used for both thermal and strain research, and the northerly short leg was also used for thermal-data acquisition. The other short leg contains the instrument-equipment building. The loop utilizes low-pressure air as the test medium. While air was circulated at 25F, the design is capable of operating over a range of 0F to 65F. (A schematic and an artist's representation of the test facility are shown in Appendix Figures 2 and 3 respectively.)

One 800-foot leg was constructed full ditch, 400 feet of which were blasted and the other 400 feet were excavated by simulated ditching. The simulated ditching consisted of boring two rows of 36-inch-diameter holes spaced such that a ditch approximately 5 feet wide was obtained when the material between the holes was removed. The second 800-foot leg was for grade construction and was ditched to a depth of one-half the pipe diameter; fill in the two 400-foot grade sections was



PRUDHOE BAY TEST FACILITY
GENERAL LAYOUT

APPENDIX FIGURE 2



Basic facility — a 2,000 foot rectangular operating loop of 48-inch pipe.

Test gas — air.

Operating temperature — range 0 to 65 degrees Fahrenheit.

Timetable — at least one year of operation, beginning July 15, 1971, with initial evaluation to be completed by October 1, 1972.

Cost — $2,000,000 including construction, one year of operation and associated soils testing program.

Design — Battelle Memorial Institute, Columbus, Ohio, and Pipeline Technologists Inc., Houston, Texas.

Construction — Wagley Incorporated, Anchorage.

Operation — Pipeline Technoligists Inc., under general supervision by Battelle Memorial Institute.

Evaluation — Battelle Memorial Institute.

ECOLOGY SYSTEMS RESEARCH
(CARRIED OUT ON SITE & VICINITY)

- PERMAFROST REGRESSION
- THERMO PATTERNS OF BERM & FILL MATERIAL
- BERM FORM CHANGES
- PLANT PRODUCTIVITY & SOCIOLOGY
- BIRD POPULATION & BEHAVIOR
- ANIMAL POPULATION & BEHAVIOR
- THAW POND CHEMISTRY
- SURFACE WATER PATTERNS
- DISTURBED AREA FERTILIZER APPLICATION [illegible]

THERMOCOUPLES, HEAT FLUX TRANSDUCERS, CONDUCTIVITY PROBES, SOIL MOISTURE & SOIL DENSITY INSTRUMENTATION IMPLANTED AROUND LOOP AND AT STRATEGIC AREAS THROUGHOUT THE TEST FACILITY

PRUDHOE BAY TEST FACILITY

APPENDIX FIGURE 3

TEST FACILITIES

placed so that one had a 30-inch cover and the other an 18-inch cover after settlement had occured. The instrumented short leg was sloping with varying depth of cover. One corner of the pipe loop was located in a thaw pond to evaluate any changes due to pipeline operation.

In addition to the pipe loop, portions of the area just to the east on Tracts 10 and 11 were utilized as a reference area to study the effects of different types of construction roads and a borrow pit. An undisturbed control area was located inside the pipe loop. Also, recognizing that the construction of the pipeline project might have to be scheduled over several years, resulting in portions of the pipeline being installed but inactive during one or more annual seasonal cycles, two short sections of non-operating pipeline were installed, one with grade construction and one with buried construction. Both were monitored to determine the extent of movement and thermal alteration of the permafrost. These inactive sections were located in the construction traffic test area.

Types of materials used in ditch fill and grade construction consisted of gravel, mixed soil materials from the ditch excavation, surface peat from an experimental borrow pit, and mixed soil materials covered with gravel. These materials extend in sections for 50 feet or longer around the test loop.

Site Description

The Coastal Plain in the general vicinity of the Prudhoe Bay area is crossed at frequent intervals by slow, north-flowing rivers with wide, braided channels. Between these major rivers the area is typical of high ice content tundra, with very low relief, poor drainage and a cover of organic material where well developed polygonal surface patterns reflect ice wedges in the permanently frozen silts and gravels of the subsurface. A high portion of the ground surface is covered with elongated, shallow thaw lakes, and it is only occasionally interrupted by pingos.

The site was selected because it is reasonably typical of conditions which will be encountered in the portion of the gas pipeline route which crosses the Arctic Coastal Plain.

A single small thermokarst pond occurs on the test site; one corner of the pipe loop is located in this pond. Many similar and larger ponds occur in the areas adjoining the test facility. Such ponds are ephemeral features on the landscape. They appear to go through a cycle of expansion, beginning perhaps as small tundra pools formed at the intersection of polygonal cracks.

No pingos occur on the test site although one of modest proportions is located approximately one-half mile to the northwest.

A typical soil profile in the vicinity of the ditch is as follows:

0 - 1 foot	Peat with less than 10% ice lenses
1 - 2 feet	Silty sand and silt. Overall estimated excess ice 10% to 15% with segregations up to 60% to 70% locally.
2 - 7 feet	Silt, organic silt and organic clay with occasional fine sands and gravel fragments. Estimated excess ice content between 30% and 75%.

7 feet plus — Silty sand and gravel with some clay. Estimated excess ice content 10% to 60%.

The depth of the active layer in undisturbed ground commonly ranges between one and one-and-one-half feet. Ice wedges occupy between 35 and 40 percent of the ditch wall and occur with centre spacings of about 45 feet and edge spacings of approximately 21 feet. An overall estimate of segregated ice in the ditch ranges between 35 and 45 percent.

In most cases the excess ice segregations are lens-like and under one inch in thickness. The summer temperature of the ground at pipe depth is about 25F and winter temperature about 10F.

Construction and Operation

Construction commenced on March 19, 1971, and the test facility became operational on July 14, 1971. Air at 40F was circulated for the first week of operation to simulate a hyrostatic test condition; the system was then placed on a cold-gas pipeline operation simulation at 25F until October, 1972. From October until operation of the facility was discontinued in January, 1973, the effects of refrigeration failure and subsequent refreezing were investigated by a hot cycle test.

Data Collected and Instrumentation

a) Geothermal Data and Instrumentation

Appendix Figure 4 shows the buried construction and two grade construction modes studied at the facility. Five thermocouple instrumentation planes were situated around the flow loop. The instrumentation was in each case placed at least 50 feet from any change in burial mode. Appendix Figure 2 shows the location of these instrumentation planes and the construction method and backfill material used. Four of the instrumentation planes were located where construction techniques and backfill materials used were thought to be most suitable for pipeline construction. Thermocouples were also installed on the inside and outside surfaces of the pipe at four of the instrumentation planes (A,B,D and E).

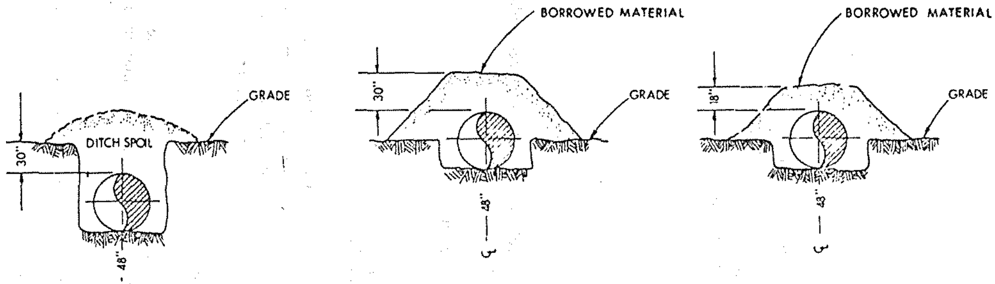
At Prudhoe Bay test facility a traffic test area was constructed and different right-of-way preparation techniques were studied. The traffic area was equipped for thermal measurement.

Thermal instrumentation was also installed in several other areas at the test facility to study the effects of construction methods on permafrost. Thermal instrumentation was located in the borrow pit, the building pad, near the building and pipe pilings, the pad underneath the building, and the culvert under the facility entrance road.

Four heat flux transducers were installed on the pipe surface at each of four instrumentation planes (A,B,D and E) to measure the energy exchange between the pipe and soil. Heat flux transducers were also installed at six-inch depth on instrumentation planes A and E to measure energy exchange between the atmosphere and ground.

Soil-moisture instrumentation and in-situ thermal conductivity probes were installed at the test-loop instrumentation planes to monitor long-term changes due to construction and operation.

Ten drill holes at the site determined ground conditions and provided cores for examination and



FULL DITCH CONSTRUCTION

30 - INCH BERM CONSTRUCTION

18 - INCH BERM CONSTRUCTION

NOT TO SCALE

[illegible]
[illegible]

APPENDIX FIGURE 4

laboratory testing. The thermal properties determined were frozen and thawed conductivity, frozen and thawed specific heats and latent heat of fusion.

b) Meteorological Data and Instrumentation

Weather data have been recorded at the facility since the beginning of operations in July 1971. Instrumentation was installed to record wind velocity and direction, temperature, precipitation and long wave radiation during facility operation.

Pipeline installation techniques will result in alterations of snow-drift patterns in the vicinity of the pipeline with resultant effects on ground temperature, melt water, and drainage. Hence, periodically during the winter, snow depth was measured on the buried and grade construction pipeline test section. Snow depth enhancement studies were also carried out.

c) Geotechnical Data and Instrumentation

- The extent of underground ice and its relationship to subsidence and drainage pattern changes were recorded.

- Mapping of soil profiles and soils behaviour on thawing was carried out.

- Soils characteristics were mapped and studied in relation to the surface-insulating peat coverage and vegetation, particularly in relation to polygon features.

- Surface temperatures were measured over the test site and compared to the physical features of the tests.

- Permafrost depth was measured periodically through the thaw season and related to surface disturbance of roads, scraped areas, ponds and backfill.

- Moisture content of the backfill mound was periodically measured and compared with the surrounding undisturbed terrain. In addition, free-standing water from thawing backfill mounds and the depth of snow was monitored. Hydraulic conductivity was measured and related to effects of winter roadways and slumping of the thawing backfill mounds.

- Various types of temporary winter roads were evaluated.

- Various combinations of both depth and backfill type for both ditch and grade construction fill were evaluated; changes in backfill mound shape, erosion, and reclamation of fill areas were studied.

- Studies to determine the necessity and feasibility of cathodic protection were carried out.

d) Construction Data

- Different types of ditching methods were investigated.

e) Pipe Stress and Strain Data and Instrumentation

To monitor the structural response of the pipe loop during the course of the program two types of instrumentation were utilized: strain gauges installed inside the pipe at several locations and level poles/offset arms connected to the pipe and projecting above ground. The structural response of the loop is defined as the combination of the overall deformations of the straight portions of the loop and the secondary stresses introduced in the loop by earth loading (backfill load, freezing, and thawing).

Strain gauges were installed to measure the axial stress and bending around both the vertical and horizontal axis at each of eight planes, four in each major leg of the test loop. Measurements at seven additional locations indicated the forces applied by anchor straps on the west leg of the loop. These anchor straps were cut prior to the hot cycle test in the fall of 1972 and were found to be not holding the pipe down.

The level poles with cross arms to monitor the vertical and horizontal displacements of the pipe loop were installed at 22 locations, 11 on each major leg. The level poles consisted of a small-diameter pipe welded to the top surface of the pipe and projecting vertically upward through the overburden. On each level pole, a cross arm was attached to provide a means of measuring the horizontal movements of the line relative to fixed bench marks.

Data from this instrumentation were then correlated to determine the overall response of the pipe loop to external influences during loop operation.

f) Ornithological and Mammalogical Data were collected at this site. They are discussed in the appropriate context.

4. Sans Sault Test Facility

Facilities Description

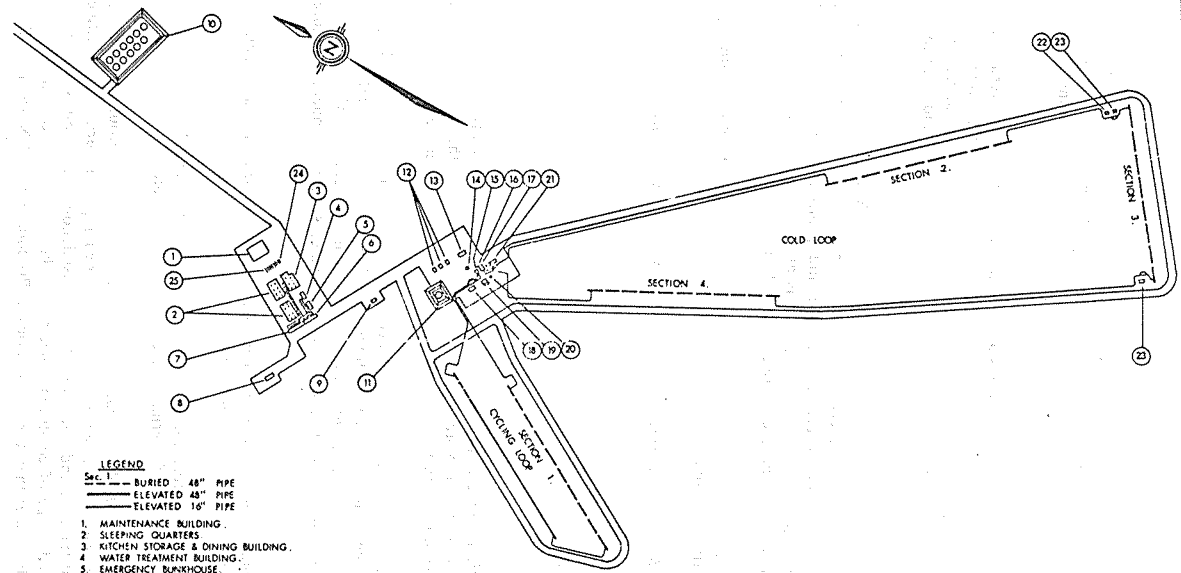
The largest of the three Arctic pipeline test facilities is the Sans Sault Test Facility at Mountain River. It is located 65 miles north of Norman Wells at the junction of the Mountain and Mackenzie Rivers at 65 degrees 40' North Latitude, 123 degrees 50' West Longitude.

The facility consists of five sections of 48-inch diameter pipeline, each 500 feet in length. Sixteen-inch diameter feeder lines connect the test sections with the compressors and refrigeration units. The five test sections are connected into two separate loops, a "cold loop" with three buried sections, and a "cycling loop" with one buried and one elevated section. (Appendix Figure 5)

There are 386 strain measurement points and 468 temperature sensors installed on and around the pipe. The temperature in each section can be controlled independently.

Compressed air, chilled to a temperature range of zero to 30F is circulated through the cold loop. The cycling loop tests the effects of alternately cycling hot and cold air.

Seven inactive sections of 42-inch and 48-inch diameter pipe are installed underground at selected locations around the site, to evaluate the performance of a buried pipeline during the inactive period between installation of the pipe and initiation of gas transmission. These pipes are sealed at each end. The number and range of conditions included at the inactive sections at the Sans Sault test site are considerably greater than the two sections at Prudhoe Bay and Norman Wells.



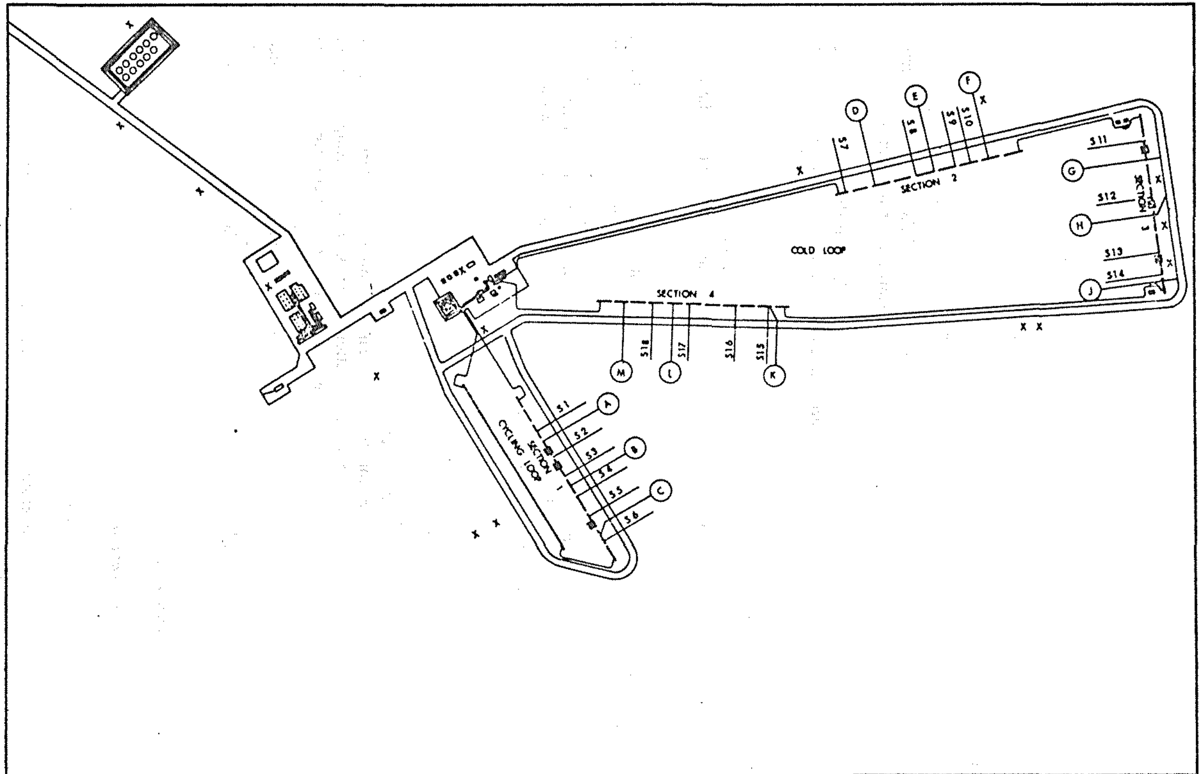
LEGEND

Sec. 1 — — — BURIED 48" PIPE
ELEVATED 48" PIPE
ELEVATED 16" PIPE

1. MAINTENANCE BUILDING.
2. SLEEPING QUARTERS.
3. KITCHEN STORAGE & DINING BUILDING.
4. WATER TREATMENT BUILDING.
5. EMERGENCY BUNKHOUSE.
6. OFFICE & FIRST AID BUILDING.
7. CONFERENCE BUILDING
8. SEWAGE TREATMENT BUILDING.
9. CAMP GENERATOR BUILDING.
10. FUEL STORAGE TANKS.
11. DAY FUEL TANK.
12. GENERATOR
13. CONTROL BUILDING.
14. BOILER BUILDING
15. CYCLING LOOP COMPRESSOR.
16. LUBE OIL CONSOLE.
17. COLD LOOP COMPRESSOR.
18. SINGLE CHILLER UNIT CYCLING LOOP.
19. LINE PACK COMPRESSOR.
20. GLYCOL COOLER
21. DOUBLE CHILLER UNIT COLD LOOP.
22. BOILER COLD LOOP INTERMEDIATE STATION.
23. CHILLER UNIT COLD LOOP INTERMEDIATE STATION.
24. FUEL TANK
25. PROPANE STORAGE TANKS

SANS SAULT TEST FACILITY
LOCATION OF STRUCTURES

APPENDIX FIGURE 5



SANS SAULT TEST FACILITY

INSTRUMENTATION & LOCATION OF TEST AREAS

APPENDIX FIG.6

TEST FACILITIES

Site Desription

The site is located at the confluence of the Mountain and Mackenzie Rivers and lies on the west bank of the Mackenzie River about 65 miles northwest of Norman Wells.

The area consists of a number of low terraces which rise from east to west in a series of stages generally from 15 to 30 feet in height. The dominant direction of drainage is to the east towards the Mackenzie River. Areas close to the Mountain River are drained in that direction while some drainage in the south part of the area is towards the Carcajou River. A former channel of the Mountain or Carcajou River runs north-south across the site with the east edge being approximately at the centre of Section 1 of the Cycling Loop. None of the streams have formed deep gulleys except where they are quite close to the Mountain, Carcajou or Mackenzie Rivers.

At the south boundary of the test facility there are a number of lakes and sloughs some of which are thermokarst features. Areas of wet muskeg are limited both in number and extent, but the area of frozen muskeg is quite extensive.

Black spruce occurs at all parts of the site while tamarack and birch are very common. The bushes consist of Labrador tea, alder and berry plants. Reindeer moss is found in the less well-drained areas. Trees in excess of 30 feet in height are only found immediately adjacent to ponds, creeks and along the rivers.

Soil deposits in the immediate vicinity of the active section consist mainly of up to 15 feet of ice-rich stratified, mainly medium plastic, fine-grained waterlaid sediments overlying clean to silty fluvial sand and gravelly sand. Soils in the vicinity of the inactive test sections consist mainly of thick sections of stratified, lacustrine, medium plastic silty clay and clayey silt sediments with some silty fine sand interbeds, either with or without a patchy surface cover of outwash sand, gravelly sand and deltaic clean to silty fine to medium sand.

Construction and Operation

Preliminary site investigations were conducted at the Mountain River site during June and July of 1970; the buried active pipe sections were installed and backfilled during December and January 1971. Operation commenced in March 1971. The three cold loop active sections were operated at temperatures of 20F, 25F and 28F for the first year. In order to determine if lower temperatures had an effect on vegetation, these loop sections were operated at temperatures of 5F, 7F and 9F for the second year. Each buried segment was temperature controlled independently. The cycling loop was subjected to four hot cycling tests to simulate the condition which would occur if a refrigeration station became inoperative. The line was normally operated at 25F and was raised to 44F when cycled. The changes in soil temperature, flotation conditions and pipe stresses were monitored during each cycling. All test facility operations were discontinued in February 1973.

Data Collected and Instrumentation

a) Geothermal Data and Instrumentation

Soil temperatures in the vicinity of the four buried active pipe sections have been monitored by twelve arrays, with 38 silicon diode temperature sensors in each array, as presented in Appendix Figure 7. Also, in this primary sensor group are twelve diode sensors in thermowells to monitor the inlet and outlet temperatures of each active section, an ambient air temperature sensor in a meteorological shelter, a control room air temperature sensor, and two sensors utilized for ice-bath checks of system accuracy. There are 37 diode sensors installed at the chilled pile test so that a total of 505 silicon diodes are used to measure temperatures throughout the facility. An automatic logging system to record where soil and other temperatures are measured commenced operation in May 1971.

Thirty-nine copper-constantan thermocouples were employed to check the accuracy of the primary soil temperature monitoring system. These thermocouples were mounted "back to back" with the diode sensors.

Additional strings of thermocouples were installed in March 1971 in the ditching test areas, and others were installed in the vicinity of inactive buried pipe sections. Their function is to measure the natural and disturbed soil temperatures in these areas.

Resistance temperature detectors (RTD's) were only used to record the inlet temperatures of the four active pipe sections.

In order to determine the effect of occasional discharges of warm gas in a pipeline buried in permafrost, four cycling tests were carried out. This involved circulating air at 44F through the pipeline for periods of one to seventeen days at different seasons of the year. Temperatures were taken every hour, so that a comparison between actual and predicted temperatures could be established.

Two of the more than one hundred remote sites for ground temperature measurements are in undisturbed areas in the vicinity.

b) Meteorological Data and Instrumentation

The following data were obtained at the Sans Sault test facility:

- Measurements were taken of air temperature, wind speed and direction, atmospheric pressure, relative humidity and incoming shortwave radiation (light).

Studies of the conditions at or near the ground surface were carried out. Data obtained included:

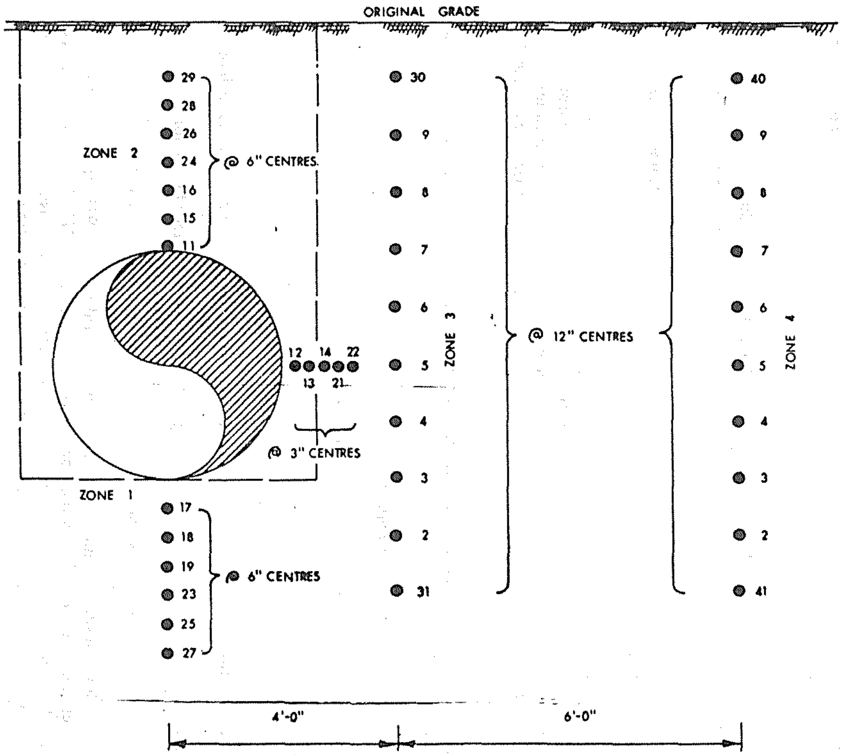
- Rain and snowfall measurements and standing or flowing ground water observations.

- Twice daily near ground surface temperature measurments for vegetal ground cover.

- Buried heat flux transducer data. Two arrays were installed in June 1971: one under growing native vegetation and the other in bare backfill material. In July 1972 six additional arrays were installed beneath a variety of revegetated surfaces. These measurements reflect the variations in day time heat flow into the soil and night time re-radiation characteristic of the surfaces.

c) Geotechnical Data and Instrumentation

Extensive investigations of terrain and subsurface conditions were carried out between June 1970 and March 1971. This drilling covered the following: site selection, soil conditions along and adjacent to proposed ditch lines, holes for temperature sensors and other measuring devices, and investigation of permafrost regression due to various construction operations. Extensive laboratory testing of core samples was carried out to determine soil characteristics in order to provide soil and permafrost data for input into the analysis of the behaviour of the active and



TYPICAL TEMPERATURE SENSOR CONFIGURATION

APPENDIX FIGURE 7

inactive test sections.

Measurements were made periodically from the time of installation on almost all structures to check on possible movement.

Conventional survey techniques were used. The following structures were monitored: buried pipe test sections, pipe support piles, cantrough support piles, building pipes, camp trailer hitches, fuel storage tanks, and ground temperature probes.

The changes in the active layer during the summer and from year to year were carefully monitored in disturbed and undisturbed parts of the site. In addition to temperatures, surface probings were made and readings of Gandhal frost tube indicators taken.

Some of the inactive test sections (1, 4, 5 and 7) are located in areas of potential buoyancy to check for pipe flotation as a result of thawing of disturbed permafrost.

Two of the inactive test sections (2 and 6) were installed in slopes to check their performance.

Inactive test Section 3 was placed across a small stream to check the possible effects of crossing small drainages.

Extensive revegetation studies in conjunction with the geotechnical-construction studies were also carried out.

Corrosion-cathodic protection studies aimed at establishing the feasibility of a cathodic protection system in permanently frozen soils were also carried out.

Backfill settlement of ice-rich soils was carefully monitored. Controlled flooding of selected ditches to freeze-in the pipe and prevent flotation due to surface run-off during the spring (when the line is not in operation) was carried out. More than 550 closed end pipe piles of 3, 4, 6 and 8 inches in diameter were installed at the test facility. Performance of these piles has been carefully monitored.

A test program was also conducted to investigate the behaviour of permafrost around piles, which were chilled by passing cold ambient air through them during the winter. A test group of four piles was installed in the four-foot gravel pad underlying the main facility.

A small program was also carried out to assess snow road contruction and performance.

d) Construction Data

Detailed observations were made during the construction period with particular emphasis on clearing methods, ditching, backfill methods and pile installation.

Clearing was carried out with respect to evaluating: winter versus summer construction, hand or bulldozer clearing, stockpiling of excavated surface vegetation and protection of vegetation.

Most of the ditching in the active and inactive test sections was done using a heavy duty wheel ditcher. This is the only test facility where a ditcher was used, so that the experience gained and observations made were extremely valuable. In addition, a 120-foot length of active Section 3 of the cold loop was excavated using explosives. The ditch was cleaned out by both ditcher and by backhoe.

e) Pipe-Stress/Strain Data and Instrumentation

Groups of strain gauges were installed inside and outside the pipe on four measurement planes on each of the instrumented sections of the cold loop. On the cycling loop there were six measurement planes. Figure 6 shows the measurement locations.

Pipe movements for the cold loop were measured by precise, conventional survey methods using stable benchmarks and rods welded to the pipe at intervals and brought above ground through sleeves. Movement of the warm cycling loop was measured by mechanical dial gauges attached to the four structural steel anchor frames installed to limit movement of the pipe when thawing of the permafrost caused the pipe to become buoyant.

5. Norman Wells Test Facility

Facilities Description

The site selected for the Norman Wells test facility is located approximately one mile southeast of the airport.

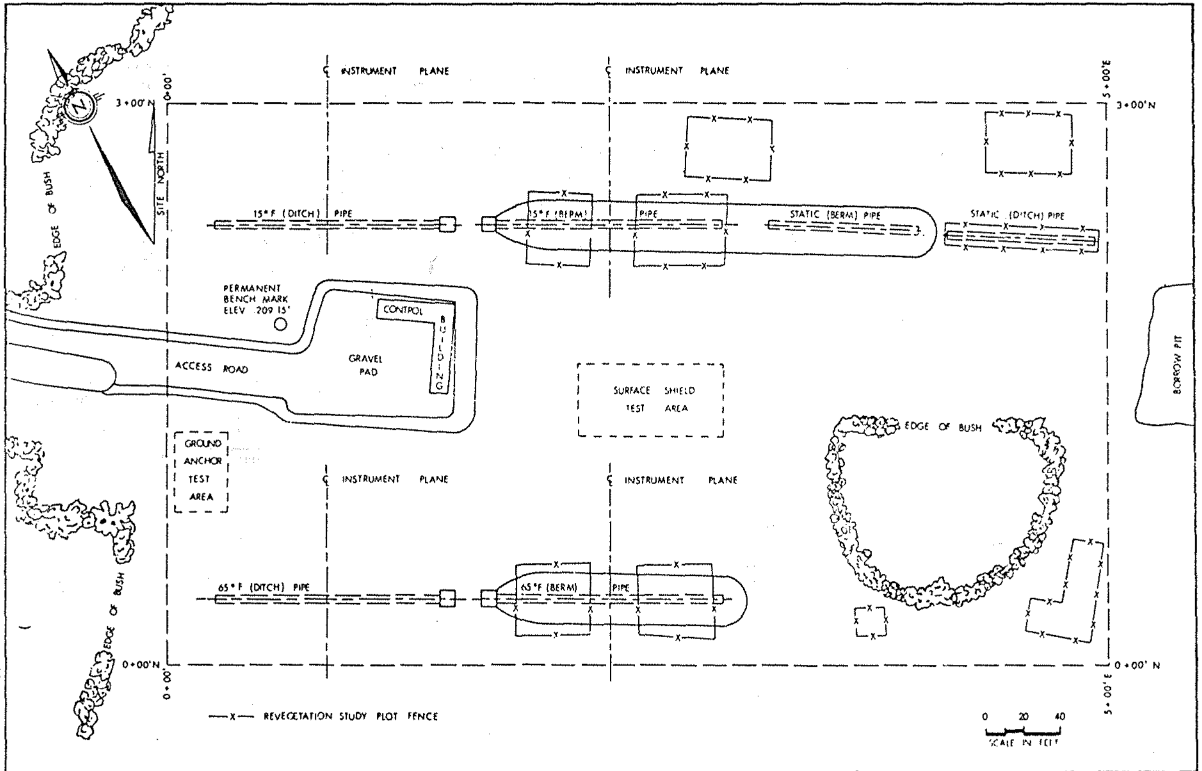
The test facility design configuration consists of six separate pipeline test sections. In four of these test sections of 48-inch-diameter pipe, each 120 feet long, air was circulated at controlled temperatures while the remaining two sections of 42-inch-diameter pipe, each 80 feet long, are inactive to simulate the dormant period between pipeline construction and operation.

In two of the four operating test sections, one buried and one grade construction, air was circulated at a nominal temperature of 15F. In the other two operating test sections, one buried and one grade construction, air was circulated at a nominal temperature of 65F. All four operating test sections have individual air temperature controls. The two operating test temperatures, 65F and 15F, were selected to represent cooled and chilled operation of a pipeline. Appendix Figure 8 and Figure 9 show, respectively, a plan and an artist's conception of the test facility.

Site Description

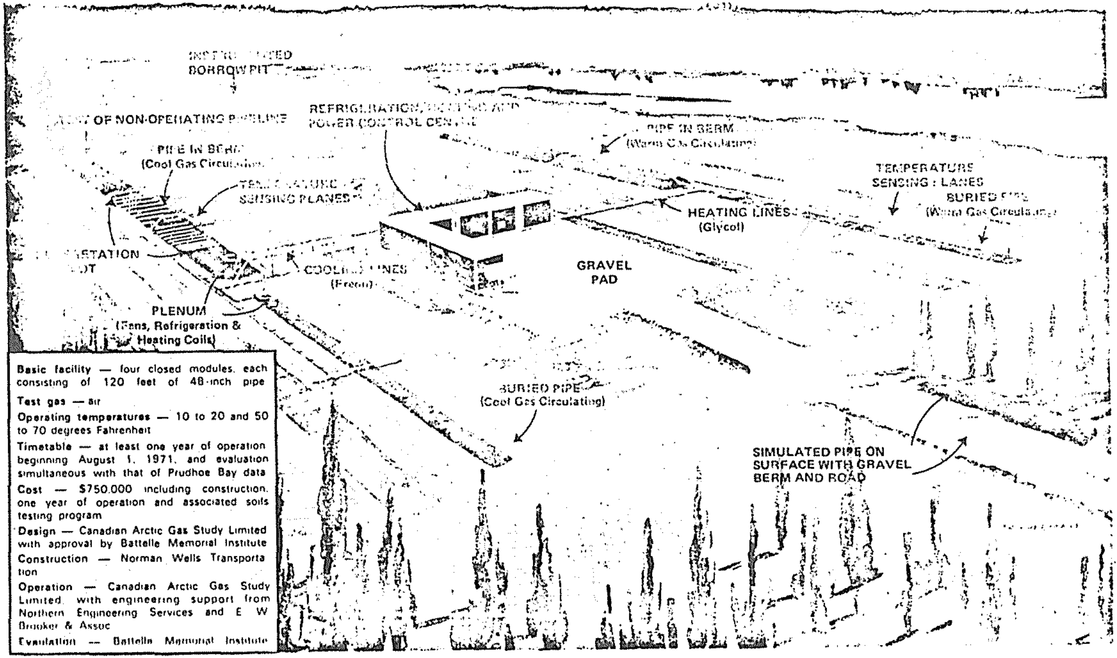
The site is located on a gentle slope, uphill of a rectangular shaped lake which is part of a lake and creek system flowing in a southeasterly direction parallel to the Mackenzie River. The pipe modules are aligned parallel to the lake and creek system and perpendicular to the general drainage of the area, which flows southwesterly to the Mackenzie River.

The vegetation uphill from the site consists of widely spaced black spruce trees 20 to 40 feet tall with moss, Labrador tea, and other related vegetation. The downhill side is vegetated with low brush, tamarack, and black spruce from 3 to 15 feet tall. Toward the edge of the lake, sedge and grasses predominate. The soils comprise fine-grained silts overlying glacial till with an intermediate layer of gravel under part of the site. A typical soils borehole log from the surface down would indicate a surface cover of a layer of brown fibrous peat, with the thickness varying quite erratically from a few inches to three feet. This is underlain by 10- to 12-foot thick deposits of ice-rich, slightly plastic brown silt containing some clay, a trace of sand and about 10 to 15 percent of organic matter by weight.



[illegible] WELLS TEST FACILITY PLAN

APPENDIX FIGURE 8



Basic facility — four closed modules, each consisting of 120 feet of 48-inch pipe

Test gas — air

Operating temperatures — 10 to 20 and 50 to 70 degrees Fahrenheit

Timetable — at least one year of operation beginning August 1, 1971, and evaluation simultaneous with that of Prudhoe Bay data

Cost — $750,000 including construction, one year of operation and associated soils testing program

Design — Canadian Arctic Gas Study Limited with approval by Battelle Memorial Institute

Construction — Norman Wells Transportation

Operation — Canadian Arctic Gas Study Limited, with engineering support from Northern Engineering Services and E. W. Brooker & Assoc.

Evaluation — Battelle Memorial Institute

THERMOCOUPLES, HEAT FLUX TRANSDUCERS, CONDUCTIVITY PROBES, SOIL MOISTURE & SOIL DENSITY INSTRUMENTATION IMPLANTED AROUND LOOP AND AT STRATEGIC AREAS THROUGHOUT THE TEST FACILITY

NORMAN WELLS TEST FACILITY

APPENDIX FIGURE 9 8.b.1.3.5

TEST FACILITIES

Excess ice occurs below the active layer as horizontally stratified layers of hairline to graded thickness of one inch, with the excess ice content varying erratically but with an average in the brown silt deposit of about 25 percent by volume. On the south side of the test site, the brown silt is underlain by about a 10- to 12-foot thick layer of slightly plastic grey silt, while on the north side a 2- to 8-foot layer of dense brown sandy gravel with cobbles underlies the brown silt; in both cases this base material has a lower ice content. Underlying these soils is a grey shale.

The active layer depth averages about two feet, with a ground temperature at pipe depth of about 31F in the summer and about 25F in the winter.

Construction and Operation

The major part of the heavy construction activity at the test site was carried out in April 1971.

Construction this late in the winter season with near 32F ambient temperature presented the opportunity to evaluate construction disturbance and effect on the permafrost for conditions immediately prior to start-up. The terrain disturbance observed at this site could be considered as the maximum which might be expected for construction carried out immediately prior to summer shutdown.

The pipe test sections were installed and backfilled during the last week of April 1971. All work requiring heavy construction equipment on the site was completed by the first week of May. By this time the spring thaw had begun, but snow roads constructed over the working site right-of-way provided excellent surface protection during this period.

Each pipe section test module was put into operation as soon as the instrumentation for that section was completed, and initial data were obtained. The chilled pipe in the ditch section started in early August 1971; all four chilled and warm sections were in operation by mid-September. The hot-cycle test was run in November-December, 1972. Operations were then discontinued. During March and April, 1973, a winter road research loop was cleared, constructed and tested. (Appendix Figure 10)

Data Collected and Instrumentation

The scope of the studies carried out in measuring and evaluating the geotechnical behaviour of the soils was more extensive at Norman Wells than at the other two test facilities. No pipe stress studies were carried out.

a) Geothermal Data and Instrumentation

A major effort at the Norman Wells test facility involved determination of the response of the subsurface temperature regime to the pipeline system. This thermal response was monitored by approximately 600 temperature sensors buried at various depths along a vertical plane perpendicular to and at the centre of each of the four operating and two inactive test sections. For the two ditched active sections, sensors were also installed parallel to and on one side of the ditch. Some 80 resistance temperature devices (RTD's) were used at each operating test section. Nine copper-constantan thermocouples were installed at the inactive test sections and the gravel pad of the facility control building. One string of thermistors was located in the inactive test section, which used grade construction, as well as one of the thermocouple strings.

Six heat flux transducers were installed to measure energy exchange at one plane on the pipe-wall surface of each operating pipe. Another 24 were installed at a six-inch depth below the ground surface at selected locations to measure heat flux between the ground and atmosphere.

Fourteen thermal conductivity probes were installed near the four operating pipes.

A "hot cycle" test comprising three weeks of 41F operation of the 15F sections, followed by a refrigerated recovery period was started on November 16, 1972, for the cold ditch and cold grade construction test sections.

Special RTD temperature sensors were installed at the two 15F test sections at selected distances from the pipe surface to measure both temperature and thaw-bulb growth during the hot cycle test.

b) Meteorological Data and Instrumentation

Instrumentation to continuously record ambient temperature, wind speed, direction and precipitation was not installed at the facility because of its proximity (less than one mile) to the government weather station at Norman Wells airport. Ambient temperature was recorded at the test site during each data aquisition period so that short-term ambient-temperature effects on ground temperatures could be monitored.

Measurements of albedo and greenhouse factor were taken to provide input data necessary for verification of thermal predictions at the site using the computerized thermal prediction programs.

Snow depth measurements were taken weekly at the site during the winter.

c) Geotechnical Data and Instrumentation

The following instrumentation was installed at the Norman Wells facility to monitor and record soil behavior.

- Settlement sensors, which have a buried sensing device that is free to move with the surrounding soil.

- Plate-foot settlement gauges, which track ground settlement at various depths in the vicinity of the plate foot. Settlement is measured with a transit by measuring gauge elevation.

- Surface-settlement gauges, which follow the movement of the ground surface. Settlement is measured by a transit.

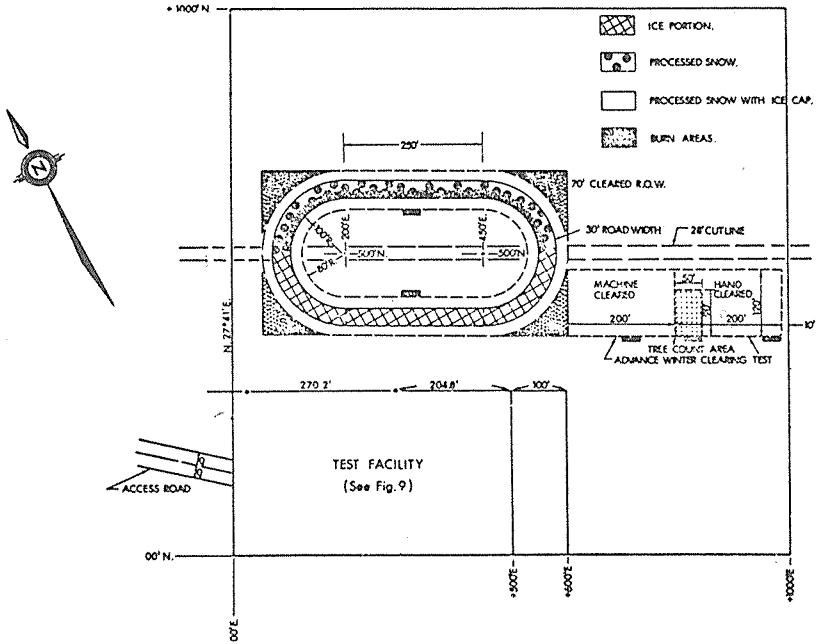
- Pipe-module settlement markers, which register the movement of the pipe as a result of settlement of the underlying soil. Settlement is measured by a transit.

- Piezometers for the measurement of pore pressure at the instant of thaw and during subsequent moisture dissipation.

- Nuclear probe with access tubes to monitor in-situ changes in soil moisture content and density.

- Moisture cells to monitor changes in soil moisture.

70-636 O - 76 - 15



Appendix FIG. 10

In addition to the above instrumentation, careful records were kept of the construction procedures used and behaviour of the ditch walls, ditch and grade construction backfill, snow roads, gravel pads and borrow areas. Cross sections of the ditch and grade construction backfill were taken and the depth of the active layer determined by probing throughout the site area periodically during the summer.

A field testing program was also carried out to evaluate the capacity of grouted rod anchors in permafrost soils. Three types of backfill were investigated, using high early strength cement, Ciment Fondu and frozen sand slurry. Water (ice) was also used as a grout.

A small program was also carried out to determine the magnitude of adfreeze shear strength between frozen soil and a variety of pipe coatings.

During the snow and ice road testing in March and April, 1973, the construction procedures, traffic characteristics and behaviour of the winter road and underlying vegetation were carefully monitored. Vegetation was again carefully examined during the summer of 1973 and the depth of the active layer checked.

d) Construction Data

During the construction period, emphasis was given to assessing clearing methods, various blasting techniques and excavation and backfilling methods.

6. Remote Sites for Ground Temperature Measurement

Since 1970, a large number of remote ground temperature measurement sites have been established that have not been directly associated with the pipeline test facilities. These are distributed along the potential pipeline routes, from the Alaska-Yukon border to northern Alberta. Currently, there are nine automatic recording units (Geomet Stations) and one hundred and fifteen passive sensor strings installed. Although these sites have been established under a variety of investigation programs, with regard to data collection and processing they have been dealt with as a single group. Consequently, the sites are collectively designated as "remote sites for ground temperature measurement".

These sites may be segregated into four groups that reflect the original site selection philosophies. The first group comprises installations to document soil temperature conditions at unique sites. For example, single and multiple sensor strings were installed at major river crossing sites. The second group includes sites selected to investigate thermal regimes at recurring features such as thermokarst depressions or peat bogs.

The third group is comprised of sites where local variability is to be investigated. At these sites, two or more sensor strings have been installed to furnish comparisons between a particular feature and the adjacent terrain. A variety of man-made disturbances, such as seismic lines, winter roads, and an abandoned airstrip, have been investigated in this way.

The fourth group is comprised of sites selected as "typical" or "representative" of an area. These sites have been installed within typical terrain units.

All the sites are being used for a generalized survey of permafrost conditions and variability along the pipeline route, as well as for survey of the prevailing conditions at specific sites. In addition, mathematical computer program predictions of thermal regimes at the various sites have been compared with the actual temperature measurements to aid in evaluating the thermal prediction capacity.

At each of the remote sites for ground temperature measurement, a vertical string of temperature sensors (thermistors, thermocouples, or diodes) has been installed in a borehole of from six to one hundred feet in depth. The majority of sensor strings extend to a depth of approximately twenty feet, with ten to sixteen sensors located from at, or near, the ground surface to the bottom of the borehole. These sensor strings, with the one hundred and fifteen "passive" sites, terminate above ground. The site must be visited with the proper read-out device to recover a data set of soil temperatures at the various depths. At the active recording sites (Geomet Stations), soil temperatures are automatically recorded sequentially. In addition, at these automatic sites, air temperatures are continuously recorded. All the sites, including the automatic units, have been visited and data collected at approximately three-month intervals.

Description Of Geotechnical Studies

(1) FIELD STUDIES

A. Terrain Typing

Modern practice for the selection of pipeline routes (technically called "location") makes extensive use of airphoto interpretation for terrain typing.

The terrain typing for the majority of the route was completed by J. D. Mollard and Associates of Regina at the time of my being seconded to NES.

B. Test Drilling

In addition, a substantial number of test borings had been made along various segments of the route. At the outset, many of the borings were drilled in locations which provided convenient access, but, as the project developed, locations were selected to cover the various terrain conditions within different physiographic units. Very little site specific drilling was done for pipeline facilities in the early stages, since several route locations were being considered. But ultimately, a total of 786 test holes were drilled on behalf of the Arctic Gas Pipeline. Several borings were made along old seismic but lines and along the Canol Road to investigate thermal regression under previously cleared areas. In addition, along the same corridor, the Mackenzie Valley Pipeline Group drilled a total of 783 borings. These were provided to the Arctic Gas project. Many of the borings do not fall within the current alignment sheet window, but nevertheless are very useful for verification of terrain typing. Of the total borings put down for the Arctic Gas and Mackenzie Valley Pipeline projects, 829 appear on the alignment sheets.

In addition to the test boring put down in connection with the pipeline, the project was provided with test boring data from the Mackenzie Valley Highway Project and the Department of Indian Affairs and Northern Development granular inventory studies. These represent a total of approximately 7,000 test borings. The data from these borings were used by the project in office studies for terrain typing verification.

C. Geological Reconnaissance

Geological studies along the proposed routes in Canada and Alaska were carried out by Canadian Arctic Gas Study Limited. The results of this work were summarized in CAGSL reports which were provided to NES for our use in route location and preliminary design work.

D. Hydrological Studies

Several hydrological field programs were also carried out. These entailed soundings of all the river crossings in Alaska, the major river crossings and the majority of the minor river crossings in Canada. In addition, studies were made of the behaviour of the major crossings (the Great Bear, Liard, Peel and three Mackenzie crossings) during break-up. These data were used in developing the design for the purpose of crossings.

A survey of water availability was made along the route during the winter of 1973 to determine the potential sources of water during construction.

(2) OFFICE STUDIES

A. Route Location and Refinement

The route was transferred from topographical maps to the photomosaics. It was then reviewed in detail by route location engineers and environmentalists. Using stereo pairs of photographs, the route alignment was refined to avoid steep slopes, unfavourable river crossings and water bodies where a preferable location could be found. The route was examined by a photogrammetric technique to determine slope angles in the immediate vicinity of the line. The various categories of potential erosion, as appear in the application exhibit, were established and each segment was classified accordingly. Similarly, areas where potential buoyancy conditions may exist were classified on the alignment sheets. During the course of this refinement, meetings were held with staff environmentalists and environmental consultants to review the alignment and to discuss the proposed design measures. These meetings resulted in further refinements and modifications to proposed designs.

B. Geothermal Studies

Conventional pipeline design practice does not normally require ground temperature (geothermal) studies. Early in the studies for the proposed pipeline, it became apparent that such geothermal analyses were absolutely essential to produce a viable pipeline system in Arctic and sub-Arctic regions. Conventional procedures were not available to make such analyses, and basic studies with considerable innovation had to be undertaken to permit such analyses to be made with a reasonable degree of accuracy. It was recognized from extensive previous experience in Arctic construction that any significant change in ground surface or subsurface characteristics can alter the established ground temperature conditions in both frozen and unfrozen soils. An alteration to the temperature regime may result in permafrost thawing or in the case where the soil is not previously frozen, it may be caused to freeze. These features may produce changes in the engineering properties of the soils, such as strength, consolidation characteristics and permeability. In order to predict changes in the ground thermal regime and the consequence of these changes, a variety of techniques were used in the engineering studies. The prime method for analyzing the ground thermal regime is by computer-oriented numerical techniques. These techniques were also supplemented by analytical methods.

Two geothermal programs were used to predict changes in the ground thermal regime and were used to check each other's results. One program was developed by Arctic Gas from the early stages of the project, and the second program by Esso Production Research Company Limited.

The programs were successfully checked against observations made at test sites. In addition, the extensive ground temperature readings which were obtained throughout the length of the pipeline route over a period of several years were used as a basis of comparison of the prediction of the thermal computer programs. When it was determined that the programs were adequate to predict changes in the ground thermal regime, and after the range of input parameters had been carefully researched, specific studies were undertaken. These included:

(a) Prediction of the thermal regime at several locations along the pipeline route, involving parametric studies of the pipeline right-of-way, granular pads, road crossings, snow roads, etc.

(b) Geothermal studies of specific slopes and problems along the pipeline route, together with specific ancillary structures.

(c) Geothermal predictions in connection with potential frost heaving along the pipeline route. These include river crossings, and locations near compressor stations, where the pipe comes out of the ground. In addition, geothermal studies of the chilled pipeline passing through unfrozen ground in the discontinuous permafrost zone were made.

(d) Study of effects of convection of the ground thermal regime. This involved a two-part study. One part was the study of convection on freezing and thawing soil, and in frozen soils, to provide a comparison with the geothermal conduction computer program. The other part involved the study of the effects of water movement due to gravity in coarse-grained porous soil, on the position and rate of movement of the frost bulb around a cold pipe buried in creek and river beds, flood plains and on some slopes, particularly in river bank areas.

C. River Crossing Studies

The river crossing hydrology studies involved river engineers, hydrologists and geotechnical and construction engineers. They included:

(a) Preliminary design of six major river crossings and one typical Arctic Coast crossing, which are included with the exhibits.

(b) Preliminary design of five river crossings on the interior route in Canada.

(c) Preliminary designs of 36 crossings north of the 60th parallel in Canada.

(d) Preliminary design of eight crossings south of the 60th parallel.

(e) Preliminary design of 30 Alaska crossings.

(f) Classification of 200 river crossings and development of their relationship to typical design procedures.

(g) An assessment of construction procedures, cost estimates and contractor's evaluation of design and construction.

(h) A study of operation and maintenance requirements for access across northern river crossings at different times of the year.

(i) An assessment of all hydrological data available from the Department of Public Works Mackenzie Valley Highway Studies.

(j) Studies of bank armouring and river training techniques.

(k) Development of a simulated hydrologic data model for two northern river basins to assess this technique for usefulness in final design.

(l) Study of frost effects problems associated with northern river crossings. The study incorporated data from the frost effects test site, as described in the next section.

(m) River Ice Study. This included an office review of information available on ice conditions, break-up and ice dams at locations of the proposed river crossings.

(n) A study of river bank rebuilding techniques following pipeline installation to ensure stability of the banks.

(o) An anlysis of pipeline weighting and anchoring requirements.

(p) An office study of the watershed hydrology along the proposed route in both permafrost and non-permafrost terrain. This study included an assessment of the applicability of the proposed drainage and erosion control measures.

(q) A study of water availability during winter months along the route.

D. Study of Special Terrain Problems

These studies cover analyses of terrain data along the route and application of these data to the development of design criteria and typical designs. An important part of this work was to ensure that there was co-ördination of geotechnical and environmental, construction and operation and maintenance considerations developed in the prelinminary designs. Some specific studies undertaken were:

(a) An analysis of all the available drillhole data and other terrain data in relation to the project terrain typing. The objective of this study was to reduce the data into a form that could be used quantitatively in the design, cost estimating and construction planning.

(b) Verification of the project terrain typing by using all available drillhole data and by comparison with published surficial geology maps.

(c) A preliminary assessment of the terrain encountered along the route and location of these areas most likely to be susceptible to frost effects that could be detrimental to the pipeline.

(d) An assessment of potential sources of construction material selected along the route on the basis of the terrain data and available drillhole data.

(e) A study of depth of cover requirements along the pipeline route. The study also incorporated input from the construction and system analysis groups at NES and also included an assessment of various measures that can be used to counter pipe flotation.

(f) An assessment of various terrain sensitivity maps, as related to pipeline design and construction, and the applicability of terrain sensitivity.

(g) A study was undertaken to assess design methods, criteria and parameters for all foundation requirements for above ground structures in continuous permafrost, discontinuous permafrost and non-permafrost areas. This study was undertaken in conjunction with the civil and mechanical design groups.

(h) A study of slope stability in permafrost regions, consisting of three interrelated sections:

(i) General studies in permafrost slope stability were reviewed, correlated and synthesized with respect to their implications on the pipeline design.

(ii) The conclusions in the first study were considered in relation to potential landslide areas along the pipeline right-of-way. This included major river crossings, typical minor river crossings and other slopes.

(iii) In the light of the above studies, detailed proposals were developed for future studies relative to final design. Critical areas requiring long-term study were emphasized.

(i) Geotechnical aspects of soil pipeline interaction. This was an integrated study involving the geotechnical and pipe stress analysis study groups. Parametric studies of the interaction between the pipe and the surrounding backfill and ditch wall for overbends, sidebends and sagbend configurations were undertaken to determine inputs required for pipe stress analysis. The response of both frozen and unfrozen ditch walls were studied using typical strength and load deformation properties. The factor of safety in both the limit equilibrium condition and immediate to long-term deformation behaviour under the action of radial forces developed at bends was investigated for appropriate combinations of soil type and thermal conditions. Preliminary guidelines identifying soil types requiring special construction techniques were established and recommendations for the geotechnical testing programs to define the load-deformation-time response of both frozen and unfrozen soils encountered along the right-of-way developed. Design criteria for soil resistence requirements at bends was established on the basis of the results of mechanical stress analysis of the structural response at field bends.

(3) TEST SITE STUDIES

A. Meteorological Studies

The objectives of the meteorological studies were to obtain a detailed record of meteorological data along the proposed right-of-way in order to increase the synoptic data base available for design studies along the pipeline route. These data were also required for input in the computerized geothermal programs developed by the Applicant. A range of meteorological data was recorded at each of the Arctic Test Facilities and a further nine automatic recording units (Geomet Stations) were installed at selected locations along the proposed route.

B. Geothermal Studies

(a) *Pipe Operations.*—The operation of chilled gas pipelines at the three Arctic facilities demonstrated the following important geothermal aspects:

(i) At all times during the test operations, a zone of frozen soil was maintained around the active chilled pipeline.

(ii) Increased chilling of the pipe resulted in an increased size of the zone of frozen soil.

(iii) During the summer, an active layer was maintained between the ground surface and the frozen zone above the chilled pipe.

(b) *Computer Program Vertification.*—Computerized geothermal programs have been developed by the Applicant to predict the effects of operating a chilled pipeline in permafrost terrain under both operating conditions and possible temporary upset or breakdown conditions. Comparisons were made of the observed performance at the test sites and the prediction of the available geothermal computer models. It was found that the models can be used with reasonable confidence to predict the geothermal regime around buried chilled pipelines.

(c) *Active Layer Studies.*—Active layer studies were undertaken to obtain information on the effects of pipeline and roadway construction on the depth of the local active layer along the right-of-way, and to obtain baseline data from adjacent undisturbed areas. Consequently, various studies were undertaken to document typical depth and temperatures of the active layer under various surface covers and disturbance conditions. It was found that the changes that occurred were within the limits expected.

(d) *Remote Sites for Ground Temperature Measurements.*—A total of nine automatic recording units (Geomet Stations) and 115 passive sensor strings were installed at selected locations distributed along the potential pipeline routes. Sites were selected in order to give baseline data, for example at river crossings, and recurring features such as thermokarst and depressions and peat bogs. Sites where there were man-made disturbance, such as seismic lines, winter roads and an abandoned airstrip, were also investigated. Finally, sites were also selected in order to give typical or representative data within typical terrain units. These sites have, and are, being used to aid in design by providing valuable baseline data of prevailing conditions along the proposed route.

(e) *Other Studies.*—Many minor studies have been conducted at the Arctic test facilities to investigate various geothermal aspects of general permafrost design and which materially add to the design base. For example, studies of pile foundation temperatures for both static and chilled conditions have been considered. Measurements of ground heat flux have been undertaken and the effects of various revegetation schemes in influencing the depth and temperature of the active layer have been considered.

(f) *Calgary Test Facility.*—Geothermal studies at the Frost Effects Study site at this facility have been concerned with monitoring the progression of the frost bulb that grows around an operating chilled pipeline buried in unfrozen frost-susceptible soil.

C. Special Terrain Problem Studies

(a) *Pipeline Stability.*—Pipeline stability has been investigated under representative actual operating conditions and during the inactive period prior to start-up following construction.

No significant movement of any of the chilled buried pipes has occurred during operation.

No significant movement of any of the active pipes has occurred prior to operation, except for one section at the Norman Wells site where an extra buoyancy load was introduced by an attached plenum chamber which caused flotation during spring runoff. No instability has occurred in any of the buried inactive test sections which were installed at varying burial depths in differing terrain conditions and then left with no chilled fluid being circulated for one thaw season. The depth of cover used was 2.5 feet at Prudhoe Bay and Norman Wells, and between 3.0 and 3.5 feet at Sans Sault.

Two inactive test pipes were installed on ice-rich slopes at Sans Sault. One section on a 28 per cent (15.6 degree) slope failed by the intiation of a shallow landslide after a heavy rainfall during the first summer after installation. Erosion subsequently worsened the situation but, whereas soil movement was experience, no pipe movements occurred and the integrity of the pipe was not immediately threatened. The onset of soil movements, such as those that occurred at this site, can be predicted and the necessary preventative measure devised to combat such instability. At the second installation, on a 12 per cent (6.8 degree) slope, some erosion of the backfill occurred after the backfill had thawed and settled the first summer. This illustrated the importance of draining and erosion control measures which would have prevented instability.

(b) *Backfill Performance.*—It was found that there was considerable slumping of ice-rich backfill which occurred prior to the pipes going into operation, although there was a tendency to form a drying crust on the ice-rich fill above ground which assisted in stability. Thus, any design configuration built in winter, particularly those using ice-rich soils, must accommodate the potential of considerable backfill settlement in order to provide the design minimum depth of cover. Gravel backfill was found to be stable on thawing.

(c) *Fight-of-Way and Winter Roads.*—In order to develop construction techniques, with particular emphasis on minimizing surface disturbance, various types of right-of-way preparation and snow and ice road construction were carried out. The general conclusion was that with reasonably careful techniques to minimize the disturbance to the organic cover, the effect of snow or ice roads on deepening the active layer was of the same order as disturbance effects associated with removal of living vegetation, as long as the organic mat was left intact. For example, at Sans Sault, removal by hand of all large trees and shrubs along the right-of-way for a winter snow road resulted in doubling of the depth of thaw compared to adjacent undisturbed terrain. At Prudhoe Bay, there was no appreciable difference in thaw depth, mainly because there was no large surface vegetation to remove. Thaw depths did increase, however, where the organic layer was deliberately scraped off. At both Prudhoe Bay and Norman Wells, it was found that the ice-capped snow road is the most easily constructed winter road that can withstand simulated pipeline construction traffic. Overall performance of this type of road was better than an ice road.

(d) *Other Geotechnical Studies.*—In order to obtain data on the installation and performance of piles in permafrost, the stability of some 550 steel pipe piles was monitored at the Sans Sault facility. A number of minor studies were also undertaken at the Norman Wells facility to evaluate the capacity of grouted rock anchors in permafrost and to investigate the magnitude of the adfreeze shear strength between frozen soils and a variety of pipe coatings.

(e) *Revegetation.*—As part of the revegetation studies conducted along the disturbed portion of the right-of-way, it was found that grasses could be readily established in the active layer that forms above the operating buried chilled pipe. This is of importance geotechnically, as it aids in the prevention of erosion.

(f) *Frost Effects Test Facility, Calgary.*—The Frost Effects Test Facility, Calgary, is currently under operation in order to investigate the effects of operating a buried chilled pipeline in unfrozen soil. This study is required because in the southern part of the discontinuous permafrost zone, there are sections of the chilled line in which unfrozen ground is encountered and the effects of freezing of the ground must be assessed. The frost effects study program can be divided into three areas: full-scale field buried pipeline tests in a frost-susceptible soil; laboratory model test; and laboratory frost heave tests on both soil samples taken from along the right-of-way and soil samples from the full-scale field test site. The frost effects program will obtain information on potential frost heave areas along the route, the possible magnitude of the heaving problem in these areas, and the effectiveness of various remedial measures if heaving is demonstrated to be a problem.

McCarthy & McCarthy,
Barristers Solicitors,
Cartan, Toronto, October 20, 1975.

Alaskan Arctic Gas Pipeline Company,
Washington, D.C., U.S.A.

Dear Sirs: I understand that Canadian Arctic Gas Pipeline Limited ("CAG") has been incorporated under the Canada Corporations Act, R.S.C. 1970, chapter C–32, which is, of course, a Statute of the Parliament of Canada. I also understand that CAG has applied to the National Energy Board pursuant to the National Energy Board Act, R.S.C. 1970, chapter N–6, which is also a Statute of the Parliament of Canada, for a certificate of public convenience and necessity authorizing CAG to construct a pipeline for the transportation of: (a) natural gas produced in the North West Territories, and (b) natural gas produced in the State of Alaska from a point on the border between Alaska and the Yukon Territory of Canada where it will interconnect with the pipeline proposed to be constructed by your company.

The CAG pipeline will pass through the Yukon and North West Territories and the Provinces of Alberta, British Columbia and Saskatchewan and will deliver gas to interconnecting pipelines in Canada and at points on the international border between Canada and the United States of America.

I also understand that CAG does not intend to own or take title to the gas which it will be transporting but will, on the other hand, act as a contract carrier for the owners of the gas.

You have asked for my opinion as to the scope of the powers of the Provinicial Legislatures in Canada to pass laws in relation to or affecting the construction and operation of the proposed pipeline in Canada.

It is essential at the outset to appreciate that the proposed CAG pipeline is a work and undertaking connecting a Province with other Provinces and also extending beyond the limits of a particular Province.

The reason I emphasize this consideration at the outset of my opinion is that by virtue of the combined effect of section 91(29) and section 92(10) of the British North America Act (a Statute of the Imperial Parliament) dealing with the distribution of legislative powers between the Dominion Parliament and the Provinicial Legislatures the following works and undertakings come within the exclusive legislative powers of the Dominion Parliament:

(a) Lines of stream or other ships, railways, canals, telegraphs, *and other works and undertakings connecting the Province with any other or others of the Provinces, or extending beyond the limits of the Province;*

(b) Lines of steamship between the Province and any British or foreign country;

(c) Such works as, although wholly situate within the province, are before or after their execution declared by the Parliament of Canada to be for the general advantage of Canada or for the advantage of two or more of the provinces."

I think it is fair to state that the judgments of the Privy Council and of the Supreme Court of Canada have recognized that the power of the Dominion Parliament to legislate with respect to the types of works and undertakings quoted above (which of course include the proposed CAG pipeline) is one of the strongest Federal legislative powers both as to scope and exclusivity.

In *City of Toronto* v. *Bell Telephone Company* (1905) A.C. 52 it was held by the Privy Council that an interprovincial telephone company authorized by Parliament to carry on business throughout Canada was within the exclusive jurisdiction of the Federal Parliament and not subject to provincial control of its operations. It was held that a Statute of the Legislature of Ontario providing that the company must obtain the consent of a municipality before entering on the streets of a municipality to construct conduits or erect poles was outside the powers of the Provincial Legislature.

In *Attorney General of B.C.* v. *Canadian Pacific Railway Company*, (1906) A.C. 204, it was held by the Privy Council that the jurisdiction of the Dominion Parliament in relation to an interprovincial railway extended to the disposition of provincial Crown lands and that the Dominion Parliament had full power to authorize the use of provincial Crown lands by the interprovincial railway company for the purposes of its railway.

The Privy Council has specifically held that Provincial Legislation may not deal with the physicial construction, repair or alteration of a work or undertaking coming within the types of works and undertakings quoted above.

See: *Canadian Pacific Railways Company* v. *Corporation of the Parish of Notre Dame de Bonsecours* (1899) A.C. 367; *Madden et al* v. *Nelson and Fort Sheppard Railway Company* (1899) A.C. 626; *Attorney General for the Province of Alberta* v. *Attorney General for the Dominion of Canada* (1915) A.C. 363.

In *Campbell-Bennett Limited* v. *Comstock Midwestern Limited and Trans-Mountain Pipe Line Company*, (1954) S.C.R. 207, the Supreme Court of Canada held that a company incorporated under a law of the Parliament of Canada for the purposes of transporting oil by means of interprovincial pipelines, was a work or undertaking within the exclusive jurisdiction of the Dominion Parliament. Consequently it was held that a provincial Mechanics Lien Act which would permit the sale of the undertaking piecemeal could not apply to the pipeline since the effect of such legislation would nullify the very purpose for which the pipeline company was incorporated. Mr. Justice Rand said at page 216:

"In Attorney General for Albert v. The Attorney General for Canada and the Canadian Pacific Railway Company (1915) A.C. 363 Alberta was held incompetent to appropriate in any manner any part of the physical property of a Dominion railway for any purpose even though no interference with the construction or operation of the railway should result. In the case before us we have such a measure by which a physical appropriation is authorized that would completely nullify the object of the legislation of Parliament."

One of the most recent declarations by the Supreme Court of Canada as to the scope and exclusivity of the power of the Dominion Parliament to legislate with relation to interprovincial works and undertaking is in its judgment in *Commission du Salaire Minimum* v. *Bell Telephone Company of Canada* (1966) S.C.R. 767. In this case the Supreme Court held that a Minimum Wage Act passed by the Legislature of Quebec which purported to regulate the wages to be paid by an employer to his employees did not apply to the Bell Telephone Company of Canada because it was an interprovincial work and undertaking. The Court held that the determination of such matters as hours of work, rates of wages, working conditions and the like was a vital part of the management and operation of the telephone company and came within exclusive legislative jurisdiction of the Parliament of Canada. At page 772 Mr. Justice Martland delivering the unanimous judgment of the Supreme Court of Canada said:

"The question is, therefore, as to what 'matters' are within the classes of legislative subjects defined in that paragraph. Clearly they extend beyond the mere physical structure of, e.g., a railway or a telegraph system. The words 'works' and 'undertakings' are to be read disjunctively "(Attorney General for Ontario v. Winner [1954] A.C. 541, 13 W.W.R. (N.S.) 657, 71 C.R.T.C. 225 and the word 'undertaking' has been defined in re Regulation and Control of Radio Communication in Canada [1932] A.C. 304 at 315, 1 W.W.R. 563.

" 'Undertaking' is not a physical thing, but is an arrangement under which of course physical things are used.

"In my opinion all matters which are a vital part of the operation of an interprovincial undertaking as a going concern are matters which are subject to the exclusive legislative control of the federal parliament within s. 91(29). It was not disputed in argument that the regulation of the rates to be paid by the respondent's customers is matter for federal legislation. In the Winner case, supra, the regulation of those places at which passengers of an interprovincial bus line might be picked up or to which they might be carried was held not to be subject to provincial control. Similarly, I feel that the regulation and control of the scale of wages to be paid by an interprovincial undertaking, such as that of the respondent, is a matter for exclusive federal control."

Hence, in my view it is clear that the Dominion Parliament has exclusive legislative powers with respect to the construction, repair, use or alternation of the proposed pipeline and also with respect to any matter which is a vital part of the operation or management of the pipeline and that conversely a Provincial Legislature cannot enact valid legislation in relation thereto.

Hence, in my opinion it is clear from the authorities that a Provincial Legislature has no constitutional power to enact legislation.

1. As to the construction, repair or alteration of the pipeline;
2. As to the rates to be charged by CAG;
3. Interfering in any way with the pipeline by expropriation or otherwise;
4. Interfering in any way so as to diminish or alter the flow of gas through the pipeline or the destination of such gas;
5. Interfering in any way with rates of pay, hours of work, working conditions or any other vital part of the operation and management of the pipeline.

The Provincial taxation power is found in section 92(2) of The British North America Act which confers on the Legislatures of the Provinces the power to make laws in relation to "direct taxation within the Province in order to the raising of a revenue for provincial purposes."

In determining the constitutional validity of provincial taxation legislation the Courts have emphasized that they will look at the true nature and substance of the legislation rather than its form. In *Attorney General for Manitoba v. Attorney General for Canada* (1925) A.C. 561 the Privy Council said at page 566 that "the question of the nature of the tax is one of substance and does not turn only on the language used by the local Legislature which imposes it, but on the provisions of the Imperial Statute of 1867 [The British North America Act]". The same approach to the validity of provincial taxation legislation was applied by The Privy Council in *Attorney General for British Columbia v. McDonald Murphy Lumber Co.* [1930] A.C. 357, and by the Supreme Court of Canada in *Texada Mines Ltd. v. The Attorney General of B.C.* (1960) S.C.R. 713. More recently Mr. Justice Disbery of the Saskatchewan Court of Queen's Bench in *Central Canada Potash Company Limited et al v. Attorney General for Saskatchewan et al* (as yet unreported) said:

"If the Court was restricted in its search to find the real purpose of regulations to merely reading them along with the authorizing Act, which is what the defendants seek to accomplish by their objection), then, whether regulations are ultra vires or intra vires would for all practical purposes often be decided by the ingenuity "and adroitness of the Legislative Counsel who drafted them coupled with his skill in juggling words in such a manner as to camouflage the real and true purpose of the regulations; so that, while pretending to carry out a purpose within the Provincial powers, their real purpose and intent was aimed at achieving a purpose beyond the powers of the Province."

It is to be observed that one limitation on the power of a Provincial Legislature to pass taxation legislation is that the legislation must create a direct tax within the Province and not an indirect tax. As a general rule taxes which have a general tendency to be passed on by the person on whom the taxes are imposed are held to be indirect. It is not the possibility of passing the tax on or its recovery or recoupment in particular cases that determines the character of the tax but the general tendency which the Legislature may be presumed to have had under contemplation. This general approach was first laid down by the Privy Council in *Bank of Toronto v. Lamb* (1887) 12 App. Cas. 575 and one of the more recent applications was in *Cairns Construction Limited v. Government of Saskatchewan* (1960) S.C.R. 619.

Over the years, however, certain taxes have been now uniformly characterized as direct taxes and certain other forms of taxation have been characterized as indirect taxation.

Any tax which is properly characterized in substance and in reality as a realty tax or a tax on profits or a tax imposed on the consumer of a commodity will now be considered to be a direct tax. On the other hand a sales tax imposed on a manufacturer or an import or export tax or a tax based upon a unit of a commodity or a service or the price of a commodity or a service are considered to be indirect taxes.

You have asked for my opinion whether a Provincial Legislature could validly impose taxation on the transit gas which will originate in Alaska and be carried through Canada to the southern international border. In my opinion it is clear that any Provincial tax related or relatable directly or indirectly to a unit of the gas carried or its price or value would be an indirect tax and beyond the competence of the Provincial Legislatures.

In *The King v. Caledonian Colleries Limited* (1928) A.C. 358, The Privy Council held that a tax on the gross revenue of a coal company which was in effect a tax on the gross proceeds of the sale of coal and which, therefore, in the ordinary way would be added to the price of the coal was an indirect tax and beyond the powers of a Province. Mr. Justice Rand of the Supreme Court of Canada in *Canadian Pacific Railway v. Attorney General of Saskaschewan*, (1952) 2 S.C.R. 231, speaking of the sense in which a tax in relation to commodities may be said to be "passed on", said:

"In relation to commodities in commerce, I take this to lie in the agreed conceptions of economists of charges which fall into the category of accumulating items: and the question is, what taxes, through intention and expectation, are to be included in those items? If the tax is related or relatable, directly or indirectly, to a unit of the commodity or its price, imposed when the commodity is in the course of being manufactured or marketed, then the tax tends to cling as a burden to the unit or the transaction presented to the market. However much, in any case, these may be actually intended or expected to be passed on it is now settled that they are to be so treated: *Attorney General of B.C. v. Canadian Pacific Railway* (1927) 4 A.C. 934; *The King v. Caledonian Colleries Limited* (1928) A.C. 358."

If a through-put tax were imposed on the shippers or the owners of the transit gas it would clearly have a general tendency to be passed on to the subsequent purchasers or consumers and would, therefore, be indirect. In my opinion the same considerations would apply if the Province were to attempt to tax the gross receipts of CAG from its tariff charges because again such a tax would have a general tendency to be passed on by CAG to the shippers or owners of the gas.

A Provincial Legislature can impose a property tax on that portion of the pipeline within the geographical limits of the Province and such a tax would normally be valid as a direct tax. However, the Province cannot, under the quise of imposing a property tax based on the assessed value of the pipeline, in reality or in substance impose a tax on the gas carried in the pipeline. A pipeline may for property tax purposes be valued with reference to its value as a pipeline but this does not mean that the Province under the guise of a property tax can tax the value of the gas being transported through the pipeline on the theory that the value of the pipeline may be measured by the reflected value of the gas which it carries. There are cases such as *Attorney General of British Columbia v. Esquimalt and Nanaimo Railway*, (1950) A.C. 87, and *Canadian Pacific Railway v. Attorney General of Saskatchewan*, (1952) S.C.R. 231, which hold that a Provincial assessment of land for property tax purposes which reflects the value of the products which may be severed from the land is valid. However, these cases deal with products that form part of the land and have not yet been severed from it to become commodities in the flow of trade. The timber that was taxed in the Esquimalt case and the minerals that were taxed in the CPR case were both taxed as interests in land and they had not been severed from it. These cases do not at all support the proposition that a province could impose a property tax on the CAG pipeline based on the value of the products which have moved through it or are moving through it. As I have pointed out above the Courts in considering the validity of Provincial taxation will look at the substance and reality of the matter and in my opinion any tax referable to the value or quantity of the gas in transit, whether under the guise of a tax on real property or not, would be held to be an attempt to tax a commodity in the course of trade and thus invalid as in pith and substance an indirect tax. In my opinion a tax in substance based upon the value or quantity, whether it be in the form of a tax on property or not, would so obviously be an attempt to tax the commodity being carried by the pipeline that a Court would conclude that the expectation and intention of the

Legislature must have been that the burden of such a tax would be shifted from the owners of the pipeline to the owners of the gas in the rates charged to the latter. Therefore, it is my view that a tax on the pipeline to the extent that it might be based on the reflected value or quantity of the gas it carries would be held to be an indirect tax and thus beyond Provincial jurisdiction.

Even within its taxing powers, in my opinion, the Province could not impose a tax if it were significantly discriminatory as between CAG's pipeline and any other pipeline carrying gas within the Province. A Province's power to impose taxation is limited not only by the requirement of it being a direct tax but also by the requirement that it be imposed for the raising of a revenue for Provincial purposes.

In *Attorney General of Alberta v. Attorney General of Canada* (1939) A.C. 117, the Privy Council held that the amount of a direct tax imposed by the Province on Federal banks was so prohibitive as to constitute an attempt to regulate the system of banking and that in fact the Provincial Legislation was a colourable exercise of the Provincial power of direct taxation to effect a legislative purpose beyond Provincial jurisdiction. Significant discrimination is a strong indication that the true legislative purpose of the Provincial Legislature is to interfere with an area of Federal jurisdiction. In *Re Royalite Company* (1931) 2 D.L.R. 418, at page 428, Chief Justice Harvey of Alberta said that the presence of unequal or discriminatory legislative treatment would justify a Court in concluding that the Legislature's real purpose was not to exercise an authority clearly given to it by section 92 but that it had in reality some ulterior purpose for the carrying out of which it had no authority, and that the Court in determining whether that is the case must consider the whole Act and its scope.

Yours truly,

JOHN J. ROBINETTE.

CAMPELL, GODFREY & LEWTAS,
BARRISTERS & SOLICITORS,
Toronto, Canada, October 27, 1975.

ALASKAN ARCTIC GAS PIPELINE COMPANY,
Washington, D.C., U.S.A.

DEAR SIRS: We are the Canadian corporate and financing counsel to your affiliated company, Canadian Arctic Gas Pipeline Limited ("CAG"). You have asked us to consider and comment on a number of questions arising out of the prepared direct testimony (the "Williston testimony") of W. B. Williston, Q. C., filed on behalf of El Paso Alaska Company with the Federal Power Commission in Docket Nos. CP 75-96, et al.

FACTUAL BACKGROUND

CAG was incorporated under Canadian federal law[1] and has applied to the National Energy Board (the "NEB"), pursuant to the Natural Energy Board Act[2] (the "NEB Act"), for a certificate of public convenience and necessity authorizing CAG to construct a pipeline (the "CAG Pipeline") for the transportation of natural gas produced in the Northwest Territories and (from a point on the border between Alaska and the Yukon Territory where it will inter-connect with the pipeline proposed to be constructed by your company) natural gas produced in Alaska. The CAG Pipeline will pass through the Yukon and Northwest Territories and the Provinces of Alberta, British Columbia and Saskatchewan, and will deliver gas to inter-connecting pipelines in Canada and at points on the border between Canada and the lower forty-eight States of the United States.

CAG does not intend to own the gas which it transports, but will rather act as a contract carrier for the owners of such gas.

Many of the questions arising out of the Williston testimony relate to the extent to which a Province may regulate, interfere with or tax CAG, the CAG Pipeline or the gas transported by the CAG Pipeline. Before dealing specifically with these questions, we will describe, in general terms, the Canadian constitutional background as it relates to these matters.

---

[1] Canada Corporations Act, R.S.C. 1970 c. C-32, as amended.
[2] R.S.C. 1970 c. N-6, as amended.

The legislative powers of the Parliament of Canada and the Legislatures of the Provinces are derived from, and governed by, The British North America Act, 1867, (the "BNA Act"), an Act of the Parliament of the United Kingdom.[3]

Under section 91 of the BNA Act, "the exclusive Legislative Authority" of the Parliament of Canada "extends to all Matters coming within" certain "Classes of Subjects", including:

"2. The Regulation of Trade and Commerce."; and

"29. Such Classes of Subjects as are expressly expected in the Enumeration of the Classes of Subjects by this Act assigned exclusively to the Legislatures of the Provinces."

Under section 92 of the BNA Act, in each Province the Legislature of that Province "may exclusively make Laws in relation to Matters coming within" certain "Classes of Subjects", including:

"10. Local Works and Undertakings other than such as are of the following Classes:

a. Lines of Steam or other Ships, Railways, Canals, Telegraphs, and other Works and Undertakings connecting the Province with any other or others of the Provinces, or extending beyond the Limits of the Province:

b. Lines of Steam Ships between the Province and any British or Foreign Country:

c. Such Works as, although wholly situate within the Province, are before or after their Execution declared by the Parliament of Canada to be for the general Advantage of Canada or for the Advantage of Two or more of the Provinces." (emphasis added).

Matters coming within the classes of subjects enumerated in subheads a. through c. of head 10 of section 92 are subject to the exclusive legislative authority of Parliament in the same manner as if those classes of subjects were specifically enumerated in section 31.[4]

An interprovincial pipe line, such as the CAG Pipeline, is a work or undertaking "connecting the Province with any other or others of the Provinces" within the meaning of subhead a. of head 10 of section 92 of the BNA Act.[5]

The classes of subjects enumerated in section 92 of the BNA Act as being subject to exclusive provincial legislative authority also include:

"2. Direct Taxation within the Province in order to the raising of a Revenue for Provincial Purposes.";

"13. Property and Civil Rights in the Province."; and

"16. Generally all Matters of a merely local or private Nature in the Province."

However, section 91 of the BNA Act provides that "any Matter coming within any of the Classes of Subjects enumerated in this Section shall not be deemed to come within the Class of Matters of a local or private Nature comprised in the Enumeration of the Classes of Subjects by this Act assigned exclusively to the Legislatures of the Provinces". It has been held[6] that this provision was meant to include and correctly describe all the matters enumerated in section 92 as being, from a provincial point of view, of a local or private nature. Accordingly, any provincial legislation properly categorized as dealing with a matter coming within a class of subjects enumerated in section 91 would be ultra vires the provincial Legislature, whether or not the legislative field has in fact been occupied by legislation of Parliament.[7]

In order to determine into which class of subjects a specific statute will fall, the true nature and character, or "pith and substance", of the statute must be

---

[3] 30 and 31 Victoria, c. 3, as amended.

[4] Corporation of the City of Toronto v. Bell Telephone Company of Canada [1905] A.C. 52; In re Regulation and Control of Radio Communication in Canada [1932] A.C. 304 (both Privy Council).

[5] Campbell-Bennett Limited v. Comstock Midwestern Limited et al [1954] S.C.R. 207 (Supreme Court).

[6] Attorney-General for Ontario v. Attorney-General for the Dominion et al [1896] A.C. 348 (Privy Council).

[7] Union Colliery Company of British Columbia, Limited et al v. Bryden [1899] A.C. 580; Attorney-General for Alberta v. Attorney-General for Canada et al [1939] A.C. 117; Attorney-General for Alberta v. Attorney-General for Canada et al [1943] A.C. 356 (all Privy Council); Commission du Salaire Minimum v. The Bell Telephone Company of Canada [1966] S.C.R. 767 (Supreme Court).

determined.[8] In ascertaining the "pith and substance" of a provincial statute, the courts will not only consider the language of the statute and the legislative history of the Province as leading up to the statute,[9] but will also take into account any public general knowledge of which a court would take judicial notice [10] and consider relevant extrinsic evidence as to the likely effects of the statute in the circumstances to which it is to be applied.[11]

Subjects which in one aspect and for one purpose fall within a head of section 92 of the BNA may, in another aspect and for another purpose, fall within section 91 of that Act.[12] In such cases the nature and scope of the legislation must be examined with reference to the actual facts in order to determine in which set of powers it falls in substance and in reality.[13]

Provincial legislation of general application enacted under one of the enumerated heads of section 92 of the BNA Act may incidentally affect an interprovincial pipeline.[14] However, such legislation may not deal with the construction, repair, use or alteration of the pipeline,[15] and may not affect a vital part of the management or operation of the pipeline.[16]

Parliament may legislate with respect to matters which, though otherwise within the legislative competence of the provincial Legislatures, are necessarily incidental to the exercise of the powers conferred upon it by the enumerated heads of section 91 of the BNA Act,[17] and such legislation will prevail over any conflicting provincial legislation which would otherwise be valid if the field were unoccupied.[18] Accordingly, Parliament, in legislating with respect to interprovincial pipelines, may enact legislation even with respect to property and civil rights in a Province if such legislation is necessary incidental to its pipeline legislation, and such legislation will operate to exclude conflicting provincial legislation dealing with the same subject matter.

The provincial taxing power is basically derived from head 2 of section 92 of the BNA Act.[19]

Canadian courts (and the Privy Council when it was the final appellate tribunal for Canadian cases), in attempting to determine what sort of tax will be considered to be a direct tax which may be imposed by a Province, have

---

[8] Russell v. The Queen (1881–82) 7 A.C. 829; Attorney-General for Ontario v. Reciprocal Insurers et al [1924] A.C. 328; Attorney-General for Alberta v. Attorney-General for Canada [1943] A.C. 356; Canadian Federation of Agriculture v. Attorney-General for Quebec et al [1951] A.C. 179 (all Privy Council).

[9] Attorney-General for Alberta v. Attorney-General for Canada et al [1939] A.C. 117 (Privy Council); Texada Mines Limited v. The Attorney-General of British Columbia [1960] S.C.R. 713 (Supreme Court).

[10] Attorney-General for Alberta v. Attorney-General for Canada et al [1939] A.C. 117 (Privy Council); Lower Mainland Dairy Products Board et al v. Turner's Dairy Ltd. et al [1941] S.C.R. 573 (Supreme Court).

[11] Attorney-General for Alberta v. Attorney-General for Canada et al [1939] A.C. 117 (Privy Council); Lower Mainland Dairy Products Board et al v. Turner's Dairy Ltd. et al [1941] S.C.R. 573 (Supreme Court).

[12] Hodge v. The Queen (1883–84) 9 A.C. 117 (Privy Council).

[13] John Deere Plow Company Limited v. Wharton [1915] A.C. 330 (Privy Council).

[14] Canadian Pacific Railway Company v. Corporation of the Parish of Notre Dame de Bonsecours [1899] A.C. 367 (Privy Council).

[15] Canadian Pacific Railway Company v. Corporation of the Parish of Notre Dame de Bonsecours [1899] A.C. 367; Madden et al v. Nelson and Fort Sheppard Railway Company [1899] A.C. 626; Attorney-General for the Province of Alberta v. Attorney-General for the Dominion of Canada [1915] A.C. 363 (all Privy Council).

[16] Corporation of the City of Toronto v. Bell Telephone Company of Canada [1905] A.C. 52; Attorney-General for Ontario et al v. Winner et al [1954] 3 All E.R. 177 (both Privy Council). See also Commission du Salaire Minimum v. The Bell Telephone Company of Canada [1966] S.C.R. 767, in which Martland, J., delivering the unanimous judgment of the Supreme Court of Canada, said: "In my opinion all matters which are a vital part of the operation of an interprovincial undertaking as a going concern are matters which are subject to the exclusive legislative control of the federal parliament".

[17] Grand Trunk Railway Company of Canada v. Attorney-General for Canada [1907] A.C. 65; Royal Bank of Canada et al v. Larue et al [1928] A.C. 187; Attorney-General for Canada v. Attorney-General for British Columbia et al [1930] A.C. 111 (all Privy Council).

[18] The Attorney General of Ontario v. The Attorney-General for the Dominion of Canada [1894] A.C. 189; Grand Trunk Railway Company of Canada v. Attorney-General of Canada [1907] A.C. 65; Royal Bank of Canada et al v. Larue et al (1928) A.C. 187; Attorney-General for Canada v. Attorney-General for British Columbia et al [1930] A.C. 111 (all Privy Council).

[19] "Direct Taxation within the Province in order to the raising of a Revenue for Provincial Purposes". Head 9, dealing with a class of subjects defined as "Shop, Saloon, Tavern, Auctioneer, and other Licences in order to the raising of a Revenue for Provincial, Local, or Municipal Purposes," gives what amounts to an additional, but subsidiary, taxing power.

adopted[20] the formulation of John Stuart Mill in his Principles of Political Economy as follows:

"Taxes are either direct or indirect. A direct tax is one which is demanded from the very persons who it is intended or desired should pay it. Indirect taxes are those which are demanded from one person in the expectation and intention that he shall indemnify himself at the expense of another; such are the excise or customs.

The producer or importer of a commodity is called upon to pay a tax on it, not with the intention to levy a peculiar contribution upon him, but to tax through him the consumers of the commodity, from whom it is supposed that he will recover the amount by means of an advance in price."

Mill's formulation, as interpreted by the courts, requires the determination of whether or not a tax can be expected to be passed on to be made by reference to the general tendencies of the tax and the common understanding of men as to those tendencies, without reference to its actual results in particular cases.[21] Thus an export tax has been treated as an indirect tax which may not be imposed by a Province, since its general tendency is to be passed along even though the exigencies of a particular market might compel the exporters to bear it themselves.[22]

On the authorities, it seems clear that any tax which is properly characterized as a realty tax or an income tax will now be treated as a direct tax which may be imposed by a Province,[23] and any tax which is properly characterized as an import or export tax will now be treated as an indirect tax which may be imposed by a Province,[24] in each case without an examination of whether its general tendency is in fact to be passed on, possibly because at the time of the passing the BNA Act these taxes were generally recognized as falling into these categories.[25]

A Province cannot, under the guise of taxation and revenue, regulate or control an undertaking, such as an interprovincial pipeline, which is within the exclusive legislative authority of the federal Parliament.[26]

Parliament's power under head 2 of section 91 of the BNA Act is exclusive so far as concerns the prohibition or regulation of exports to and imports from other countries, and a Province may not, as legislator, prohibit or regulate the export of goods therefrom.[27] Once an article enters into the flow of interprovincial or international trade, the subject matter and all its attendant circumstances cease to be a matter of local concern.[28] Although provincial legislation enacted pursuant to a valid provincial legislative power may, in the absence of conflicting federal legislation, incidentally affect interprovincial or international trade (at least in cases where such effect is not substantial,[29]) a Province may not legislate in relation to the regulation of interprovincial or

---

[20] Bank of Toronto v. Lambe (1887) 12 A.C. 575; Cotton v. The King [1914] A.C. 176; Attorney-General of British Columbia v. Kingcome Navigation Company, Limited [1934] A.C. 45; Atlantic Smoke Shops, Limited v. Conlon et al [1943] A.C. 550 (all Privy Council).

[21] Bank of Toronto v. Lambe (1887) 12 A.C. 575; Attorney-General for British Columbia v. Esquimalt and Nanaimo Railway Company et al [1950] A.C. 87 (both Privy Council); Cairns Construction Ltd. v. Government of Saskatchewan (1960) 24 D.L.R. (2d) 1 (Supreme Court).

[22] Attorney-General for British Columbia v. McDonald Murphy Lumber Company, Limited [1930] A.C. 357 (Privy Council).

[23] Canadian Pacific Railway Company v. Attorney-General of Saskatchewan [1952] 2 S.C.R. 231 (Supreme Court); Forbes v. Attorney-General for Manitoba [1937] A.C. 260 (Privy Council).

[24] Attorney-General for British Columbia v. McDonald Murphy Lumber Company, Limited [1930] A.C. 357 (Privy Council); Texada Mines Limited v. Attorney-General of British Columbia [1960] S.C.R. 713 (Supreme Court).

[25] City of Halifax v. James P. Fairbank's Estate et al [1928] A.C. 117 (Privy Council).

[26] Attorney-General for Alberta v. Attorney-General for Canada et al [1939] A.C. 117 (Privy Council).

[27] The Attorney-General for Manitoba v. Manitoba Egg and Poultry Association et al [1971] S.C.R. 689 (Supreme Court).

[28] In the Matter of a Reference Respecting The Farm Products Marketing Act R.S.O. 1950 ch. 131 as amended [1957] S.C.R. 198 (Supreme Court).

[29] If provincial legislation does have a substantial effect on interprovincial or international trade, a court might well conclude that it must be characterized as an attempt to interfere with such trade. In Carnation Company Limited v. The Quebec Agricultural Marketing Board et al (1968) 67 D.L.R. (2d) 1, the Supreme Court of Canada, in upholding provincial enactments, stated that the enactments "did not purport directly to control or to restrict such trade. There was no evidence that, in fact, they did control or restrict it."

internatonal trade and commerce, and a provincial statute which aims at such regulation will be ultra vires.[30]

THE WILLISTON TESTIMONY

Against the constitutional background described above, we will now deal specifically with certain portions of the Williston testimony.

Provincial Taxation of the CAG Pipeline

1. Mr. Williston states (on pages 25 and 26 of the Williston testimony) that the taxing powers of the Canadian Provinces are set forth in head 2 of section 92 of the BNA Act, that these are "Direct Taxation within the Province in order to the raising of a Revenue for Provincial Purposes", that the CAG Pipeline would pass within the borders of British Columbia, Alberta and Saskatchewan and would be subject to the taxing power of those three Provinces, and that, as the provincial taxing power has been interpreted by the courts in Canada, each of the three Provinces would have power to levy property taxes, income taxes, sales taxes[31] and license taxes.[32] We agree in substance with these statements.[33]

2. In our opinion, a tax, in the nature of a throughput tax, could not be imposed by a Province on the gas passing through the CAG Pipeline, or on the owners of such gas, because such a tax would be an indirect one ultra vires the Province since it would clearly have a general tendency to be passed on. As stated by Rand J. in *Canada Pacific Railway Company et al v. The Attorney-General for the Province of Saskatchewan et al*,[34] in describing the sense in which a tax in relation to commodities may be said to be passed on:

"In relation to commodities in commerce, I take this to lie in the agreed conceptions of economists of charges which fall into the category of accumulating items: and the question is, what taxes, through intention and expectation, are to be included in those items? If the tax is related or relatable, directly or indirectly, to a unit of the commodity or its price, imposed when the commodity is in course of being manufactured or marketed, then the tax tends to cling as a burden to the unit or the transaction presented to the market. However much, in any case, these may be actually "intended" or "expected" to be passed on, it is now settled that they are to be so treated".

3. On pages 25, 26 and 27 of the Williston testimony, Mr. Williston states that, so long as a tax is held to be "in pith and substance" one on land, and for provincial purposes, the provincial power to levy a tax on land is without limit, that a Province may levy a tax on land by reference to the value that attaches to the land by reason of the use to which it is put, e.g. for a pipeline, that the courts in Canada have consistently held that property tax can be imposed measured by reference to the value that attaches to a piece of property by reason of the use to which it is put, and that, in the case of the land in Provinces which would be used in the CAG proposal, the value of the property for taxation purposes could be measured by reference to the value of the pipeline, which in turn could be measured by the reflected value of the gas

[30] In the Matter of a Reference Respecting The Farm Products Marketing Act R.S.O. 1950 ch. 131 as amended [1957] S.C.R. 198; Carnation Company Limited v. The Quebec Agricultural Marketing Board et al (1968) 67 D.L.R. (2d) 1; The Attorney-General for Manitoba v. Manitoba Egg and Poultry Association et al [1971] S.C.R. 689; Burns Foods Limited et al v. The Attorney-General for Manitoba et al [1975] 1 S.C.R. 494 (all Supreme Court).

[31] That is retail sales taxes imposed in respect of the purchase in the province of goods by or on behalf of the final consumer thereof. See Attorney-General of British Columbia v. Canadian Pacific Railway Company [1927] A.C. 934; Attorney-General of British Columbia v. Kingcome Navigation Company, Limited [1934] A.C. 45; Atlantic Smoke Shops, Limited v. Conlon et al [1943] A.C. 550 (all Privy Council); Cairns Construction Ltd. v. Government of Saskatchewan (1960) 24 D.L.R. (2d) 1 (Supreme Court).

[32] A Province, in requiring the licensing of a particular business, cannot, however, discriminate against federally incorporated entities such as CAG. See Motor Car Supply Co. of Canada Ltd. v. Attorney-General of Alberta et al (1939) 3 D.L.R. 660 (Alberta Supreme Court) and Great West Saddlery Company, Limited v. The King (1921) A.C. 91 (Privy Council).

[33] The categories of taxes described by Mr. Williston are those generally recognized by the Courts as being direct and within the provincial taxing power. However, as described in 4 and 5 below, the provincial power to impose even direct taxes is not without limit.

[34] (1952) 2 S.C.R. 231 (Supreme Court).

it carries. He refers to three Canadian cases[35] as authority for these propositions, and states that, through proper draftsmanship, a Province may enact property tax legislation which relates the value of the property (and therefore of the tax payable) to the particular value attaching to the property because of the use—e.g. a pipeline—to which it is put, that the provincial Legislature of Alberta would have power to levy such a tax on a pipeline right-of-way which traversed Alberta, and that such a tax could be measured by the value of the use to which this was put.

We agree that, subject to the limitations described in 4 and 5 below, a Province may levy a tax on land measured by reference to the value that attaches to the land by reason of the use—e.g. a pipeline—to which it is put and that the value of such land for taxation purposes may reflect such use. We disagree, however, that the value of land used for pipeline purposes could be measured by the reflected value of the gas carried by the pipeline.

In this connection, the first question to be considered is whether a tax on a pipeline, measured in part at least by reference to the value of the gas transported by it, would be a tax on land, at least insofar as the value attributable to the gas is concerned, and as such direct taxation, according to the well established character of a tax on land, regardless of the tendency of the tax to be passed on. In our opinion, none of the three cases cited by Mr. Williston support such a proposition. The timber which was taxed in *Attorney-General for British Columbia v. Esquimalt and Nanaimo Railway Company et al*, and the minerals which were taxed in *Canadian Pacific Railway Company et la v. The Attorney-General for the Province of Saskatchewan*, both formed, as a matter of law, part of the land to which they were attached and were taxed as interests in land, not having been severed from it so as to have become commodities in the flow of trade. As stated by Rand, J. in the latter case:

"In *Esquimalt*, Lord Greene takes as a significant consideration the fact that the tax was charged upon the land only and did not attach to the severed timber. That is the effect of section 23(a) here: the tax is in respect of materials *in situ*, and only against them as they form part of the land does the charge apply".

Regina v. Churchill, the decision of a single judge at trial, involved a tax on land to the extent the land was used as a mobile home park. The extent of such use was measured by the number of mobile homes located in the park during a month. It was not a tax on the value of the mobile homes as such. In our opinion, any tax based on the value of the gas transported by a pipeline would be held to be in pith and substance a commodity tax, and not a realty tax.

The next question to be considered is whether such a tax, even though not a realty tax, would nevertheless be a direct tax. In our opinion, for the reasons stated in 2 above such a commodity tax would be held to have a general tendency to be passed on and to be demanded from the taxpayer in the expectation and intention that the taxpayer will indemnify itself at the expense of its customers, and therefore to be an indirect tax ultra vires the Province.

Mr. Williston seems to place considerable reliance on the skill of the legislative draftsman being able to overcome the inability of a province to levy an indirect tax. In this connection, it should be noted that "the question of the nature of the tax is one of substance, and does not turn only on the language used by the local Legislature which imposes it".[36] As stated by Disbery, J., in a recent judgment of the Saskatchewan Court of Queen's Bench:[37]

"If the Court was restricted in its search to find the real purpose of regulations to merely reading them along with the authorizing Act, (which is what the defendants seek to accomplish by their objection), then, whether regulations are ultra vires or intra vires would for all practical purposes often be decided by the ingenuity and adroitness of the legislative counsel who drafted them coupled with his skill in juggling words in such a manner as to camouflage

---

[35] Attorney-General for British Columbia v. Esquimalt and Nanaimo Railway Company et al [1950] A.C. 87 (Privy Council): Canadian Pacific Railway Company et al v. The Attorney-General for the Province of Saskatchewan (1952) 2 S.C.R. 231 (Supreme Court); Regina v. Churchill (1973) 29 D.L.R. (3rd) 368 (British Columbia Supreme Court).

[36] Attorney-General for Manitoba v. Attorney-General for Canada et al [1925] A.C. 561 (Privy Council). See also Attorney-General for British Columbia v. McDonald Murphy Lumber Company, Limited [1930] A.C. 357 (Privy Council).

[37] Central Canada Potash Co. Ltd. et al v. Attorney-General for Saskatchewan et al (as yet unreported).

the real and true purpose of the regulations; so that while pretending to carry out a purpose within the provincial powers their real purpose and intent was aimed at achieving a purpose beyond the powers of the Province.";
and further:

"The Courts decide constitutional cases such as this on the sound principle that it is the substance that is to govern and not the form. It is generally necessary, and most certainly so in this case, that the Court receive relevant extrinsic evidence as well at the impugned legislation and consider both in arriving at its decision as to the true purpose of the legislation."

4. Even in the case of a direct tax, the provincial power to levy a tax on a federally incorporated entity, such as CAG, or an undertaking, such as the CAG Pipeline, which is within the exclusive federal legislative power, is not unlimited. If the magnitude of the tax is such that, if it were applied by each of the other Provinces entitled to tax CAG, it would have the effect of preventing CAG from carrying on business, or the tax is in a practical business sense prohibitive, it would, in our opinion, be held to be ultra vires the province.[38]

5. On pages 28 and 29 of the Williston testimony, Mr. Williston states that discriminatory levies could be exacted against pipelines by the Provinces, and that the fact that a tax on the pipeline industry was different from and higher than the taxes on other industries would not cause it to be invalid. We agree that (subject to the qualification stated in 4 above as to a tax which is in a practical business sense prohibitive) a Province can impose a tax on one industry—such as the pipeline industry—which is different from and higher than that imposed on other industries. However, if a tax were imposed by a Province on a federally incorporated interprovincial pipeline company, such as CAG, on a basis which was different from that applicable to other pipeline companies operating in the Province and which discriminated in any real sense against the federal company, the legislation imposing such tax would, in our opinion, be held to be ultra vires the Province as being a colourable attempt to regulate or interfere with an undertaking subject to exclusive federal jurisdiction, and an invasion of the exclusive powers of the federal Parliament.[39]

Provincial Regulation of the CAG Pipeline

6. On pages 29 and 30 of the Williston testimony, Mr. Williston states that Provinces may legislate with respect to interprovincial or international trade, even when the impact is great, so long as the effect on such trade is incidental to a valid provincial function. In support of this proposition he cites *Carnation Company Limited v. The Quebec Agricultural Marketing Board et al.*[40] In that case it was held that it is not the possibility that provincial legislation might affect interprovincial trade which should determine its validity, but whether it is enacted "in relation to" the regulation of trade and commerce, and that once a provincial statute aims at regulation of trade in matters of interprovincial concern, it is beyond the competence of a provincial legislature.[41] The court held that the regulatory orders in question were not directed at the regu-

---

[38] Attorney-General for Alberta v. Attorney-General for Canada et al [1939] A.C. 117 (Privy Council).

[39] If the purpose of the tax is only to raise revenue for provincial purposes, how can a higher tax on a federal pipeline than on a provincial pipeline be justified? As stated by Harvey, C.J.A. in the decision of the Appellate Division of the Alberta Supreme Court in Re Royalite Oil Co. [1931] 2 D.L.R. 418 (a case dealing with the validity of provincial company legislation ". . . where we find statements in . . . judgments that the provincial legislation would be upheld if it applied to all companies alike implying that otherwise it could not be upheld, I think what is meant is that if it is not so uniform the Court would be justified in concluding that the Legislature's real purpose was not to exercise an authority clearly given to it by s. 92 but that it had in reality some ulterior purpose for the carrying out of which it had no authority, and to determine whether that is the case the whole Act and its scope must be considered". In Attorney-General for Alberta v. Attorney-General for Canada et al ([1939] A.C. 117), the Privy Council, dealing with provincial tax legislation which singled out only banks for taxation, pointed out that: "Under the guise of discriminatory taxation in the Province it would be easy not only to impair, but even to render wholly nugatory, the exclusive legislative authority of the Dominion over a number of the classes of subjects specifically mentioned in s. 91 by making them valueless." See also Motor Car Supply Company of Canada Ltd. v. Attorney-General of Alberta et al [1939] 3 D.L.R. 660 (Alberta Supreme Court).

[40] (1968) 67 D.L.R. (2d) 1 (Supreme Court).

[41] See also, In the Matter of a Reference Respecting The Farm Products Marketing Act R.S.O. 1950 ch. 131 as amended [1957] S.C.R. 198; Burns Foods Limited et al v. The Attorney-General for Manitoba et al [1975] 1 S.C.R. 494 (both Supreme Court).

lation of interprovincial trade, they did not purport directly to control or restrict such trade, and there was no evidence that, in fact, they did control or restrict it. In *The Attorney-General for Manitoba v. Manitoba Egg and Poultry Association et al.*,[42] Martland, J., in discussing the *Carnation* decision, stated that:

"Our conclusion was that each transaction and regulation had to be examined in relation to its own facts, and that, in determining the validity of the regulatory legislation in issue in that appeal, the issue was not as to whether it might affect the inter-provincial trade of the appellant company, but whether it was made in relation to the regulation of inter-provincial trade and commerce. There was cited the following passage from the reasons of Kerwin, C.J.C., in the *Ontario Reference* (at p. 204) :

Once a statute aims at "regulation of trade in matters of interprovincial concern" it is beyond the competence of a Provincial Legislature." in the same case, Laskin, J. stated:

"It has been put beyond doubt that Parliament's power under s. 91(2),[43] is exclusive so far as concerns the prohibition or regulation of exports to and imports from other countries, and that a province may not, as legislator, prohibit or regulate the export of goods therefrom. This last-mentioned proposition, which is exemplified in such decisions as *In Re Grain Marketing Act 1931*, and *Re Sheep and Swine Marketing Scheme*, does not, however, mean that, in the absence of federal legislation, a province is incompetent to impose any regulation upon transactions in goods produced therein and between persons therein simply because the regulation may have an effect upon ultimate export of the goods from the province, whether in their original or in some processed form."

Accordingly, if Mr. Williston means that provincial legislation, otherwise intra vires, which incidentally might affect, but does not aim at prohibiting or regulating, interprovincial or international trade would be intra vires, we would agree. If his statements are meant, as they appear, to be broader than that, we would disagree.

7. On pages 30 and 38 of the Williston testimony, Mr. Williston states that an emergent shortage of energy supplies within a Province or a portion thereof could, in his view, be considered a matter of local concern and therefore within the competence of the provincial Legislature, entitling the Province to require diversion to local uses of natural gas produced outside the Province and flowing through it to markets outside the Province, that such legislation could be upheld as an exercise of the provincial power to regulate matters of local concern, under head 16 of section 92 of the BNA Act,[44] having only expropriate gas produced in Alaska as it was passing through a pipeline in the incidental affect on interprovincial commerce, and that, assuming an emergent situation and that the legislation was not merely colourable, a Province could expropriate gas produced in Alaska as it was passinf through a pipeline in the Province. The Williston testimony cited no authority for these propositions. In a document headed "Corrections and Additions to the Prepared Direct Testimony of W. B. Williston, Q.C.", filed on October 22, 1975, Mr. Williston cited *Canadian Bankers' Association et al. v. Attorney-General of Saskatchewan*[45] as a case which, in his opinion, supported his proposition and stated that, in "giving this opinion, I am making the assumption that there are existing means within the province to enable one to take gas from the pipeline without the construction of new facilities".

In his subsequent cross-examination, Mr. Williston admitted that the statement on which he was relying in the *Canadian Bankers' Association* case was obiter dictum. (In that case, the Supreme Court unanimously declared a provincial statute to be ultra vires.) In our opinion, even the obiter dictum relied on by Mr. Williston, when read in the light of previous decisions, does not support Mr. Williston's proposition, and we consider it significant that Mr. Williston was unable to cite any other decided case as authority for his proposition.

In view of the cases cited above with respect to the regulation or prohibition of interprovincial or international trade, and of the exclusive

---

[42] [1971] S.C.R. 689 (Supreme Court).
[43] Head 2 of section 91 of the BNA Act—"The Regulation of Trade and Commerce".
[44] "Generally all Matters of a merely local or private Nature in the Province".
[45] [1955] 5 D.L.R. 736 (Supreme Court).

legislative authority of the federal Parliament over interprovincial and international pipelines, we can see no reasonable basis for Mr. Williston's proposition. As stated by Kerwin, C.J.C. in *In the Matter of a Reference Respecting The Farm Products Marketing Act, R.S.O. 1950 ch. 131 as amended:* [46]

"Once an article enters into the flow of interprovincial or external trade, the subject-matter and all its attendant circumstances cease to be a mere matter of local concern." [47]

In our opinion, the existence of a local energy shortage or an emergent situation would not extend the ambit of provincial legislative jurisdiction so as to enable a Province to require diversion to local uses of natural gas produced outside the Province.

8. On page 31 of the Williston testimony, Mr. Williston states that both the federal and provincial governments are competent to legislate with respect to construction and safety standards for a pipeline such as that proposed by CAG, and with respect to environmental and pollution controls affecting such a pipeline, and that in case of differing requirements, the pipeline would be required to comply with the stricter. He does not cite any authority for these propositions, and we are unable to agree with them. As above stated, although, in the absence of a conflicting federal statute, provincial legislation of general application enacted under one of the enumerated heads of section 92 of the BNA Act may incidentally affect an interprovincial pipeline, such legislation may not deal with the construction, repair, use or alteration of the pipeline, and may not affect a vital part of the management or operation of the pipeline.

Yours truly,

CAMPBELL, GODFREY, LEWTAS.

TRANSPORTATION COST FOR ARCTIC GAS PIPELINE DELIVERIES TO NORTHERN BORDER PIPELINE COMPANY SHIPPERS (INCLUDING FUEL AT $1 PER MILLION BTU)

Deliveries to—	Transportation costs in cents per million Btu: 3d year costs	10 year average costs	15th year costs	20-year average costs
Columbia Gas Transmission Corp., serving the District of Columbia, Kentudky, Maryland, New York, Ohio, Pennsylvania, Virginia, and West Virginia	172.8	156.6	110.9	133.2
Michigan-Wisconsin Pipe Line Co., serving Illinois, Indiana, Iowa, Kansas, Michigan, Missouri, Ohio, Tennessee, and Wisconsin	155.6	141.3	101.3	120.7
Natural Gas Pipeline Co. of America, serving Illinois, Indiana, Iowa, Kansas, Missouri, Nebraska, Oklahoma, Texas, and Wisconsin	158.8	144.1	103.1	123.0
Northern Natural Gas Co., serving Colorado, Illinois, Iowa, Kansas, Michigan, Nebraska, South Dakota, and Minnesota	142.4	129.6	93.9	111.1
Panhandle Eastern Pipe Line Co., serving Illinois, Indiana, Kansas, Michigan, Missouri, and Ohio	165.4	150.0	106.8	127.8
Texas Eastern Transmission Corp., serving Alabama, Arkansas, Illinois, Indiana, Kentucky, Louisiana, Mississippi, Missouri, New Jersey, New York, Ohio, Pennsylvania, Tennessee, and Texas	179.2	162.2	114.5	137.8
Per unit averages and annual totals	165.1	149.8	106.8	127.6

TRANSPORTATION COSTS FOR ARCTIC GAS DELIVERIES TO WEST COST SHIPPERS (INCLUDING FUEL AT $1 PER MILLION BTU)

Deliveries to—	Transportation costs in cents per million Btu: 3d year costs	10 year average costs	15th year costs	20-year average costs
Pacific Lighting System (Southern California)	145.3	134.1	102.1	117.2
Pacfic Gas and Electric System (Northern California)	141.7	130.7	99.0	113.8
Northwest Pipeline System (Pacific Northwest area)	118.5	108.5	80.1	93.5
Per unit averages and annual totals	143.3	132.2	100.4	115.4

[46] [1957] S.C.R. 198 (Supreme Court).

[47] See also Central Canada Potash Co. Ltd. et al v. Attorney-General for Saskatchewan et al. (Saskatchewan Court of Queen's Bench), as yet unreported.

CORRECTED TRANSPORTATION COST FOR LNG TANKER SYSTEM DELIVERIES TO NORTHERN BORDER PIPE LINE COMPANY SHIPPERS (INCLUDING FUEL AT $1 PER MILLION BTU)

Deliveries to—	Transportation costs in cents per million Btu			
	3d year costs	10-year average costs	15th year costs	20-year average costs
Columbia Gas Transmission Corp., serving the District of Columbia, Kentucky, Maryland, New York, Ohio, Pennsylvania, Virginia, and West Virginia	251.6	243.2	201.0	221.5
Michigan-Wisconsin Pipe Line Co., serving Illinois, Indiana, Iowa, Kansas, Michigan, Missouri, Ohio, Tennessee, and Wisconsin	239.1	231.5	192.5	211.4
Natural Gas Pipeline Co. of America, serving Illinois, Indiana, Iowa, Kansas, Missouri, Nebraska, Oklahoma, Texas, and Wisconsin	223.0	216.1	180.1	197.6
Northern Natural Gas Co., serving Colorado, Illinois, Iowa, Kansas, Michigan, Nebraska, South Dakota, and Minnesota	218.5	212.0	177.3	194.1
Panhandle Eastern Pipe Line Co., serving Illinois, Indiana, Kansas, Michigan, Missouri, and Ohio	238.0	230.4	191.4	210.3
Texas Eastern Transmission Corp., serving Alabama, Arkansas, Illinois, Indiana, Kentucky, Louisiana, Mississippi, Missouri, New Jersey, New York, Ohio, Pennsylvania, Tennessee, and Texas	244.1	235.9	194.6	214.6
Transwestern Pipeline Co	207.6	197.7	165.8	181.3
Per unit averages and annual totals	239.6	231.8	192.3	211.4

Note.—For purposes of this study a portion of the gas assumed to be delivered by Northern Border Pipe Line Co. to Texas Eastern Transmission Corp. in Pennsylvania was assumed to be delivered to Transwestern Pipeline Co. (a subsidiary) in California.

CORRECTED TRANSPORTATION COSTS FOR LNG TANKER SYSTEM DELIVERIES TO WEST COAST SHIPPERS (INCLUDING FUEL AT $1 PER MILLION BTU)

Deliveries to—	Transportation costs in cents per million Btu			
	3d year costs	10-year average costs	15th year costs	20-year average costs
Pacific Lighting System (Southern California)	203.6	197.7	165.7	181.2
Pacific Gas and Electric System (Northern California)	195.6	189.9	158.7	173.8
Northwest Pipeline System (Pacific Northwest area)	195.6	189.9	158.7	173.8
Per unit averages and annual totals	200.9	195.0	163.3	178.7

TRANSPORTATION COSTS FOR ARCTIC GAS PIPELINE DELIVERIES (FULLY POWERED) TO NORTHERN BORDER PIPELINE COMPANY SHIPPERS (INCLUDING FUEL AT $1 PER MILLION BTU)

Deliveries to—	Transportation costs in cents per million Btu			
	3d year costs	10-year average costs	15th year costs	20-year average costs
Columbia Gas Transmission Corp., serving the District of Columbia, Kentucky, Maryland, New York, Ohio, Pennsylvania, Virginia, and West Virginia	151.3	141.2	102.2	121.1
Michigan-Wisconsin Pipe Line Co., serving Illinois, Indiana, Iowa, Kansas, Michigan, Missouri, Ohio, Tennessee, and Wisconsin	134.9	126.5	92.2	108.7
Natural Gas Pipeline Co., of America, serving Illinois, Indiana, Iowa, Kansas, Missouri, Nebraska, Oklahoma, Texas, and Wisconsin	138.0	129.2	94.0	111.0
Northern Natural Gas Co., serving Colorado, Illinois, Iowa, Kansas, Michigan, Nebraska, South Dakota, and Minnesota	123.3	116.0	85.1	100.0
Panhandle Eastern Pipe Line Co., serving Illinois, Indiana, Kansas, Michigan, Michigan, Missouri, and Ohio	144.1	134.7	97.7	115.7
Texas Eastern Transmission Corp., serving Alabama, Arkansas, Illinois, Indiana, Kentucky, Louisiana, Mississippi, Missouri, New Jersey, New York, Ohio, Pennsylvania, Tennessee, and Texas	159.3	148.5	107.1	127.3
Per unit averages and annual totals	144.3	134.9	97.9	115.8

CORRECTED TRANSPORTATION COST FOR LNG TANKER SYSTEM DELIVERIES TO NORTHERN BORDER PIPELINE COMPANY SHIPPERS (INCLUDING FUEL AT $1 PER MILLION BTU)

Deliveries to—	Transportation costs in cents per million Btu			
	3d year costs	10-year average costs	15th year costs	20-year average costs
Columbia Gas Transmission Corp., serving the District of Columbia, Kentucky, Maryland, New York, Ohio, Pennsylvania, Virginia, and West Virginia	231.8	224.3	186.7	203.8
Michigan-Wisconsin Pipe Line Co., serving Illinois, Indiana, Iowa, Kansas, Michigan, Missouri, Ohio, Tennessee, and Wisconsin	212.0	205.5	172.4	162.6
Natural Gas Pipeline Co. of America, serving Illinois, Indiana, Iowa, Kansas, Missouri, Nebraska, Oklahoma, Texas, and Wisconsin	197.3	191.4	160.4	174.5
Northern Natural Gas Co., serving Colorado, Illinois, Iowa, Kansas, Michigan, Nebraska, South Dakota, and Minnesota	189.3	183.8	154.6	167.9
Panhandle Eastern Pipe Line Co., serving Illinois, Indiana, Kansas, Michigan, Missouri, and Ohio	211.3	204.8	171.7	186.7
Texas Eastern Transmission Corp., serving Alabama, Arkansas, Illinois, Indiana, Kentucky, Louisiana, Mississippi, Missouri, New Jersey, New York, Ohio, Pennsylvania, Tennessee, and Texas	217.2	210.1	174.1	190.4
Transwestern Pipeline Co.[1]	181.4	176.3	148.7	161.2
Per unit averages and annual totals	215.4	208.6	174.3	186.9

[1] For purposes of this study a portion of the gas assumed to be delivered by Northern Border Pipeline Co. to Texas Eastern Transmission Corp. in Pennsylvania was assumed to be delivered to Transwestern Pipeline Co. (a subsidiary) in California.

TRANSPORTATION COST FOR ARCTIC GAS PIPELINE DELIVERIES (USING CANADIAN "NO-EXPANSION" CASE) TO NORTHERN BORDER PIPELINE COMPANY SHIPPERS (INCLUDING FUEL AT $1 PER MILLION BTU)

Deliveries to—	Transportation costs in cents per million Btu			
	3d year costs	10-year average costs	15th year costs	20-year average costs
Columbia Gas Transmission Corp., serving the District of Columbia, Kentucky, Maryland, New York, Ohio, Pennsylvania, Virginia, and West Virginia	175.4	162.1	113.5	137.2
Michigan-Wisconsin Pipe Line Co., serving Illinois, Indiana, Iowa, Kansas, Michigan, Missouri, Ohio, Tennessee, and Wisconsin	158.4	147.1	104.0	124.9
Natural Gas Pipeline Co. of America, serving Illinois, Indiana, Iowa, Kansas, Missouri, Nebraska, Oklahoma, Texas, and Wisconsin	161.5	149.9	105.7	127.2
Northern Natural Gas Co., serving Colorado, Illinois, Iowa, Kansas, Michigan, Nebraska, South Dakota, and Minnesota	145.4	135.5	96.6	115.4
Panhandle Eastern Pipe Line Co., serving Illinois, Indiana, Kansas, Michigan, Missouri, and Ohio	168.0	155.6	109.3	131.9
Texas Eastern Transmission Corp., serving Alabama, Arkansas, Illinois, Indiana, Kentucky, Louisiana, Mississippi, Missouri, New Jersey, New York, Ohio, Pennsylvania, Tennessee, and Texas	181.6	167.7	117.0	141.7
Per unit averages and annual totals	167.8	155.4	109.2	131.7

TRANSPORTATION COSTS FOR ARCTIC GAS DELIVERIES TO WEST COAST SHIPPERS (INCLUDING FUEL AT $1 PER MILLION BTU)

Deliveries to—	Transportation costs in cents per million Btu			
	3d year	10-year average costs	15th year costs	20-year average
Pacific Lighting System (Southern California)	148.0	139.6	104.7	121.3
Pacific Gas and Electric System (Northern California)	144.4	136.1	101.5	117.8
Northwest Pipeline System (Pacific Northwest area)	121.6	114.3	83.1	97.9
Per unit averages and annual totals	146.0	137.7	103.0	119.5

SUMMARY OF CAPITAL COSTS—ARCTIC GAS ROUTE VERSUS FAIRBANKS CORRIDOR, MID-1975 DOLLARS

[In thousands of dollars]

	Alaska	Canada	Total
	Fairbanks Corridor		
Construction costs	$2,059,042	$5,944,847	$8,003,889
Allowance for funds used during construction	539,899	1,192,566	1,732,465
Total costs	2,598,941	7,137,413	9,736,354
	Cross Delta Route		
Construction costs	$535,133	$5,048,012	$5,583,145
Allowance for funds used during construction	109,768	1,097,444	1,207,212
Total costs	644,901	6,145,456	6,790,357
	Difference		
Construction costs	$1,523,909	$896,835	$2,420,744
Allowance for funds used during construction	430,131	95,122	525,253
Total costs	1,954,040	991,957	2,945,997

CAPITAL COSTS—FAIRBANKS CORRIDOR—48 INCH, CANADA; MID-1975 DOLLARS UNESCALATED

[In thousands of dollars]

	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Total
Pipeline	$476, 399	$1, 178, 069	$1, 636, 823	$1, 361, 945	$58, 737				$4, 711, 973
C/S and C/H equipment		8, 586	70, 353	195, 886	258, 071	$162, 663	$105, 888	$37, 207	838, 654
Buildings and improvements		8, 077	44, 103	20, 920	13, 112	10, 299	5, 303	2, 964	104, 778
Measuring equipment		671	4, 414	5, 282	64				10, 431
Transportation equipment		2, 154	11, 415	3, 243					16, 812
Communication equipment	33, 709	34, 872	28, 889	8, 447	1, 122	1, 296	450	323	109, 108
Tools and work equipment		8, 470	44, 159	9, 140					61, 769
Office furniture and equipment		150	767	89					1, 006
Land		42	216	58					316
Prepermit	90, 000								
Construction costs	600, 108	1, 241, 091	1, 841, 139	1, 605, 010	331, 106	174, 258	111, 641	40, 494	5, 944, 847
Allowance for funds used during construction	51, 294	178, 072	400, 739	394, 586	110, 692	26, 548	27, 254	3, 381	1, 102, 506
Total costs	651, 402	1, 419, 163	2, 241, 878	1, 999, 596	441, 798	200, 806	138, 895	43, 875	7, 137, 413

FAIRBANKS CORRIDOR—48 INCH, ALASKA; UNESCALATED MID-1975

[In thousands of dollars]

	Year 2	Year 3	Year 4	Year 5	Year 6	Total
Pipeline	$109,678	$189,444	$837,724	$663,146	$12,872	$1,812,864
C/S and C/H equipment			13,602	73,628	28,139	115,369
Buildings and improvements			6,366	32,207	1,924	40,497
Measuring equipment			695	3,743	1,308	5,764
Transportation equipment			2,775	13,871		16,646
Communication equipment	7,534	19,569	1,987	1,864	794	31,748
Tools and work equipment			4,305	21,517		25,822
Office furniture and equipment			58	292		350
Land						
Prepermit costs	10,000					
Total construction costs	127,212	209,013	867,512	810,268	45,037	2,059,042
Allowance for funds used during construction	11,450	39,596	118,021	226,503	144,329	539,899
Total costs	138,662	248,609	985,533	1,036,771	189,366	2,598,941

FAIRBANKS CORRIDOR (PRUDHOE BAY GAS ONLY)—42 INCH, CANADA TOTAL; UNESCALATED MID-1975

[In thousands of dollars]

	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Total
Pipeline	$149,263	$331,916	$1,000,834	$1,198,951	$39,902			$2,720,866
C/S and C/H equipment		6,179	50,783	131,552	131,054	$97,885	$102,994	520,447
Buildings and improvements		3,922	24,463	26,373	12,216	11,376	10,703	89,053
Measuring equipment			1,523	8,054	729			10,306
Transportation equipment			733	4,365	3,506			8,604
Communication equipment	16,865	23,850	24,383	7,013	1,081	969	785	74,946
Tools and work equipment		4,111	22,467	9,611				36,189
Office furniture and equipment		121	621	95	10	55		902
Land		43	219	59				321
Prepermit costs	90,000							90,000
Total direct costs	256,128	370,142	1,126,026	1,386,073	188,498	110,285	114,482	3,551,635
Allowance for funds used during construction	26,065	67,622	180,889	356,947	236,218	7,629	19,110	896,480
Total costs	282,193	439,764	1,306,915	1,743,020	424,716	117,914	133,592	4,448,115

FAIRBANKS CORRIDOR (PRUDHOE GAS ONLY)—42 INCH, ALASKA TOTAL; UNESCALATED MID-1975

[In thousands of dollars]

	Year 2	Year 3	Year 4	Year 5	Year 6	Total
Pipeline	$93,687	$161,823	$715,584	$556,459	$10,995	$1,538,548
C/S and C/H equipment			9,641	52,190	19,945	81,777
Buildings and improvements			8,117	41,065	2,454	51,636
Measuring equipment			688	3,707	1,313	5,708
Transportation equipment			2,775	13,871		16,646
Communication equipment	7,534	19,569	1,987	1,864	794	31,748
Tools and work equipment			4,305	21,517		25,822
Office furniture and equipment			58	292		350
Land						
Prepermit costs	10,000					10,000
Total costs	111,221	181,392	743,155	690,965	35,502	1,762,235
Allowance for funds used during construction	10,354	34,884	102,737	195,691	124,353	468,019
Total	121,575	216,276	845,892	886,656	159,855	2,230,254

TRANSPORTATION COST FOR ARCTIC GAS PIPELINE DELIVERIES TO NORTHERN BORDER PIPE LINE COMPANY SHIPPERS (INCLUDING FUEL AT $1 PER MILLION BTU)

Deliveries to—	Transportation costs in cents per million Btu			
	3d year costs	10-year average costs	15th year costs	20-year average costs
Columbia Gas Transmission Corp., serving the District of Columbia, Kentucky, Maryland, New York, Ohio, Pennsylvania, Virginia, and West Virginia	214.9	195.4	132.2	162.7
Michigan-Wisconsin Pipe Line Co., serving Illinois, Indiana, Iowa, Kansas, Michigan, Missouri, Ohio, Tennessee, and Wisconsin	197.4	180.0	122.4	150.1
Natural Gas Pipeline Co. of America, serving Illinois, Indiana, Iowa, Kansas, Missouri, Nebraska, Oklahoma, Texas, and Wisconsin	200.6	182.8	124.2	152.4
Northern Natural Gas Co., serving Colorado, Illinois, Iowa, Kansas, Michigan, Nebraska, South Dakota, and Minnesota	184.0	168.0	114.9	140.3
Panhandle Eastern Pipe Line Co., serving Illinois, Indiana, Kansas, Michigan, Missouri, and Ohio	207.3	188.7	128.0	157.2
Texas Eastern Transmission Corp., serving Alabama, Arkansas, Illinois, Indiana, Kentucky, Louisiana, Mississippi, Missouri, New Jersey, New York, Ohio, Pennsylvania, Tennessee, and Texas	221.3	201.1	135.8	167.4
Per unit averages and annual totals	207.1	188.5	127.8	157.0

TRANSPORTATION COSTS FOR ARCTIC GAS DELIVERIES TO WEST COAST SHIPPERS (INCLUDING FUEL AT $1 PER MILLION BTU)

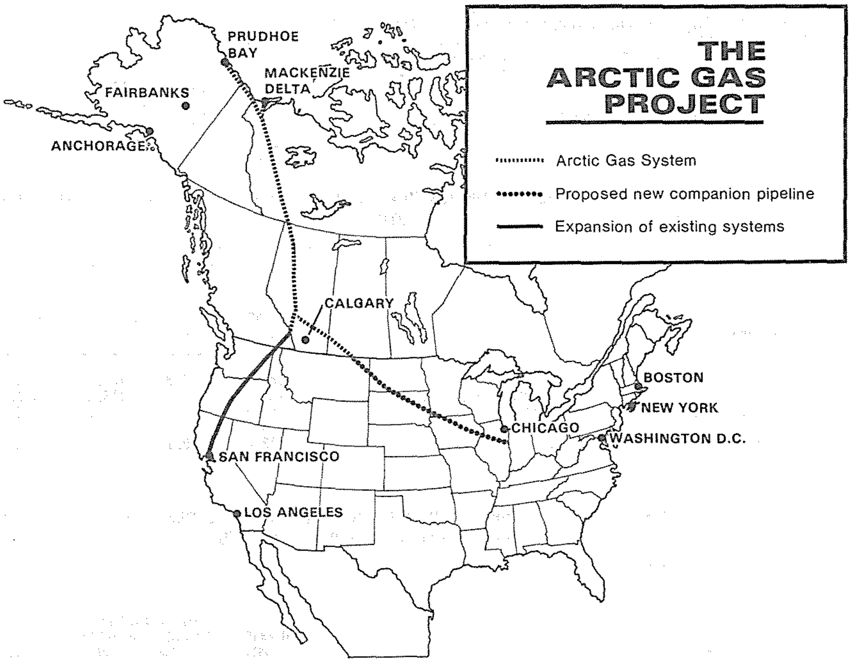
Deliveries to—	Transportation costs in cents per million Btu			
	3d year costs	10-year average costs	15th year costs	20-year average costs
Pacific Lighting System (Southern California)	185.9	171.3	121.9	145.2
Pacific Gas and Electric System (Northern California)	181.4	167.1	118.3	141.2
Northwest Pipeline System (Pacific Northwest area)	158.8	145.4	99.8	121.3
Per unit averages and annual totals	183.6	169.1	120.0	143.2

TRANSPORTATION COST FOR ARCTIC GAS PIPELINE DELIVERIES TO NORTHERN BORDER PIPE LINE COMPANY SHIPPERS (INCLUDING FUEL AT $1 PER MILLION BTU)

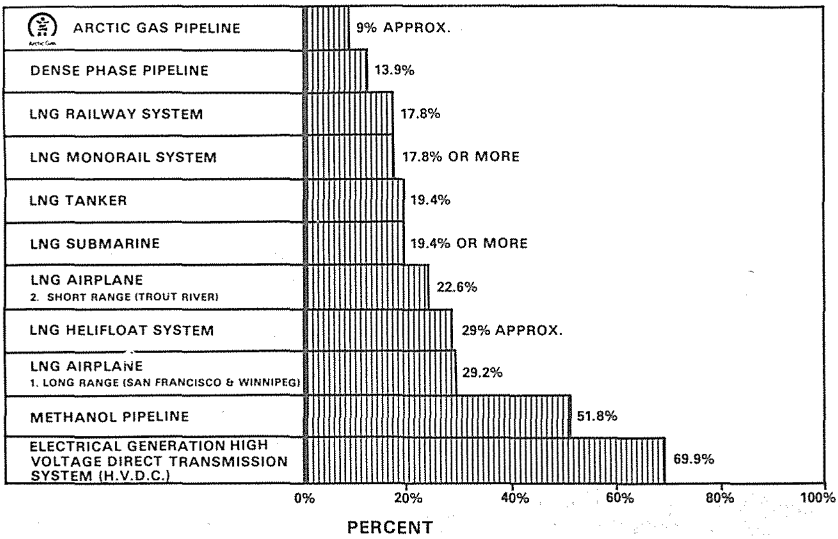
Deliveries to—	Transportation costs in cents per million Btu			
	3d year costs	10-year average costs	15th year average costs	20-year average costs
Columbia Gas Transmission Corp., serving the District of Columbia, Kentucky, Maryland, New York, Ohio, Pennsylvania, Virginia, and West Virginia	216.0	201.4	136.6	167.9
Michigan-Wisconsin Pipe Line Co., serving Illinois, Indiana, Iowa, Kansas, Michigan, Missouri, Ohio, Tennessee, and Wisconsin	199.4	186.6	127.3	155.8
Natural Gas Pipeline Co. of America, serving Illinois, Indiana, Iowa, Kansas, Missouri, Nebraska, Oklahoma, Texas, and Wisconsin	202.5	189.3	129.0	158.0
Northern Natural Gas Co., serving Colorado, Illinois, Iowa, Kansas, Michigan, Nebraska, South Dakota, and Minnesota	186.4	175.0	120.0	146.3
Panhandle Eastern Pipe Line Co., serving Illinois, Indiana, Kansas, Michigan, Missouri, and Ohio	208.8	194.9	132.6	162.6
Texas Eastern Transmission Corp., serving Alabama, Arkansas, Illinois, Indiana, Kentucky, Louisiana, Mississippi, Missouri, New Jersey, New York, Ohio, Pennsylvania, Tennessee, and Texas	221.9	206.6	139.9	172.1
Per unit averages and annual totals	208.6	194.7	132.4	62.4

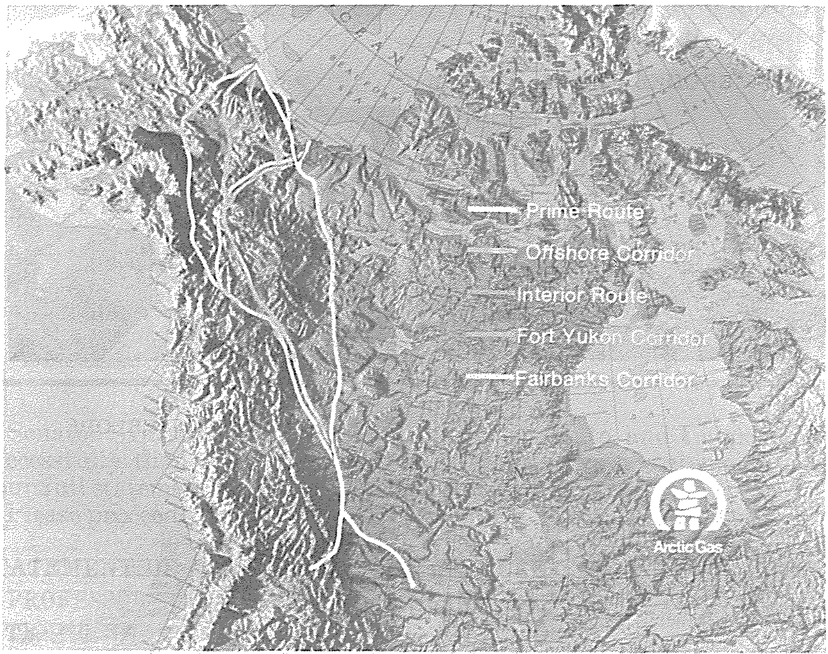
TRANSPORTATION COSTS FOR ARCTIC GAS DELIVERIES TO WEST COAST SHIPPERS (INCLUDING FUEL AT $1 PER MILLION BTU)

Deliveries to—	Transportation costs in cents per million Btu			
	3d year costs	10-year average costs	15th year costs	20-year average costs
Pacific Lighting System (Southern California)	184.7	174.9	124.7	148.4
Pacific Gas and Electric System (Northern California)	180.4	170.8	121.2	144.5
Northwest Pipeline System (Pacific Northwest area)	158.8	150.1	103.5	125.5
Per unit averages and annual totals	182.5	172.8	122.9	146.4



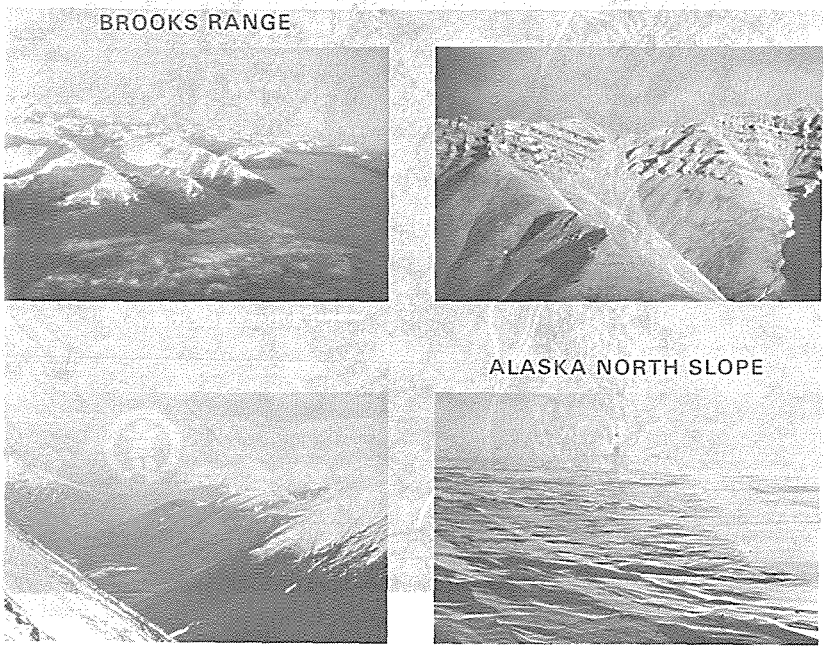
Energy Usage For Systems Studied By Alaskan Arctic Gas

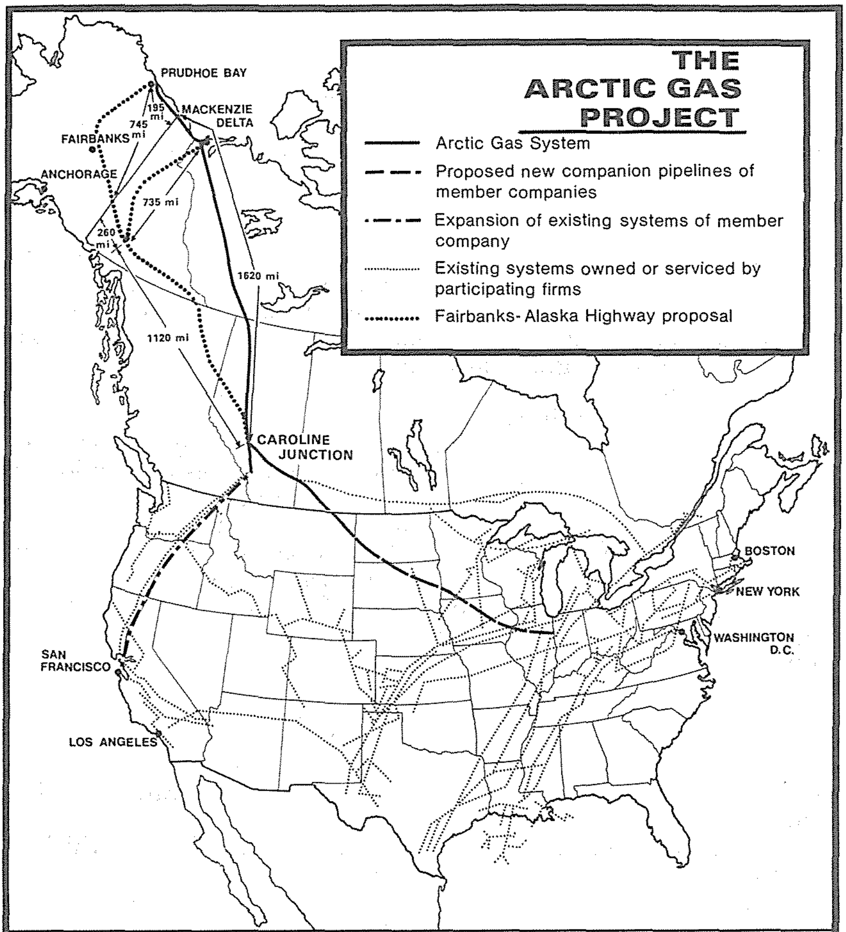




Caribou graze nonchalantly on the Arctic tundra within sight of an oil drilling rig on Alaska's North Slope, site of the largest oil field ever discovered in North America. Photo was taken during the caribou's annual migration across the North Slope.

Alyeska Pipeline Service Company.





MILEAGES TO CAROLINE JUNCTION (Approx.)

FAIRBANKS-ALASKA HIGHWAY ROUTE		ARCTIC GAS ROUTE
745 MILES	IN ALASKA	195 MILES
2115 MILES	IN CANADA	1620 MILES
2860 MILES	TOTAL	1815 MILES
MACKENZIE DELTA "LEG" 735 MILES		

Senator STEVENSON. Dr. Thomas, I will ask you to, and I hope more successfully than your predecessors, summarize your statement, and your full statement will be put in the record.

Please proceed.

STATEMENT OF DR. CARL O. THOMAS, DEAN FOR RESEARCH AND PROFESSOR OF CHEMICAL ENGINEERING, UNIVERSITY OF TENNESSEE

Dr. THOMAS. Thank you, Mr. Chairman.

I think I can hold this to about 10 to 15 minutes. My name is Carl Thomas, I am dean for research, and professor of chemical engineering, University of Tennessee. I am here primarily today to be a technical witness, not as an advocate of any particular method for the transportation of Alaskan gas.

I would like to take a moment to respond to some of Mr. Blair's comments this morning. We did not assume a 50 cent wellhead price for the gas in Alaska. What we did was to, at the direction of the Federal Energy Administration, treat 50 cent, $1, and $2 wellhead prices, and the results of this are presented in the study and prepared testimony delivered to you this morning.

A second point has to do with the plant conversion efficiency. Instead of a 63 percent efficiency, as indicated by Mr. Blair, we treated a range from 53 to 61 percent efficiency, which we believe is representative of current technology in this particular field. It should be pointed out that one ought not to compare plant efficiency for manufacturing of chemical grade methanol with that for the fuel grade methanol. Efficiencies will be higher in the latter case, and the latter type of alcohol is that being discussed.

The last point is we did look at a 10-year and a 25-year depreciation schedule in order to take into account differences of opinion of how long or how severe operations might be in the Arctic.

The study was done under contract with the FEA. The original intent of the study was to develop a kind of ace in the hole strategy in the event there were undue delays in permitting either of the two pending gas transmission line proposals. I do not think the studies that have been done to date are yet adequate to present methanol as a competitive strategy vis-a-vis either of the two pending gas line strategies.

If that were to be the interest of the Congress, it would be essential to do a far more detailed study of the methanol strategy. This could be carried out within the time framework of the first benchmark date which I believe is January 1, 1977, in the Alaska strategy recommended by the President to the Congress.

The nature of the alcohol product is a fuel-grade alcohol, which is a mixture of methyl alcohol and higher molecular weight alcohols. The synthesis technology for these alcohols is roughly a half century old, there is really no new technology involved.

There, however, engineering questions associated with putting in place a methanol synthesis capacity in the North Slope, anywhere from 5 to 8 times the total present in-place capacity of the lower 48 States. This would be a major engineering job.

Alcohol is now used primarily as an industrial chemical. If one contemplates a 5- to 10-fold increase in the supply of that product, then clearly the fuels market is mandated. Is there such a reasonable fuels market?

Much of the push for alcohol in the past 2 years has revolved around the automotive market and two particular strategies have been pushed. One is to use a blend of alcohol with gasoline, possibly in the 10 or 15 percent by volume range. A second automotive strategy is to use straight methanol, but this would require specially modified automotive engines.

I personally feel that of these two, the straight methanol strategy is better. It is an argumentative point, but I would like to point out that methanol is not very soluble in retail grade gasoline. It is highly sensitive to water included phase separation, which would cause the alcohol to separate in the automotive gasoline tank, and destroy the blends. To the best of my knowledge, this particular problem with blends has not been resolved.

There is, however, another possible use for a fuel grade alcohol, and that is in the peaking turbines of the electrical utility industry.

In this particular case, there have been some tests. There have been burner tests conducted by both Westinghouse and GE; there has been a turbine test on an operational basis at the Bayboro station in Florida and its results are encouraging.

From a supply-demand standpoint, the some half-million barrels per day of methanol that would come from Alaska would if they went fully into the automotive market, reach a supply-demand match by the early 1980's. If it went into the electrical utility market, the potential demand already exceeds the total production capacity from Alaska.

The FEA study was directed toward a procedure which would manufacture methanol, fuel grade, at the North Slope, bring it south in some kind of mix with the crude oil in the existing line, transship by tankers, not cryogenic tankers, to the west coast and separate the the crude oil and alcohol and direct them to the irrespective markets.

Senator STEVENSON. Could I interrupt right there? That is very interesting, but how would it be transported after it got down south? I mean, the pipeline is there ——

Dr. THOMAS. From Valdez to the Pacific coast, or subsequent ——

Senator STEVENSON. Subsequent to the Pacific coast, how would that volume of alcohol be transported?

Dr. THOMAS. We would have to make use of existing or expanded pipeline capacity, railroad tanker, these sorts of things.

The strategy that we examined took two approaches. One was to take a conservative approach and to assume that the methanol would be completely soluble in the crude oil, which from an engineering standpoint is probably not the case.

Nevertheless, it does put the most conservative pressure on the system and one would have to build at Los Angeles a distillation plant capable of handling the full throughput. Therefore, it is the conservative economic approach.

A second approach would be to run the alcohol through the Alyeska line on a batch basis, and this would essentially eliminate the need for a distillation facility at Los Angeles, and would be a more economical approach.

Now on the cost estimates, it is clearly impossible for a study with a $50,000 budget contemplating $5 to $6 billion investment to be more than an approximation. Nevertheless, we did try to be quite conservative. We did things such as to escalate all costs in Alaska to 350 percent of the most conservative lower 48 State estimates. We have estimated the operations and maintenance costs associated with the Alaskan project at almost 20 times the percentage of fixed capital that they would run for either of the two pipeline strategies.

In our particular assessments, the operations and maintenance costs account for more than 50 percent of the tariff on the methanol to the lower 48.

Now, the results of this, when one looks at the various wellhead prices, the various strategies for pumping, the various efficiencies and various depreciation schedules, 24 are possible base cases.

The most optimistic of these cases is for a 25-year depreciation schedule and a 50 cent wellhead price. This leads to a tariff of $2.84 and a price of $3.69 per million Btu. The most pessimistic tariff, to respond to Mr. Blair's comment, is approximately $5.77, and a $2 wellhead price would bring the price to more than $11 per million Btu's.

So there is substantial sensitivity to gas prices. Nevertheless, if one does take the supposedly best case out of this parametric analysis, the estimated price to market for the methanol would be 25 cents per gallon, f.o.b. west coast. This compares to a current price of about 40 cents per gallon for chemical grade methanol f.o.b. gulf coast.

On an equal Btu basis, it would be comparable to about 52 cents per gallon of gasoline, ex-tax and f.o.b. at the refineries.

If one compares the tariffs, we have estimated $2.84 per million Btu in the best case, and the Interior Department study of the two competing gas line proposals estimates roughly $1.60 on the tariff.

If one makes adjustments to treat the O. & M. costs comparably for all three projects, the the tariff elements would be comparable within what I judge to be the error band of the estimates.

I should, for completeness, add two other things. One is that there is as yet an unevaluated proposal for an alternative transportation strategy which I do not feel competent to comment upon, but it would be to use nuclear powered submarine tankers to bring the methanol under the Arctic Ice Cap and into the east coast markets.

A second point for completeness of information is that there are parallel studies underway, and some completed, to examine the use of coal, municipal solid wastes, and other types of waste products for the synthesis of alcohol, fuel grade, for the American markets.

I think it would be important to keep all of these in mind as one assesses the potential for alcohol markets. Now it seems to me under the present condition of available information, one cannot make a reasonable evaluation between the two gas lines and the alcohol strategy as a third present alternative.

If one wishes to consider these as three alternatives, rather than two alternatives and one ace in the hole, I think it is essential that a competent and detailed study of the alcohol strategy be undertaken.

Senator STEVENSON. Is it true that the methanol conversion process results in a 40 percent loss of energy?

Dr. THOMAS. There is a conversion loss. The plant efficiencies, which are design dependent, could go as high as 60 percent efficient, which would be about a 40-percent loss at the plant.

One should, however, be careful in comparing this with the gasoline strategies. For example, you do not need the dry pipeline grade natural gas as a feedstock for the methanol plant. The inplace natural gas has a substantial amount of carbon dioxide in it, and rather than discard that, it is an asset in the alcohol synthesis option.

What has to be dealt with is the net system efficiency for the entire system rather than just the net energy loss on a single operational step and I do not know what that comparison would show.

Senator STEVENSON. In your opinion, is there enough merit in this strategy to warrant an extensive study of it at this point and if so, how long would you guess such a study would take?

Dr. THOMAS. To your first question, I think, yes; there is enough merit to warrant a comprehensive study. I think such a study could be conducted, if it were undertaken promptly within a 6-month time frame.

I suspect the cost would be trivial compared with the capital investments at stake here.

Senator STEVENS. Are there any indications in the industry that there could be a proponent for such a mechanism?

Dr. THOMAS. Yes, there is a proponent. Westinghouse and a consortium of seven companies are promoting or proposing an Alaska methanol strategy, I have not seen any study leading to any conclusions on that, but there is a proposal that has now been promoted publicly and I believe there is a proposal pending with the Maritime Commission.

Senator STEVENS. Thank you.

I think MarAd turned down their proposal. But in terms of your study, did it project the cost of the methanol plant?

Dr. THOMAS. Yes, sir, it did. The costs on the methanol plants were scaled to 5,000 tons per day plants, which are quite large by present inplace standards. There was a scaling factor of almost fivefold from present 1,000 ton-per-day plants. We estimated by the lower 48 State standards, 1974 dollars, a fixed capital investment approaching $80 million each for these plants.

Senator STEVENS. How many would be required?

Dr. THOMAS. Fourteen plants were required.

Senator STEVENS. That is stateside plants?

Dr. THOMAS. That is stateside.

Before factoring this into a price for the methanol, we scaled each of these up by a factor of 3½ in the fixed capital investment, and we also scaled the working capital and O. & M. costs by the 3½ factor for all costs incurred in Alaska.

Senator STEVENS. What was the total capital requirement?

Dr. THOMAS. The total capital requirement, if one used the mixed flow system which would have a distillation facilitity at Los Angeles. would be roughly $4.5 billion on fixed capital, a little more than $1 billion on working capital, and an annual O. & M. of about $1 billion.

For the batch flow basis, the fixed capital drops to about $4.1 billion.

Senator STEVENS. You are postulating using the existing oil pipeline on the batch flow basis, right?

Dr. THOMAS. Yes, sir, that was one premise. There were to variations, either mixed flow or batch flow.

Senator STEVENS. How much of the pipeline's capacity then would be utilized by the methanol relative to oil?

Dr. THOMAS. At full stream capacity, one would approach 600,000 barrels per day of methanol and if the Alyeska line at the same time is operating at full capacity of 2 million barrels per day of crude, that would be about 20 percent of the total throughput.

Senator STEVENS. It would require looping, eventually.

Dr. THOMAS. That is correct, it would. I should add that to my knowledge, there are no negotiations with Alyeska, and I think clearly one would have to negotiate with them on the use of their pipelines.

Senator STEVENS. Well, they are a common carrier.

What would be the cost of the independent study for 6 months?

Dr. THOMAS. I think one could do this within 6 months on the order of \$200,000–\$400,000. I should point out that the Interior Department, in the last part of 1975, did an evaluation of the two pipeline's economics, and it is my understanding that that independent study came in at about a half million dollars, or somewhat higher than that.

Senator STEVENS. How labor intensive is the methanol once it is underway?

Dr. THOMAS. Once it is underway, it is not a very labor-intensive operation. I don't recall exactly the staffing. But generally a chemical plant, once in operation, can be maintained and operated by a reasonably sized staff. I just don't recall the number.

Senator STEVENS. Thank you, very much.

Senator STEVENSON. Methanol, you said, can either be used directly with engine modifications or mixed with gasoline and then used as a fuel without modification. Is that right?

Dr. THOMAS. No; there are two proposals in the automotive market. One is the blended with gasoline approach, the other one is straight.

Now in my view, the blend with gasoline is not a very attractive approach because it would require dry fuel handling systems, including the storage tanks, distribution systems, gasoline station tanks, and so forth.

The trace amount of water in such a fuel system would cause the alcohol to separate from the gasoline, and the alcohol would be at the bottom of the tank.

This would mean the engine would be running part time with alcohol and part time with gasoline, rather than on the blended mixture.

I suspect that this would be a substantial problem to maintain a dry distribution system nationwide.

Senator STEVENSON. What kind of engines use the straight methanol? Would you use it in an internal combustion engine?

Dr. THOMAS. Yes; these can still run in an internal combustion engine. In fact, racing cars at Indianapolis have run on alcohol for a long time.

Basically there is a substantial change in the carburetion mixture, the air-to-fuel ratio.

I think these are probably beyond a retrofit picture for existing engines.

Senator STEVENSON. Would that be the principal use for this methanol, namely in new internal combustion engines?

Dr. THOMAS. Personally, I think a better use would be in the peaking turbines of electric utilities, which are now running on either natural gas or No. 2 oil. The reason for stating that is that the turbines are under much tighter maintenance and control, there is a better quality of operation, the fuel storage distribution facilities would be under tighter control and one would not get into the problems of a very highly diversified public market for a special fuel.

Second: The heat of vaporization of the alcohol is much higher than for gasoline and you might then have cold start problems. This could be handled by using some volatile material such as butane for starting plus heat exchangers on the manifolds to vaporize the alcohol fuel during continuous operations. These are some examples of the kinds of modifications one would have to do.

In fact, all of your statements will be entered into the record. And I will ask you, as I have the others, to try to summarize, if you can. We will come back after you have completed your statements, to questions.

Mr. Evans?

Senator STEVENSON. Thank you, Mr. Thomas.

[The statement follows:]

STATEMENT OF CARL O. THOMAS, DEAN OF RESEARCH AND PROFESSOR OF CHEMICAL ENGINEERING, UNIVERSITY OF TENNESSEE, KNOXVILLE, TENN.

INTRODUCTION

Mr. Chairman and distinguished members of the Committee: I appreciate the opportunity to appear today to discuss some aspects of an Alaskan methanol strategy.

At present there are two proposals for gas transmission lines to bring the Alaskan natural gas to the lower 48 states—one via a trans-Canadian route and the other via a trans-Alaska route with tanker shipment to the west coast.[1] Substantial private sector investment has gone into these two competing proposals, and the Interior Department in 1975 conducted a major study of "Alaskan Natural Gas Systems: Economic and Risk Analysis, Conclusions and Results.

During 1975 the "Alaskan Methanol Concept: A Pre-Feasibility Study" was conducted under my direction at the Institute for Energy Analysis, Oak Ridge, under contract to the Federal Energy Administration.[2] That study cannot compare in depth with the studies on the competing natural gas transmission systems. Nevertheless, it is the only recent independent study on the subject of which I am aware, and is the source of most of my comments in the testimony today.[3]

At this point there is insufficient information upon which to base an advocacy of an Alaskan methanol strategy. In the interest of adequate evaluation of alternatives I do, however, strongly recommend a prompt and thorough study of the methanol alternative—including alternative methods of transportation for the methanol to the lower 48 states.

BACKGROUND ON METHANOL

Methanol (or methyl alcohol) is the simplest of the alcohols. It is sometimes referred to as "wood alcohol," having been prepared for many years by the destructive distillation of wood. Since the late 1920's, it has been synthesized from natural gas.

In the present testimony the term "methanol" refers to a fuel grade methyl alcohol containing some 80–90 per cent methyl alcohol, with the balance consisting of higher molecular weight and more complex alcohols.

There is little or no logic in preparing methanol for the fuels market from lower 48 state natural gas. This would merely convert a premium chemical and fuel into another fuel, adding both dollar and energy loss costs to the final product. There may however be logic in synthesizing methanol on site at overseas natural gas sources (including Alaska in this definition) since the much longer transportation distances may shift the trade-offs between the dollar and net energy costs.

POTENTIAL MARKETS FOR ALASKAN METHANOL

Gross production of Alaskan methanol is projected to be 514,000 to 592,000 barrels per day, and net available to the lower 48 states as 364,000 to 571,000

[1] No position as to the relative merits of these two proposals is implied in this testimony.
[2] IEA (M)–75–5, November 1975: Institute for Energy Analysis, Oak Ridge, Tennessee.
[3] Statements in this testimony do not necessarily reflect any official position of the Federal Energy Administration or of the Institute for Energy Analysis.

barrels per day. This is approximately 5–8 times the total current U.S. production. An initial question then is whether there is a credible future market for this level of methanol production.

Methanol is used in the U.S. primarily as an industrial chemical, and domestic production currently is in the range of 75,000 barrels per day. Only a trivial portion of current production is routed into the fuels market. Methanol production rates have been growing at 10–12 per cent annually over recent years, and methanol now is one of the "top 20" industrial chemicals in the U.S. Figure 1 shows projected demand at 7 and at 10 per cent annual growth rates, reaching the Alaskan supply level in the mid 1990's.

The industrial chemical demand curve may well bend over in future years. Also, new methanol capacity is now being installed in the lower 48 states. For these reasons, an Alaskan methanol strategy should depend primarily upon a credible fuels market.

During the past few years methanol has been promoted as a potential fuel in the spark ignition internal combustion engine (automotive) market. One possible strategy is to blend the methanol with gasoline at a level of 5–15 per cent by volume. Figure 2 shows projected methanol demand curves for these three blending levels and at two projected growth rates. There would be a supply-demand match by the early 1980's at the lowest of the three blending levels—consequently this particular projection is less vulnerable to future trend certainties.

There are, however, several serious problems associated with the use of gasoline-methanol blends. For example trace amounts of moisture can cause phase separations with attendant engine malfunctions. If methanol is to be used at all in the automotive market, a more practical strategy might be to work with captive fleets (e.g., taxicabs, postal vehicles, etc.) using straight methanol. This strategy would require a special engine design, but would eliminate many of the engineering problems associated with the blended fuel. The probable demand level for this second automotive strategy would lie between the 5 per cent and the 10 per cent blend lines in Figure 2.

A third, and far more attractive, fuel strategy would be to use the methanol as a substitute for No. 2 oil and natural gas in the peaking turbines of the electrical utility industry.[4] The principal turbine manufacturers have made burner tests with methanol, and there has been a test run with a turbine at the Bayboro power station in Florida. Operational results to date are more encouraging than those in the automotive sector. Also, the turbines are "captive engines," subject to a high level of maintenance, and the fuel storage-distribution systems would be under tighter control.

The dashed line in Figure 2 shows the projected methanol demand level for peaking turbines in the electrical utility industry, at a 7 per cent annual growth rate. The potential demand *already* matches the potential Alaskan supply.

In summary then, it appears that either the automotive or the electrical utility markets could absorb the entire Alaskan methanol supply, but that the electrical utility market would be the more attractive of the two.

ENERGY COST OF THE METHANOL STRATEGY

The economics of the Alaskan methanol strategy are discussed in a subsequent section. It is also important to recognize the net energy costs associated with this strategy.

The synthesis of methanol from hydrocarbons such as natural gas involves a partial oxidation, i.e. combustion. Inherently then there is an energy loss which cannot be overcome, and design efficiencies in the synthesis plants can only approach this theoretical energy loss limit.

If one assumes pure methane (the principal component of natural gas) as the raw material and pure methanol as the product, the limiting efficiencies are 86 per cent for the product in the gas phase and 82 per cent for the product in the liquid phase, or 14 per cent and 18 per cent losses respectively. The efficiency is defined as the ratio of the heat of combustion of the methanol product to the heat of combustion of the methane raw material.

[4] A separate study on the potential synthesis of methanol from coal and from municipal solid wastes and its utilization in the electrical utility market was jointly sponsored by FEA, EPA, and TVA during 1975.

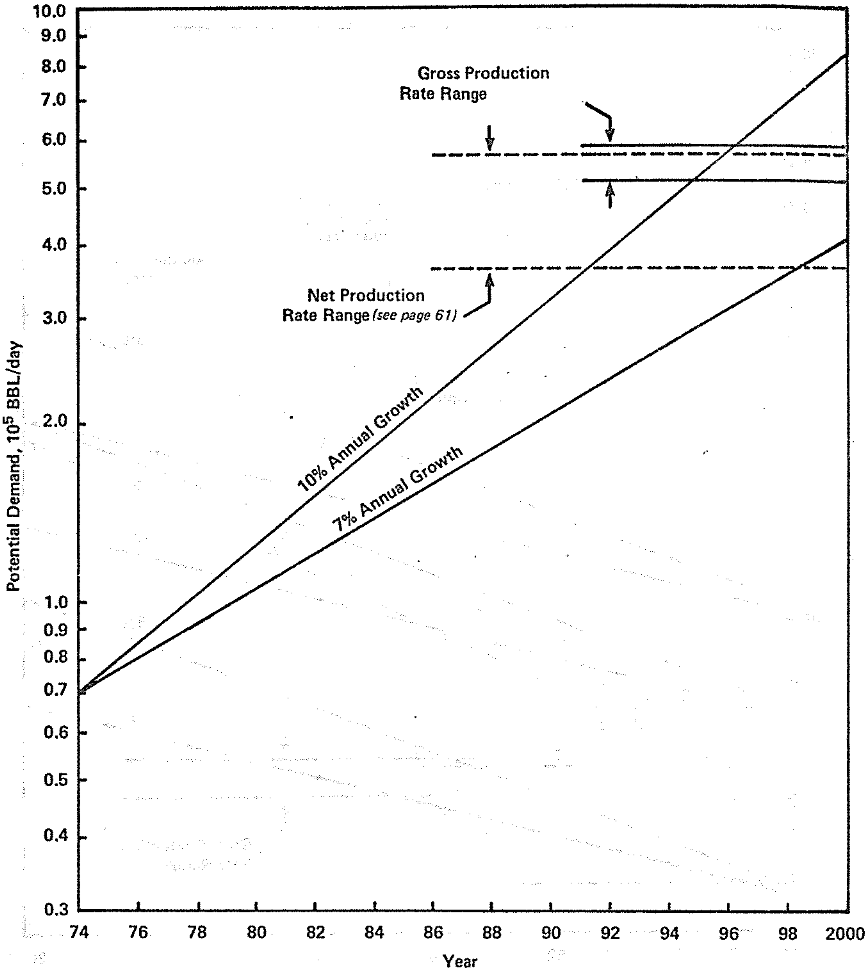


Figure 1
Chemical Market for Methanol

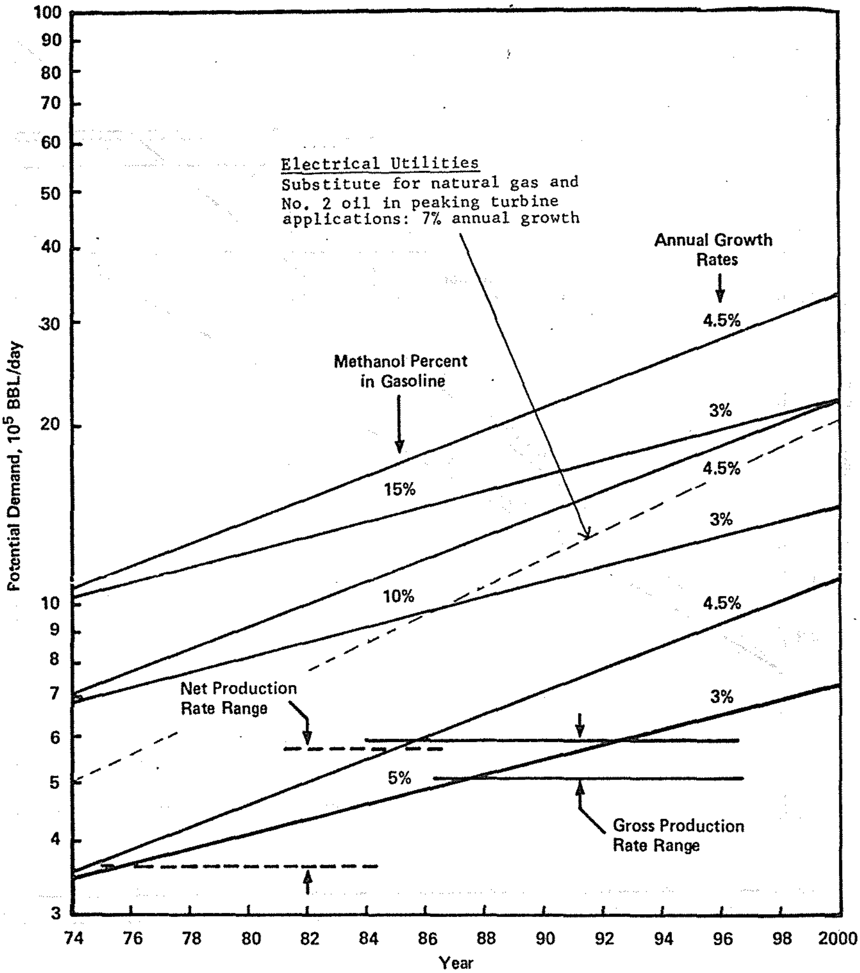


Figure 2

Automotive and Electrical Utility Markets for Methanol

In the Alaskan case, fuel grade methanol would be manufactured from natural gas containing other hydrocarbons in addition to methane, plus water vapor and carbon dioxide. The theoretical efficiency limit therefore is likely to be somewhat better than for the preceding simple illustration.

Methanol plant design and operational constraints further reduce the actual plant efficiencies. For the Alaskan methanol study we have used a range of 53–61 per cent efficiency as representative of the current state of the technology.

Additional shrinkages may occur elsewhere in the methanol system, attributable to the use of methanol to power supplemental pump turbines along the Alyeska pipeline and the use of methanol as a boiler fuel in distillation-separation facilities on the west coast.

I am not aware of any adequate three-way comparisons of the net energy efficiencies of the two competing gas line strategies and the methanol strategy to date. Since energy conservation must be an element in the evaluation of alternatives, a detailed evaluation of this point should be made in addition to the more traditional economic comparisons.

THE ALASKAN METHANOL STUDY

At the request of the Federal Energy Administration in 1975 we made a preliminary evaluation of the Alaskan methanol strategy, including engineering, economic, and market feasibility studies. The market conclusions have been summarized in a preceding section.

The general framework of the study was as follows. Some fourteen methanol synthesis plants, with production capacity in excess of 5,000 tons per day each, would be constructed on site at the North Slope. The fuel grade methanol would be injected into the Alyeska crude oil pipeline as an ill-defined mixture with the crude oil, or on an alternating slug (batch) flow basis. Slug flow would require supplemental storage capacity for both methanol and crude oil at the North Slope and at Valdez.

The strategy assumes that, given additional turbine driven pumps, the Alyeska pipeline would have sufficient reserve capacity to handle 600,000 barrels per day of methanol.

The mixture would be transported from Valdez to Los Angeles in standard ocean going tankers, separated by distillation, and the two fuel components delivered to their respective markets.

Since the physical and chemical characteristics of a crude oil-methanol mixture are not yet adequately defined for the mixed flow system we assumed total mutual solubility, requiring complete distillation for separation at Los Angeles. This represents the most expensive and conservative approach to that part of the operations.

The slug flow strategy represents a more optimistic approach, including minimal mixing of the two components. By analogy to slug flow as presently used with other liquids in the lower 48 states, one can estimate the mixture interface losses to be negligible. This strategy would eliminate the expensive distillation facilities at Los Angeles with the attendant losses of methanol used as boiler fuel in the distillation units.

By considering two depreciation schedules, of 10 years and 25 years, one generates the eight base cases included in the study. These are summarized in Table 1.

Table 2 summarizes the estimated figures on gross and net methanol rates utilized in the eight base cases.

TABLE 1.—BASE CASES CONSIDERED IN THE STUDY

Case No.	Depreciation (years)	Plant efficiency (percent)
Mixed flow:		
I	10	53
II	10	61
III	25	53
IV	25	61
Slug flow:		
V	10	53
VI	10	61
VII	25	53
VIII	25	61

TABLE 2

[In barrels per day]

	For synthesis plant efficiencies of—	
	53 pct	61 pct
Gross production at north slope	514,000	592,000
Net at Los Angeles for mixed flow and distillation/separation	364,000	419,000
Net at Los Angeles for slug flow	496,000	571,000

Table 3 summarizes the overall system efficiencies in terms of net energy and includes the previously discussed synthesis plant efficiencies.

TABLE 3

[In percent]

Process	For synthesis plant efficiencies of—	
	53 pct	61 pc
Mixed flow and distillation separation	37.5	43.2
Slug flow	51.1	58.9

It must be recognized, of course, that there are also shrinkages in both of the proposed gas transmission systems and these have been discussed in materials prepared in support of their permit applications.

ENGINEERING ISSUES

It should be noted that from an engineering viewpoint all of the technology required for the operations covered in this study has been well developed and in use for a number of years. It appears that the bulk of the engineering issues would be those associated with the quite severe construction and operational problems of the Arctic. These are not trival and should not be underestimated.

Also, in this study there has been a tacit assumption tahat arrangements could be made for access to the Alyeska pipeline in the event that other arguments were favorable to the methanol strategy. To the best of my knowledge this has not yet been seriously discussed with the owner-operators of the Alyeska pipeline.

Another transportation strategy has been proposed by the Westinghouse Corporation and seven other companies. Initially the methanol would be transported to the lower 48 states via the Alyeska pipeline in a manner somewhat analogous to that previously outlined in this testimony. Later in the operation of the system transportation would be accomplished via nuclear powered submarine tankers to bring the methanol under the Arctic ice cap to the east coast. No evaluation of this transportation strategy was included in the study for the Federal Energy Administration.

ECONOMIC ISSUES

It is clearly impossible to make accurate cost estimates in the range of $4–5 billion within the context of a six month study budgeted at $50,000. For that reason we consciously attempted to bias all of our cost estimating in the conservative or high cost direction.

Constructon costs for the methanol synthesis plants and for additional turbine pumps on the transmission pipeline were estimated by analogy to lower 48 state costs. The same approach was used for storage tanks, berthing facilities at Valdez, etc. All fixed capital, working capital, and operations and maintenance costs occurring physically within Alaska were then escalated to 350 per cent of the lower 48 state cost estimates, to allow for the more severe conditions in Alaska. The escalation factor clearly is a rough approximation, derived by analogy to labor costs prevailing on present Arctic construction.

The additional turbine pumps, totaling about 225,000 brake horsepower, necessary to handle the supplemental volume of methanol in the pipeline, were fully charged against the methanol operations. On the other hand, no pro rata portion of the existing pipeline was charged against the methanol operations. It was assumed that the pipeline has sufficient marginal capacity and therefore marginal costs would be zero, exclusive of the extra pumping capacity. We recognize that this approach is open to argument.

Additional tanker costs were estimated from information published by the Phillips Petroleum Company.

The distillation facilities at Los Angeles were estimated from cost information in standard engineering source materials. It should be noted that the methanol and the crude oil are likely to be only partially soluble in each other, and a substantial degree of separation probably could be obtained by normal settling. For conservative purposes, however, we assumed complete mutual solubility, thus requiring a distillation facility with a throughput capacity equal to the combined delivery rate for the crude oil and the methanol. Process heat for the distillation units is obtained by burning a portion of the fuel grade methanol, thus further reducing the net methanol to market.

Table 4 summarizes the cost estimates for the mixed flow system and Table 5 for the slug flow system. In both cases the previously mentioned adjustment for Alaskan operations has been applied.

TABLE 4.—COST ANALYSIS SUMMARY FOR MIXED FLOW SYSTEM—2 YEAR BUILD UP SCHEDULE

Item	Year 1	Year 2	Total
Methanol plant:			
Fixed capital	1,585.5	1,974	3,559.5
Working capital	396.9	494.2	891.1
Operations and maintenance (new)	263.55	351.4	614.95
Pipeline:			
Fixed capital	0	199.5	199.5
Working capital	0	50.05	50.05
Operations and maintenacne (new)	9.42	18.87	28.29
Tankers and storage:			
Fixed capital	86.6	187.65	274.25
Working capital	21.65	46.93	68.58
Operations and maintenance (new)	99.75	158.2	257.95
Separation plant:			
Fixed capital	258.8	243.6	529.4
Working capital	71.4	60.8	132.2
Operations and maintenance (new)	54	72	126
Totals:			
Fixed capital	1,957.9	2,604.75	4,562.65
Working capital	489.95	651.98	1,141.93
Operations and maintenance (new)	426.72	600.47	1,027.19

TABLE 5.—COST ANALYSIS SUMMARY FOR SLUG FLOW SYSTEM—2 YEAR BUILD UP SCHEDULE

Item	Year 1	Year 2	Total
Methanol plant:			
Fixed capital	1,585.5	1,974	3,559.5
Working capital	396.9	494.2	891.1
Operations and maintenance (new)	263.55	351.4	614.95
Pipeline:			
Fixed capital	0	199.5	199.5
Working capital	0	50.05	50.05
Operations and maintenance (new)	9.42	18.87	28.29
Tankers and storage:			
Fixed capital	113.39	223.37	336.76
Working capital	28.37	55.89	84.26
Operations and maintenance (new)	103.95	163.8	267.75
Los Angeles terminal:			
Fixed capital	6.51	8.68	15.19
Working capital	1.62	2.16	3.78
Operations and maintenance (new)	0.90	1.20	2.1
Totals:			
Fixed capital	1,705.4	2,396.62	4,102.02
Working capital	426.89	602.3	1,029.19
Operations and maintenance (new)	377.82	535.22	913.04

With the assumption of an accelerated two-year build-up schedule, the general financial assumptions were as follows:

TABLE 6

Fixed capital—75 percent debt and 25 percent equity.
Working capital—100 percent debt.
Debt service—8.5 percent on working capital, 10.5 percent on fixed capital.
Return on investment—15 percent after taxes, at a 50 percent tax rate.
Depreciation—Straight line to 0 salvage value.

Table 7 summarizes the average prices per MMBTU for the methanol, FOB Los Angeles. All eight cases are shown, including the price component exclusive of the gas cost, and for gas costs of $0.50, $1.00, and $2.00 per MMBTU at the well head. The "best" price is that indicated for Case VIII at a gas price of $0.50 per MMBTU. It is equivalent to a price of $10.30 per barrel or 25c per gallon for the methanol. Methanol is currently selling (in the chemical market) for about 40c per gallon on bulk orders, FOB Gulf Coast. On an equivalent energy basis the "best methanol price" is comparable to an ex-tax FOB gasoline price of about 52c per gallon.

TABLE 7.—METHANOL PRICE SUMMARY, FOB LOS ANGELES

Case	$0	$0.50	$1	$2
I	$5.77	$7.10	$8.44	$11.10
II	5.02	6.18	7.34	9.65
III	4.99	6.32	7.66	10.32
IV	4.33	5.49	6.65	8.96
V	3.78	4.76	5.74	7.69
VI	3.29	4.14	4.99	6.69
VII	3.27	4.25	5.23	7.18
VIII	2.84	3.69	4.54	6.24

The alcohol price estimates are higher than the current estimates of under $3 per MMBTU for the delivered Alaskan natural gas.

It should be emphasized, however, that we have taken a very conservative approach to estimating the Alaskan methanol costs, and especially the operations and maintenance costs. We have set the latter at 25 per cent of the total in-place fixed capital investment in Alaska. This is a much higher percentage than used in the Interior Department's independent economic evaluation of the two gas transmission line strategies. In our approach the operations and maintenance costs contribute $1.57 of the $2.84 ex-gas price. This particular cost element may be amenable to substantial reductions which would further reduce the price to market for the Alaskan methanol.

SUMMARY

In summary, the engineering issues involved in a potential Alaskan methanol strategy are based upon well established and in-place engineering technologies. No new fundamental engineering issues appear to be involved. On the other hand, the construction and operation of methanol synthesis plants in the Arctic, with an agregate capacity roughly eight times that now in the U.S., is no trivial matter.

There is in principle the possibility of pre-fabricating the synthesis plants and bringing them in by large. If feasible this could reduce Arctic construction problems. Also the concept of a nuclear powered submarine tanker transportation system has been proposed. Neither of these approaches has been dealt with in the FEA sponsored study.

There are two potentially attractive uses for fuel grade methanol in the U.S. The first is in the automotive market as a partial replacement for gasoline. The second is in the utility peaking turbine market as a replacement for No. 2 oil and natural gas. The utility market appears to be the more attractive since the engineering issues are more straightforward and the distribution and storage of the methanol would be under tighter control. Either market could absorb the entire Alaskan methanol product.

The economic analyses to date suggest that the price of fuel grade methanol in the lower 48 state market may be competitive, subject to a far more careful cost-price analysis.

There is an inherent energy loss in the conversion of natural gas to methanol (a statement generally applicable to any synthetic fuels strategy). There does not appear to be adequate information available to make a reliable comparison of the overall net energy efficiencies of the two gas transmission line strategies and the methanol strategy.

In general, the studies completed to date suggest, but not conclusively, some potential for an Alaskan methanol strategy. If the methanol strategy is to be considered seriously as a third alternative, it is essential that a far more intensive and exhaustive study of the issues be carried out. Such a study should include consideration of some of the synthesis plant and transportation strategies not dealt with to date.

Since there is considerable pressure, and justifiably so, for an early decision relative to the Alaskan natural gas, such a study should be initiated promptly and on a time frame that will not unduly delay a final policy decision. Otherwise the choice will have to be made between two strategies without adequate evaluation of the third.

It should also be noted that there have been several studies directed toward the possible synthesis of methanol from coal, from miscellaneous waste materials such as municipal solid wastes, and from mixed systems. The possible relationship of these to the overall market supply and demand for methanol should be recognized when considering an Alaskan methanol strategy.

I appreciate the opportunity for presenting this brief background information and would be happy to respond to your questions today, as well as by additional discussions or supplemental written material following these hearings.

Senator STEVENSON. Our next and final witnesses are Brock Evans, Sierra Club; Barbara Heller, Environmental Policy Center; Cynthia Wilson, the Washington representative of the National Audubon Society; and Pamela Rich, of the Friends of the Earth.

I understood there would be four witnesses; there are five of you seated at the table.

STATEMENTS OF BROCK EVANS; AND DAVID W. LEVINE, SIERRA CLUB, WASHINGTON, D.C.; PAMELA RICH, ALASKAN LIAISON, FRIENDS OF THE EARTH; BARBARA HELLER, ENVIRONMENTAL POLICY CENTER, WASHINGTON, D.C.; CYNTHIA WILSON, WASHINGTON REPRESENTATIVE, NATIONAL AUDUBON SOCIETY; AND BREC A. COOKE, WILDERNESS SOCIETY, WASHINGTON, D.C.

Mrs. RICH. Only four of us are testifying.

Senator STEVENSON. But there is a statement for the five?

Mrs. RICH. Yes.

Mr. COOKE. Mr. Chairman, I am the conservation coordinator for the Wilderness Society. The staff asked us not to give oral testimony, and painfully we agreed to that. And we did submit our statement, and they did invite us to participate in any questions you may ask.

Senator STEVENSON. Your statement will be entered into the record.

Mrs. RICH. Mr. Chairman, members of the committees, my name is Pamela Rich and I am the Alaska liaison for Friends of the Earth, here in their Washington, D.C. office. I very much appreciate the opportunity to appear here today before the Senate Interior and Commerce Committees to discuss the critical issue before us—via which route the Prudhoe Bay natural gas will be transported to markets in the lower 48 States.

Let me state at the outset that the environmentalist community recognizes that with the development of Prudhoe Bay oilfields, the associated natural gas will eventually be produced, and we will not oppose the transport of Prudhoe Bay gas per se. In other words, the issue is not whether, but how and where that gas will be transported.

There are two legislative proposals now before the Senate, each mandating a particular delivery system and each establishing a method to circumvent administrative proceedings and preempt judicial review. However, there are two additional alternatives for which legislation has not yet been introduced. One is the so-called Fairbanks-Alcan Highway Corridor alternative which would parallel the Alyeska pipeline corridor to Fairbanks, Alaska, and thence travel eastward along the Alcan Highway into Canada and south to appropriate markets. This route was recommended by the Federal Power Commission environmental staff in their draft EIS, "Alaska Natural Gas Transportation System" [November 1975], and was given favorable economic and risk analysis in the Department of Interior title III study, pursuant to Public Law 93–153 [December 1975]. We believe this alternative is practical, competitive, and has the greatest potential for least environmental damage.

The other is the methanol conversion alternative in which North Slope gas would be converted to methanol and shipped through the trans-Alaska oil pipeline and transported to markets by conventional tankers. This is a most interesting proposal which merits further study. Our one immediate reservation is that this alternative would cause an increase in tanker traffic.

Members of Congress and the general public do have a voice and role to play in deciding which route Prudhoe Bay gas should reach the contiguous 48 States. However, environmentalists believe that any decision at this time to mandate a route would be very premature. It is a complex issue and a decision now would preclude thorough consideration of each of these alternatives. Furthermore, hearings now under way before the FPC and the analysis conducted under the National Environmental Policy Act are both producing much useful information about this issue which is clouded by many conflicting statements and unanswered questions.

If Congress is to take any action this year, the most constructive forum for consideration of this issue would be legislation which guarantees a full hearing through administrative proceedings, concurrent with congressional consideration of all the alternatives.

Congress should have final word on the decision rendered by the FPC and the Department of Interior. The bill sent down by the administration does give the administrative proceedings until early 1977 to render a decision and provides a mechanism for review of the alternatives. However, we believe the alternatives must be explicitly states, that is, in addition to the El Paso and Arctic Gas prime proposals, the alternatives of the Fairbanks-Alcan corridor and methanol conversion must also be considered as equally legitimate alternatives. We firmly believe that judicial review under NEPA must be upheld and that some means for public involvement in the formulation of stipulations and enforcement thereof should be provided. Finally, we think that the final decision should rest with Congress rather than the administration.

Of all the alternatives, we view the Fairbanks-Alcan Highway corridor as a positive compromise solution between the totally unacceptable environmental impacts of the Arctic Gas primary and secondary routes across the Arctic National Wildlife Range or its proposed extensions, and the many safety questions and west coast delivery problems of an all-Alaska, LNG, system. It seems to be the barebones system which would be more appropriate to the now unpredictable producibility of the Prudhoe Bay wells, and which would not be contingent upon Canadian approval of developing the MacKenzie Delta reserves now, as part of a large, integrated consortium project. Such a minimum system, wth fewest uncertainties surrounding its ultimate completion, would presumably be more easily finance.

Furthermore, the Fairbanks-Alcan corridor appears to be the most environmentally acceptable alternative because it uses a developed transportation corridor which will not degrade the wilderness character of the Arctic National Wildlife Range and obviates the inherent long-term risks of an all-Alaska, LNG, system. This transportation system will deliver gas to the appropriate markets and appears to face fewer legal and political constraints, particularly with regard to Canada. Thus, considering all these factors, this alternative may very well deliver a cheaper, more reliable supply of natural gas than any of the other alternatives.

There are many problems with the other two alternatives which have led us to cast this Fairbanks-Alcan corridor alternative in a more favorable, compromise light. First of all, all the national and Alaska environmental organizations as well as groups in Canada are united in their unalterable opposition to the Arctic Gas primary or secondary route proposals. Either would cut a wide swathe across untouched country, irreparably destroying the unique natural values of the Arctic National Wildlife Rrange. The range is the only protected region on the North Slope which encompasses a complete Arctic ecosystem from the sweep of the coastal plains through the foothills and into the Brooks Range. It is a land of priceless wilderness and wilderlife values which we believe must be protected, especially as oil and gas development proceeds in virtually all other areas on Alaska's North Slope. It is the wilderness character of this region which we value so highly. The problems of siting a pipeline across this vast expanse cannot be mitigated. It is purely and simply a locational problem.

Even so, we find Arctic Gas' major mitigating proposals—to build in the winter and to use a snow-ice road—to be highly optimistic. One has only to look at the number of forced slowdowns experienced by Alyeska these past 2 winters to realize the impracticality of such a proposal. Also questionable is the technical feasibility of the snow-ice road for which the Department of Interior has stated there is not enough snow or water on the North Slope. The impacts of the project must be evaluated as a short term consumptive use of a resource which has long-term, self-sustaining values.

Moreover, we believe that there are several serious political uncertainties about the Canadian share of the consortium which must be overcome before Arctic Gas is a real possibility. There are the native claims settlement issues which must be resolved before the MacKenzie country will be open to development. This is a practical as much as it is a political question. No one for certain at this time can predict where and/or how Canada will choose to develop her natural gas reserves. There are two competing proposals now before the Canadian National Energy Board—the Arctic Gas consortium proposal and an all-Canada project, the Foothills proposal.

A third possibility is the Polar Gas project which would develop the reserves in the high Arctic Islands region. The Polar Gas project would open up an area which has twice the proven reserves as are now estimated for the MacKenzie Delta region. Given time, this might in fact be the more lucrative region into which Canada will choose to sink what will be a substantial capital investment. With the recent lifting of the wellhead price in Canada, additional exploration of already developed areas has been stimulated, and it looks as though many of the immediate shortages will thus be alleviated. Canada may not stand to gain as much from an integrated, consortium project as she could over the longrun by developing her own reserves at a pace appropriate to Canadian capital limitations and socioenvironmental concerns.

As for an all-Alaskan system which would involve transport and processing of LNG, we are not yet certain that this potentially high-risk, high-cost technology will be the best way to go for delivery of Prudhoe Bay natural gas. We believe that the safety questions and sitting issues are best decided by the regions which must bear the costs—the West Coast States.

Furthermore, an all-Alaska proposal has implications for future offshore oil and gas development in Alaska. We believe that any development proposal must be evaluated as part of an integrated process: that the consequences of one project on future decisions must be taken into full account. Otherwise piecemeal decisions can effevtively lead us down a road which we may or may not want to travel. El Paso Alaska is but one proposal among many which will involve LNG delivery to the west coast. We would hope that this project will be evaluated in the context of this larger picture, and the regional policy issues such as where, how much, and when will be resolved as part of the evaluation process.

Finally, I wish to raise some additional considerations about pipelines from the Arctic in general. We are learning all too painfully from the Alyeska experience that when constructing in the tough Arctic environment, one must be almost as concerned about what the environment will do to a project as what the project will do to the environment. There have been many problems and consequent delays encountered on the project from the difficulties of punching a new route through untouched, rugged terrain. There have been repeated slowdowns and even shutdowns forced on the project by severe climate. This has resulted in a stepped-up summer schedule with instances of reinstalling many miles of pipe because of careless work.

It is consequently apparent to us that additional pipelines from the Arctic which use an already developed corridor can thus build to their advantage on the experience gained from developing that corridor. To use existing, developed corridors is a land use decision which can optimize project efficiencies and minimize environmental impacts. This one project must be evaluated in the context of potential future development projects in the Arctic. To set a pattern of development which is most efficient and least damaging environmentally, we recommend that transport of Prudhoe Bay gas be accomplished at least through a developed corridor.

Our major concern at this time is not to get sucked into backing a proposal on the basis of scare tactics declaring legislative urgency. There really is no urgency yet. Who's to say how much gas will be produced from the Prudhoe Bay wells once the oil is being produced? State estimates are much lower than the design capacities of the Arctic Gas and El Paso projects would lead us to believe. The only real need which we see at this time is to clearly illucidate the total ramifications of this highly complex issues before we are locked into having to back one or another. This could tie us into some serious problems further down the road, when the true costs of the project become apparent and capital must be raised to cover the cost overruns, when Canada decides how and when she will develop her natural gas reserves, and when the west coast States formulate regional siting and safety policies for LNG. We think it will behoove any party looking to Alaska for a reliable supply of natural gas in the 1980's to have selected a route for transport which will not only deliver gas to the appropriate markets, but which also encounter fewest environmental risks and political uncertainties.

Only with full analysis of all the alternatives, can we have any assurance that the pipeline system which best meets our needs, at lowest environmental and socioeconomic costs, will be the one which is finally built.

A project which requires a capital investment anywhere from $6 to $9 billion in 1975 is clearly a huge project for which there have not been many precedents in North America. The ones we have experienced, such as the Alyeska oil line, have run into tremendous cost overruns at least doubling the original cost estimates, as well as many unanticipated problems inherent in the difficulty of effectively managing such a large-scale project. To see such a project through until Prudhoe Bay gas is available at the spigot in Chicago is a long journey upon which we should not be too hasty to embark.

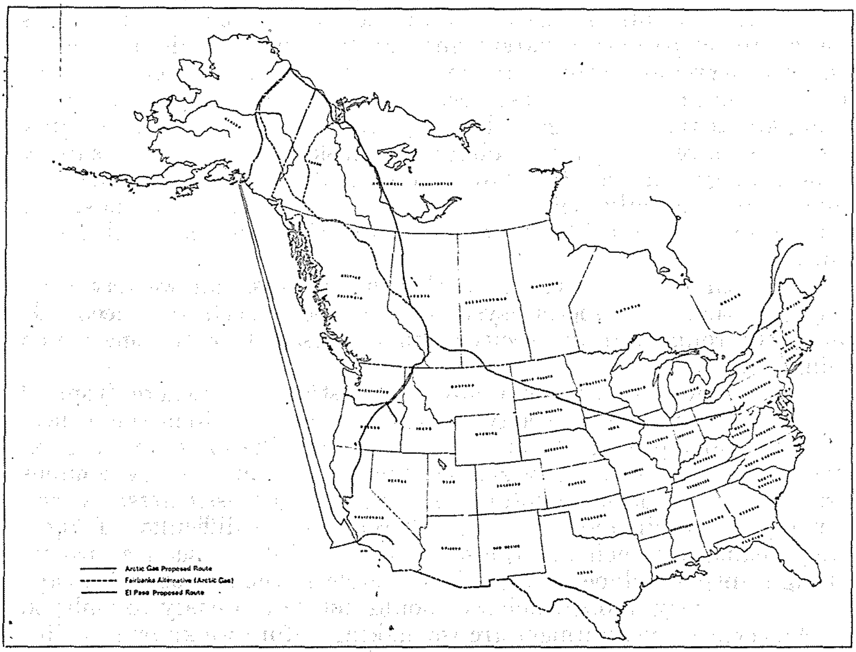
What type of commitment are we making before we know how this project can conceivably be financed? Will financing be on an all-events tariff basis, where the consumer must pay for any cost overruns, as well as backing the project against any risks? How much gas will flow through the pipe initially and over the life of the project? Who will be the beneficiaries of this new supply? Will they be able to afford Prudhoe Bay gas when it is finally delivered? These and many other questions must be raised before Congress, and answered, or we will be left footing the bill and shivering in the cold with inadequate gas supplies.

As stated at the outset, Friends of the Earth concurs that moving Prudhoe Bay natural gas to markets in the lower 48 is the best use of that scarce resource, inasmuch as Prudhoe Bay oilfields are being developed. However, it is our fervent hope that Congress will not leap into any additional commitments for development of Arctic oil and gas resources. As we are now witnessing with development of Prudhoe Bay oil and gas, development of frontier Arctic areas cannot be accomplished without tremendous capital outlays and severe, irreversible environmental costs. This one gas pipeline will finally cost upward of $9 billion. Administration policy seems bent on sinking additional billions into development of additional, but exhaustible, Arctic oil and gas resources.

When will we take a real leap forward and finally instead, invest these same billions into promoting and utilizing renewable energy resources?

Thank you very much. We certainly appreciate this opportunity to present our views on this critical issue.

[The attachment follows:]



Senator STEVENSON. Thank you.

Who is next?

Mrs. RICH. Mr. Evans just arrived.

Senator STEVENSON. Well, it is your turn.

Mr. EVANS. Thank you very much. I apologize for being late. We had a slide show about the Arctic Wildlife Range which takes about 10 minutes that was scheduled to be part of my testimony. We would like to show it to you, if it is your pleasure. The screen and projector are ready, but if, in your judgment, it will take too much time, I can just proceed.

Senator STEVENSON. We have been trying, somewhat unsuccessfully to get all of the witnesses to summarize their presentations. It is now 2 o'clock and we have been here continuously since 9:30. I would like to see it sometime, but since there are only two Senators here anyway, maybe we better try to build the record with your statement.

Mr. EVANS. I understand you have that problem. So I will proceed with summarizing my statement, and perhaps there will be an occasion at a later time to show the slides to those who are interested. We think it would be important at some time, but one of the major reasons we are here is because of the values, the natural values and wildlife values inherent in the Arctic National Wildlife Range, and it is a remote place to many of us. Those of us who have been there know what it is like, and we hope these pictures become a part of the decision-making process at some time.

For the time being, I will just read my statement.

Senator STEVENSON. There are only two Senators here, and one of them has probably seen much of what is depicted in your slides.

Mr. EVANS. That is true. Mr. Stevens is certainly well aware of the values up there, too.

I am Brock Evans, the director of the Sierra Club Washington office, and we are very much concerned about the issues before us today.

The decision on how to transport natural gas from Prudhoe Bay to the lower 48 States is a momentous land use issue with important environmental, social, foreign policy, and economic ramifications. On one level, the numerous interrelated and unanswered questions make this seem like a very complicated question. On another, and deeper level, the issue is very basic and simple: Should the Government authorize a destructive large scale industrial project in the Arctic National Wildlife Range—the National's largest, wildest, and most awesome wildlife refuge?

In our testimony today we will deal with some of the complex aspect of this issue. But we want to emphasize two basic points: (1) the Arctic National Wildlife Range has the finest and the greatest wilderness remaining on the North Slope; and (2) it is not necessary to violate the range in order to deliver Prudhoe Bay gas to the lower 48 States.

Any pipeline will have serious environmental consequences that need to be carefully scrutinized. There is no question that the best way to minimize environmental damage is to utilize existing, developed corridors. This would mean using the Alyeska oil pipeline corridor to Fairbanks and then either routing the pipeline along the Alcan Highway south through Canada to the Midwest or continuing along the Alyeska corridor to a point on Alaska's southern coast and then using LNG tankers to deliver gas to the lower 48 States. There are some serious problems and concerns regarding LNG transport and facility siting, as we all know.

While our statement does not deal with these problems in any detail, because they will be discussed by others on this panel, we want to emphasize that we share these concerns and want to see them addressed. Indeed, unless these concerns can be met, there is increasing evidence that the Alcan Highway routing may be the most environmentally preferable of all the alternatives now before us. More information is needed on these alternatives.

We know enough right now however, to unequivocally state that either the Arctic Gas prime or secondary routes would cause unacceptable ecological damage and should be ruled out entirely. Attached to my statement is a resolution of the Canada-United States Environmental Council opposing any pipeline through the Arctic National Wildlife Range and its proposed extensions (appendix A).

The reason we are so adamant about not industrializing the Arctic National Wildlife Range is that this is the last chance the United States and Canada have to preserve intact a representative portion of wilderness arctic econ-systems sweeping from the coastal plain to the foothills and into the Brooks Range. With the development of Prudhoe Bay and increased oil exploration in Naval Petroleum Reserve No. 4, the wildlife range and the proposed Alaska National Interest Land extensions are the only part of the North Slope remaining as wilderness and where there is a chance for wilderness preservation.

The recent population crash of the Arctic caribou herd to the west makes it even more imperative to protect the porcupine caribou herd that utilizes the Arctic National Wildlife Range. This is a unique, invaluable, and irreplaceable area for baseline biological research, wildlife protection, and wilderness recreation. The construction of a pipeline there is absolutely incompatible with these uses. There is no way its destructive impacts upon the range can be be meaningfully mitigated. This is a locational problem, not a question of mitigation.

We would list each pipeline impact and why we think they cannot be mitigated, but this would not be a very fruitful exercise for the committee. The effect of each individual impact boils down to a trading of assertions: For example, Arctic Gas claims compressor station noise would be in a 2–3 mile radius around each station; our research indicates a 10–30 mile noise radius is more likely. Arctic Gas claims their project will not adversely impact the porcupine caribou herd; scientists not in Arctic Gas employ predict high mortality for the herd.

The resolution of these types of conflicting claims is a question of credibility and realism. Arctic Gas proposed mitigation measures and construction schedule are highly presumptive. The scale of their miscalculations is illustrated by the realization that only half of the water necessary for snow/ice roads is available in the wildlife range.

Arctic Gas answer to this problem has been to say that they will conduct field studies to locate the remaining 50 percent of the required water. Even if the water can be located in this Arctic desert, the environmental impact of this type of construction will be enormous.

Also, the feasibility of all winter construction is doubtful. For example, this winter, the oil companies were only able to complete 4 out of 160 planned miles of fuel gas line at Prudhoe Bay before having to stop construction in December.

In addition to cold weather constraints, there was difficulty in locating enough snow to construct snow roads. Artificial snow making was hampered by a lack of water. Furthermore, it has been realized that the snow work pads have damaged the tundra. Construction on the fuel gas line was not able to start up again until this month and will continue past spring breakup utilizing gravel work pads. Similar difficulties would inevitably occur on the Artic Gas prime or secondary routes causing long delays, cost overruns, and even worse wildlife impacts than would occur if the idealized plan could be adhered to.

Amid all these questions regarding the project's impacts and feasibility, one salient fact is irrefutable. The Arctic National Wildlife

Range and the proposed extensions are a unique and important wilderness area, and the wilderness character of the range would be destroyed by a pipeline. We note the claims of Arctic Gas that the Arctic National Wildlife Range is not a wilderness area. In their reply to the Interior Department draft environmental impact statement the company alleges that: "Although the range is not a 'wilderness area,' since it has not been designated as such by Congress, the argument is made that the entire range is de facto wilderness. Nothing could be further from the truth as far as the coastal portion of the range is concerned."

In reality, the wildlife range is one of the Nation's most outstanding wilderness areas and Arctic Gas' attempt to deny this raises serious doubts about its credibility in other statements it makes.

As required by the Wilderness Act of 1964, the Fish and Wildlife Service studied the Arctic National Wildlife Refuge for its suitability for inclusion in the national wilderness preservation system. According to the Fish and Wildlife Service report:

> All of the land of the 8,900,000 acre Arctic National Wildlife Range are currently suitable for inclusion in the National Wilderness Preservation System with the following exceptions: A 456 acre tract at Camden Bay . . . a 420 acre acre tract near Beaufort lagoon . . . the 4500 acre Barter Island withdrawn under PLO 3849 and . . . all of the lands selected by the villagers of Kaktovik under ANCSA.

The only reason the Fish and Wildlife Service has not yet forwarded to Congress its recommendation for wilderness designation is that the Interior Department wanted it considered in the overall context of their Alaska national interest—D-2—land proposals. Attached are two maps showing known human impacts on the range and the few areas the Fish and Wildlife Service thought should not be encompassed by the wilderness designation—appendix B.

It is absolutely preposterous for Arctic Gas to claim that the construction of a large permanent industrial facility would have the same impact on the range's wilderness and wildlife as the existing distant early warning line station and the village of Kaktovik. The few existing human impacts on the coastal plan within the range have been highly localized, largely on islands, and are not of an industrial nature. It is an insult to the native people for Arctic Gas to insinuate that traditional subsistence hunting-gathering activities have destroyed the area's wilderness character.

Arctic Gas also claims that the range is not unique, "inasmuch as similar sequences of terrain can be found all across the arctic coastal plain and the Yukon." This flies in the face of ecologic and geologic fact. As the Interior Department environmental impact statement stated:

> The Arctic National Wildlife Range is de facto wilderness which encompasses the only remaining largely undisturbed continuum of arctic ecosystems and vegetation types from the Arctic Ocean to the interior of Alaska. It is the only place in the United States where it is still possible to conduct long-term investigations into the natural history of arctic plant and animal communities in protected portions of the Arctic coastal plain, Arctic foothills, Brooks Mountain Range, and the Porcupine Plateau. Nowhere else in the Alaskan Arctic are these physiographic provinces compressed into such a short distance.

The Fish and Wildlife Service's present management objectives for the range have been developed to protect these unique qualities. These objectives are:

One: To establish and preserve in a natural state a biologically self-sufficient area for scientific study and specialized public use, in which natural ecological communities are represented.

Two: To assure the survival in a natural state of northern plant and animal species and communities which are rare, unusual, or require special protection for their perpetuation.

Three: To expand and publicize understanding and appreciation of wildlands and man's role in his environment.

Four: To offer optimum opportunities for quality wildlife and wildlands-oriented recreation.

Five: To preserve migratory bird habitat as a contribution to the migratory waterfowl flyways and to recreation.

Six: To preserve and exhibit geologic and historic features.

Seven: To maintain wide geographic distribution of wildlife by preserving varied habitat.

Eight: To use varied environments and wildlife populations to provide long-term ecological monitoring benefits, thereby providing undisturbed natural biotic communities for comparison with similar communities that have been or are being significantly altered by man. All use purposes involving physical alterations of the landscape, or which would have undesirable effects upon the ecology of the area are denied.

Clearly, the Arctic Gas prime and secondary routes are totally incompatible with these goals. Congress must be aware that a decision to authorize a pipeline through the range is a decision to industrialize the range. Not only is the Arctic Gas pipeline incompatible with the purposes for which the range was established, but the pipeline would be the opening wedge for future exploitation. Even the Arctic Gas project would ultimately be bigger, hence have more adverse impacts, than the present plan. According to Arctic Gas' submissions to the Interior Department: "In the future, compressor stations will be installed as necessary to assure full utilization of the line." Authorizing the Arctic Gas prime or secondary routes would convert this magnificent wilderness into a national pipeline range.

In 1971, John D. Findlay, then Fish and Wildlife Service regional director, stated:

> Industrialization of the Arctic National Wildlife Range would clearly be contrary to the purpose for which it was established. The mass of men, materials and machinery associated with oil and gas industrialization, for example, would overwhelm the wilderness character of the Range and ultimately, and irrevocably, destroy its unique naturalness. It could also have a profound effect on the United States international responsibilities in the management of the Porcupine caribou herd. The twice yearly crossing of the international boundary by this herd is an illustration of the interrelationships which exist between those adjoining United States and Canadian Arctic regions.

Thus it is obvious that what is at stake is our largest and one of our most beautiful and important wildlife refuges. Also at stake is the largest and finest remaining wilderness in all of northern Alaska. With all of this background, then, let us turn now to what Congress role in this issue should be and briefly analyze the legislation now before us.

Given the nationwide importance of this issue and the irreversible commitment of land and resources involved, Congress will be involved at some point in making the route choice. If there is to be any congressional action, it is our judgment that such action should include the following elements:

One: A prohibition against any pipeline across the Arctic National Wildlife Range and proposed extensions;

Two: A careful examination of the other routes with particular attention to the Fairbanks-Alcan Highway alternative;

Three: A provision for public participation in the promulgation and enforcement of environmental stipulations. Administrators should not have broad discretion to waive stipulations;

Four: No provision which would circumvent the normal NEPA and judicial review process. At times of great national moment, judicial review can be expedited, but we do not believe it is ever in the national interest to eliminate or circumvent such review.

Finally, since what is at stake here is the future integrity of the Arctic National Wildlife Range, it would also be appropriate for Congress to immediately consider the proposed Alaska national interest land extensions to the range and wilderness designation. How do the bills now before these committees measure up to these requirements?

S. 2950 creates the most serious problem for both the environment and the consumer. Not only would it mandate a pipeline across the Arctic National Wildlife Range, with all of the destructive impacts already mentioned, but it also contains provisions that would allow Arctic Gas to avoid meeting environmental protection stipulations. Section 7(a) of the bill states, in part:

> The Secretary, the Commission, and such other Federal officers and agencies may waive any procedural requirements of law or regulation which they deem desirable to waive in order to accomplish the purposes of this Act, and may grant requests of any person which shall construct or operate any portion of the Alaskan natural gas pipeline for modifications of the route or facilities thereof which are not inconsistent with the purposes of this Act.

In other words, the company could do just about anything they want to expedite construction. This reaffirms the statement in the Interior Department draft environmental impact statement that: "All environmental mitigation measures will be secondary to construction schedules."

We are also very concerned that S. 2950 would circumvent the NEPA review process and judicial review. Although the rationale for this provision is to expedite pipeline construction, the real reason is to avoid the close judicial scrutiny which would reveal the serious flaws in the company's plans. If the concern was really to avoid delays the Arctic Gas prime and secondary routes would not even be considered; for of all the alternative routes these two have the greatest risk of delay due to such factors as the impracticality of all winter construction and snow/ice roads, the need to settle Canadian native land claims in the northern part of the Yukon Territory and the Northwest Territories, and the reluctance of the Canadian Government to approve the Arctic Gas project quickly, if at all.

S. 2778 has some good points: It does not override NEPA or limit judicial review and it mandates a route that would not violate the wildlife range and proposed extensions. It also has a worthwhile provisions for the equitable distribution of Prudhoe Bay gas. The main problem with the bill is that it eliminates the Fairbanks-Alcan Highway alternative and does not address concerns on LNG safety.

S. 2510 is not a very satisfactory bill. It rules out the Alcan Highway alternative, imposes an unrealistic time frame for an FPC decision, and limits judicial review.

The President's proposed legislation fails to address environmental concerns in some important ways. Like S. 2950, it limits judicial review and allows unwarranted discretion for the waiver of environmental stipulations. Furthermore, the decisionmaking process it establishes within the executive branch and the bill's failure to define the alternative routes seems to impede serious consideration of the Fairbanks-Alcan Highway alternative.

Thus, all of these bills do not squarely face one of the key issues that must be resolved: The full protection of the Arctic National Wildlife Range and the need to transport Prudhoe Bay natural gas in an environmentally sound manner. Rather than trying to work with Canada to destroy this fragile ecosystem, the United States should be working with Canada to protect these remnants of the Arctic wilderness. The porcupine caribou herd and the millions of migratory waterfowl that utilize the wildlife range are a nationally and internationally significant wildlife resource. Rapid, uncontrolled exploitation of the arctic would not only destroy the wildlife and wilderness but it is also fraught with the danger of disrupting global ecological processes we do not fully understand. The gas companies have less destructive alternative routes to bring the gas out. For those who treasure this unique arctic wilderness there is no alternative area with comparable solitude, wildlife, beauty, and wilderness.

[The attachments follow:]

APPENDIX A

Arctic Gas Pipeline Position Statement

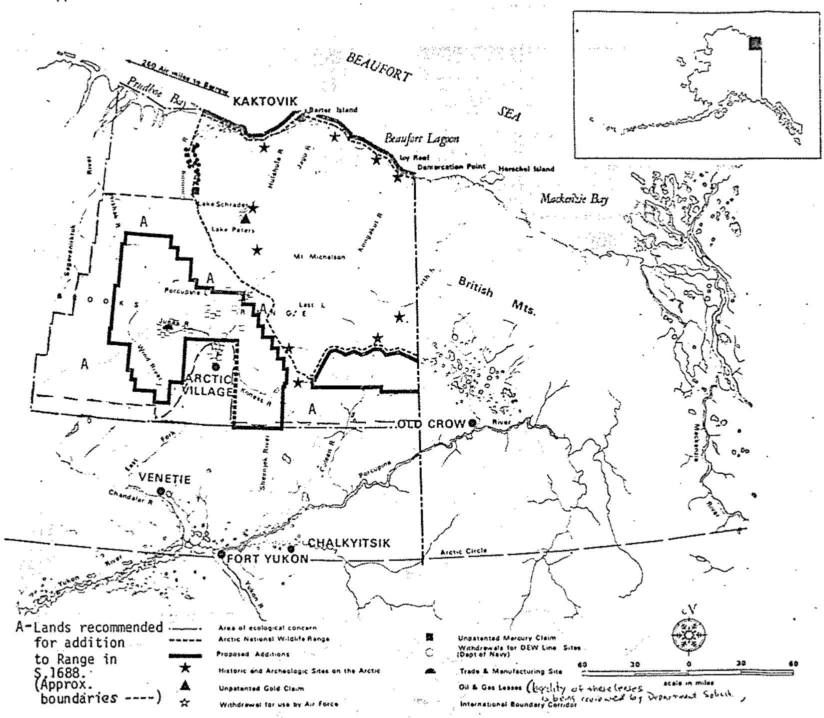
The proposed Arctic International Wildlife Range, which comprises both the existing Arctic National Wildlife Range (and its proposed extension) in Alaska and a similar area on the Canadian side of the border, embraces some of the most superb scenery, wilderness and wildlife habitat on this continent.

The Canada-United States Environmental Council believes that current proposals to transport gas from Prudhoe Bay to the lower United States across this area would cause unacceptable damage to these values. The Canada-United States Environmental Council is therefore opposed to any method of transport of natural gas or petroleum from Prudhoe Bay or other parts of Alaska which requires the crossing of any part of the Arctic Wildlife Range, and its proposed extensions.

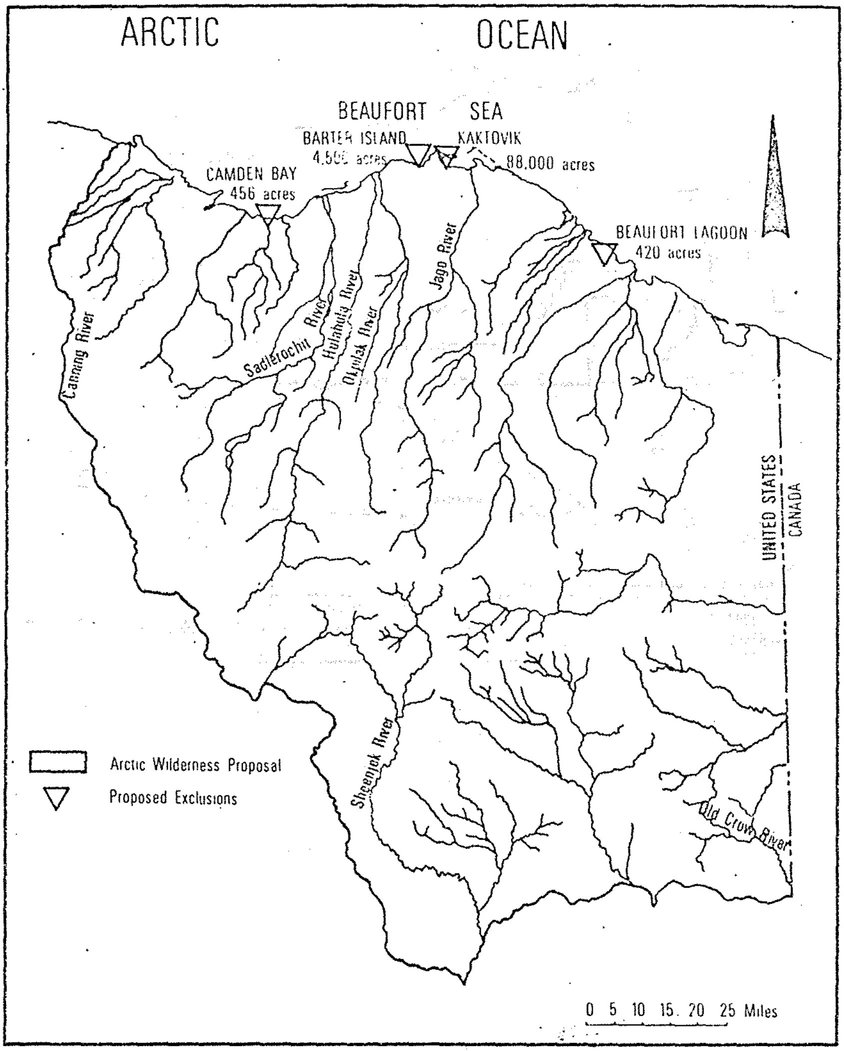
The above statement endorsed by:

Alberta Wilderness Association
Canadian Artic Resources Committee
Canadian Environmental Law Association
Canadian Nature Federation
Federation of Ontario Naturalists
Friends of the Earth
Izaak Walton League of America
National Audubon Society
Natural Resources Defense Council
Pollution Probe
Prairie Environmental Defense League
Sierra Club
The Wilderness Society
Western Canada Chapter, Sierra Club

MAP 4. HISTORIC AND ARCHEOLOGICAL SITES AND LAND COMMITMENTS
Appendix B



Appendix B



Map 3.1.1.11-1. Lands recommended for wilderness status by U.S. Fish and Wildlife Service, 1972.

Senator STEVENSON. Thank you.

Mrs. HELLER. Mr. Chairman, I am Barbara Heller from the Environmental Policy Center. And we, too, appreciate the opportunity to present our views here today on the various ways of transporting Alaska national gas to the lower 48 States.

Alaskan gas will be an important element in our national energy supply picture in the future. It is a controversial source of energy, partly because the way we transport it to the lower 48 may have serious economic and environmental implications for some areas.

There appears to be many unresolved questions involved in the various ways of transporting Alaskan gas. These trade offs lie primarily in two main areas of concern: (1) Energy and safety issues; and (2) environmental and safety issues.

We believe that there are significant questions in each of these broad areas which are not being properly addressed.

ENERGY SUPPLY AND ECONOMIC ISSUES

The west coast is currently facing a multitude of proposals for bringing in oil and gas from Alaska and elsewhere. Three liquefied natural gas sites have been proposed in California, Outer Continental Shelf oil is being developed, negotiations are underway to determine where Alaskan oil will be brought in, including negotiations between Sohio and El Paso for the reversal of one or two gas pipelines in California to take oil to the Midwest, a northern tier pipeline from Washington State across the North Cascades has been proposed.

We still don't know how much oil and gas will be coming to the west coast, or where it will be coming in. It seem only fair to allow the west coast States, which have been discussing and studying these various options in some depth, together and individually, some time to sort out these proposals.

The administration seems utterly oblivious to legitimate concerns of the States in these matters. Congress, on the other hand, through coastal zone management, deepwater port, OCS, and other legislation, has seemed to be saying that the States have the right to participate in those decisions which clearly affect their economies and environments. We hope that the intention will not change because of this issue, however controversial it may become.

I would like to pursue for a minute some of the supply and economic issues facing California.

As mentioned previously, Sohio and El Paso are negotiating the reversal of one, and perhaps two, of El Paso's currently east-to-west-flowing gas pipelines from Texas to California, so that they may become west-to-east-flowing oil pipelines to transport Alaskan oil to Texas, and then the Midwest.

If, in fact, these negotiations result in such a reversal and the El Paso LNG route is approved, then California may well be locked out of relatively cheap gas from the Permian Basin and into the most expensive gas available.

All of this makes good sense, of course, for El Paso. Why should El Paso want to deliver cheap Texas gas to California when it can sell very expensive Alaskan gas? If an LNG alternative were to be approved, would the exorbitant price of this gas be rolled in? When El Paso wanted either to have the price of its proposed synthetic gas from a proposed New Mexico plant rolled in, or to have a guaranteed cost of production, the FPC denied both.

The cost of gas to the consumer, as we have seen this year in Congress, is a very important issue, and one which must be fully addressed before a decision is made.

One must wonder why the most active proposals for transporting Alaskan gas are so extensive and expensive when there appear to be less capital-intensive ways to bring natural gas to the States. The Alaskan Natural Gas Transportation Systems' report to Congress from the Interior Department, December 1975, provokes many questions about the Arctic Gas and El Paso proposals. The following table from the Interior Department report suggests that the Fairbanks-Alcan Highway alternative may be the least expensive, most efficient way to bring gas to the lower 48, and we believe that it would also be the most environmentally desirable.

[The table follows:]

TABLE 22.—SUMMARY AND COMPARISON OF ALTERNATIVE ALASKAN NATURAL GAS DELIVERY SYSTEMS

[In millions of dollars]

System	Description	Total capital	Annual operations and maintenance		Shrinkage—Btu [1]		Total Canadian tax cost [1]	NNEB
			$81–$84	$85–$2,000	$81–$84	$85–$2,000		
Alaska-Canada (U.S. share of Canadian costs is 0.82).	Base case (100 pct flow to Midwest).	$7,117 (6,188)	38 (33)	77 (67)	6.4	10.4	$1,930	$8,729
	Base case minus displacement costs.	7,102 (6,173)	38 (33)	77 (67)	6.4	10.4	1,930	8,737
	Gas flow 75 pct to midwest and east 25 pct to west.	8,080 (7,076)	42 (37)	85 (75)	7.2	12.5	2,079	7,757
Alaska-LNG	Base case (100 pct flow to West).	7,023	109	149	11.0	12.4		7,803
	Base case minus displacement costs.	6,431	109	149	11.0	12.4		8,129
	Base case with lower LNG shrinkage.	6,971	109	149	8.5	9.9		8,281
Other pipeline routes.	Fairbanks—Alcan Highway.	6,525	28	50	5.4	9.5	1,692	9,036
	South of Arctic Wildlife Range.	7,612 (6,696)	39 (33)	78 (67)	6.5	10.6	1,930	8,323

[1] U.S. share only in 1975 dollars assuming a 7 pct inflation rate after 1981.

Note.—Figures in parentheses are U.S. share of costs.

Mrs. HELLER. There may be two reasons why such a huge system was proposed by the Artic Gas consortium. Some members of the consortium are utilities which are interested in obtaining natural gas, but which are equally—if not more—interested in their utility rates. Their rates are determined largely on the basis of their capital investment. The more capital they invest, the higher the rates they can charge their consumers. It is, therefore, in their interest to invest in the most capital-intensive energy production and transportation systems they can find, whether or not those systems produce and transport energy efficiently. The Arctic Gas proposal fulfills this high capital investment requirement very well. Arctic talks about the need for new pipelines to California to bring gas down to the lower 48, to California in particular.

A little while ago, between witnesses, I was talking to a gentleman from P.G. & E. The existing pipeline from Alberta to California carries about 1 billion cubic feet a day of Alberta gas to California. The gentleman from P.G. & E. said they could probably squeeze in at the moment another 100 million cubic feet a day without too much trouble.

We wonder, whether by looping, that could be expanded enough to handle the new gas from the pipelines that are being proposed, whether we can use existing pipelines already coming to California, or whether we need to invest in very expensive, entirely new pipeline systems.

Another possible reason for an oversize delivery system is the potential for Federal subsidy. In December, Congress turned down a $6 billion loan guarantee program for the commercialization of synthetic fuels. However, much of the energy industry has been talking for years about capital shortages, the need for rapid expansion of energy facilities to meet future demand, and the need for Federal assistance in virtually every aspect of energy production and distribution. Such assistance may range from tax breaks to expedited procedures to Federal preemption of State decisions to direct Federal subsidies and price supports.

In the case of the Arctic Gas proposal, the tremendous capital costs are bound to engender a request for Federal aid, either in the form of a direct subsidy or of a loan guarantee program. I think that was pretty well covered by the gentleman from Arctic Gas this morning, who said he couldn't rule out that contingency.

We have always taken the position that our energy-economic market can handle the costs of producing and distributing energy supplies in this country far more efficiently, and with less environmental damage, than artificial promotion of particular energy systems for special interests. Furthermore, we feel that no subsidies are necessary to deliver natural gas from Alaska, and that a more efficient, less expensive system would be wise. A less elaborate system would certainly benefit the consumer, and a proposal which utilizes existing corridors would have far fewer adverse environmental effects, lower operating and maintenance costs, and less chance of cost overruns than either of those proposed.

Environmental and Safety Issues: The Department of Interior's draft environmental impact statement noted some interesting aspects of the relationship between the Arctic Gas proposal and the Montana-North Dakota coal fields:

"The Northern Border Pipeline is so located geographically as to permit advantageous use for transportation of synthetic natural gas from possible future gasification of coal from large coal deposits in Montana, North Dakota, and South Dakota.

Michigan-Wisconsin Pipe Line Company has filed an application with the FPC to construct and operate four coal gasification plants in the general area of Garrison Reservoir, North Dakota. The first plant is proposed to be in operation by 1980 with an additional plant to be built and in operation in intervals of 2 to 3 years thereafter. As part of its long range gasification program, they expect to develop coal reserves sufficient to support the construction and operation of 22 coal gasification plants in North Dakota. . . . The initial plants will be capable of producing at least 250 mcf/d of synthetic gas. An estimated 10 million tons of coal per year will be required to support the first 250 mcf/d coal gasification complex.

The Natural Gas Pipeline Company of America has extensive lignite coal resources in Dunn County, North Dakota. The company considers these reserves to be adequate to support the construction and operation of eight 250 mcf/d coal gasification plants. . . . The first plant would be in operation by 1980 with additional plants at 3 year intervals or as otherwise directed by market requirements. Each plant would consume about 9.9 million tons of coal annually.

The El Paso Company of Texas (not now associated with the Northern Border Pipeline Company) has filed an application with the North Dakota State Water Commission for sufficient water to support four 288 mcf/d coal gasification plants. These plants would be located in the Stark and Billings County area of North Dakota.

It is important to note, we think, that there are extensive plans for Maine gasification facilities. Each 250 million-cubic-foot-per-day gasification facility will require about 10 million tons of coal mined annually. We must consider when determining a transportation corridor and the size of the proposed facility will inadvertently stimulate massive strip mining in the Northern Great Plains States, whether it will stimulate new requests for synfuels subsidies.

Will the choice of the Arctic Gas corridor through the Great Plains coal fields in effect mandate the great shift westward of the coal industry which Congress has been hearing so much about in the debate over the strip mining bill? This question must be examined very carefully before a choice is made.

The significance of the transgression of the Arctic Wildlife Refuge is an important one. I will not discuss it in detail since it has been covered well by my colleagues. Let me only say that we have very few totally undisturbed wild areas left in this country. The Alaskan wild areas are important not only to people in Alaska, and not only to a few elitists who happen to have had the opportunity to see them; they are important to millions of people who hope to have such an opportunity someday, like the millions of people who fought to save the Grand Canyon, who may not care to venture down the Colorado in a raft, but for whom the Grand Canyon is a symbol.

To extract energy minerals, we can only develop where the energy resources are. In this case we are talking about a transportation corridor, and we do have a choice. We will always have the opportunity to develop. Once we make that decision to develop and construction begins, it is irrevocable. We will never have the opportunity to restore the natural order of life in the Arctic Wildlife Refuge. This is one instance where the question is not whether or not to develop the resource. We are talking about a transportation corridor and alternatives exist which make more sense economically and environmentally. There is no need to destroy the Arctic Refuge in the interest of energy distribution.

We do not mean to convey the impression that the Arctic Gas proposal is the only one with environmental risks. The public safety hazards of LNG transportation, storage, and processing are significant. LNG technologies are considered to be low-probability/high risk technologies. Comprehensive siting criteria for LNG facilities have never been established. Although a great deal is now known about liability and insurance schemes for oil spills, and many States have oil spill liability laws, very little is known about liability and insurance for LNG accidents, whether they result from shipping, transfer operations, storage, or processing operations. The safety implications of LNG siting must be thoroughly examined, and comprehensive siting criteria must be developed.

If LNG is brought into California, will the State need two LNG terminals, as some have suggested, to ensure reliability of supply in case one facility is disabled? The El Paso LNG proposal includes an LNG facility at Point Conception. The FPC, in its DEIS on the proposed marine terminal for Point Conception, concluded that: ". . . the Oxnard site would constitute the most suitable location for development of the proposed LNG terminal project . . ."

The California Coastal Plan, which was the result of about 1,000 hours of public hearings around the State, would restrict LNG siting to remote areas ". . . until the risks inherent in LNG terminal operations can be sufficiently identified and overcome and such terminals are found to be consistent with the health and safety of nearby human population concentrations."

Thus, it appears that the FPC staff may be proposing siting which is inconsistent with the State's coastal zone management policy.

The Coastal Zone Management Act of 1972 requires that Federal licenses and permit be consistent with approved State coastal plans. Assuming that Congress intended to encourage the States to act responsibly in siting decisions, and to have authority in coastal siting matters, and assuming that Congress intended the Federal Government to act in a manner consistent with State policy on internal siting decisions as the Coastal Zone Management implies, will Congress now supersede its previous actions and dictate to the State where natural gas, liquefied or otherwise, will enter the State? LNG facilities in California must be considered in light of increased tanker traffic carrying Alaskan oil, increasing numbers of oil rigs offshore resulting from Federal leasing, and generally increased coastal development, some of which may conflict with LNG facility development.

We believe that the decision regarding the preferable route for transportation of Alaskan gas to the lower 48 States is an extremely important one. A policy as important as this—delivery of a needed energy resource from Alaska to the gas-short Midwest and California—should not be determined in response to the relative convenience to, and the political strength of, either the Arctic Gas or El Paso groups.

If the delivery of this gas to consuming regions is so much in the public interest that congressional intervention is justified, then Members of Congress, rather than intervening on behalf of either company, should identify a route which will protect the values of U.S.

public lands and which will most efficiently deliver natural gas where it is needed. Private companies should then be required to compete with each other to determine which is the most capable of building and operating a pipeline on a route such as the Fairbanks-Alcan Highway route, which would serve all the public interests.

Thank you.

Mrs. WILSON. Mr. Chairman and members of the committee I am Cynthia E. Wilson, Washington representative of the National Audubon Society, a citizen conservation organization with 350,000 members around the Nation. We appreciate this opportunity to testify on this very important issue. At the outset I think it is essential that we define the issue, for there is no question that the natural gas of Prudhoe Bay will be developed and we are not opposed to this. The question is which route will be used for transporting the gas.

The National Audubon Society has a long history of a close relationship to the National Wildlife Refuge System. In fact, early in this century our officers were instrumental in persuading the Government to establish the first Federal wildlife refuges. We also own and operate more than 40 wildlife sanctuaries of our own. Thus, we look with particular alarm upon this proposal to destroy one of the Nation's greatest wildlife refuges, the Arctic Wildlife Range, with a pipeline and related facilities. We are unilaterally opposed to the encroachment by gas or oil pipelines on the Arctic Range and its proposed extensions.

The priceless wildlife resources of the Arctic Range are well known, and I will not go into detail about them here. However, I am submitting a copy of a report prepared for us last year by Mr. John Hakala, who was for many years manager of the Kenai National Moose Range in Alaska. He is not only familiar with the wildlife of Alaska, but also had extensive experience with oil and gas leasing in the Kenai Range.

It is important to bear in mind that many of the species found in the range are dependent upon its wilderness character they require large areas of land to support their biological needs, and they are intolerant of human disturbance. Life in the Arctic is harsh, and survival might best be described as a balancing act.

I believe it is worth noting that the Arctic caribou herd which is located west of the range has declined from an estimated 240,000 animals in 1970 to around 100,000 animals in 1975, according to the Alaska Department of Fish and Game. A number of factors are thought to be responsible for this decline, but whatever the reasons this illustrates how quickly a large population can diminish. This also makes the well-being of the porcupine caribou herd, which uses the Arctic Range for calving grounds, all the more important.

The proponents of the route through the wildlife range have made the incredible claim that it is not a wilderness. Although the stupidity of that statement hardly merits rebuttal, for the record I must say they are totally wrong.

In April 1973, the Fish and Wildlife Service submitted a wilderness report on the Arctic Range to Secretary Morton that states:

> If established as one large area, its wild and remote features would surpass any existing wilderness in the United States and offer quality outdoor experience to citizens that would be unexcelled. It would also assure perpetuation of

those species of wildlife dependent upon a wilderness environment, such as the (barren ground) grizzly bear, wolf, wolverine and Dall Sheep.

The report concluded that:

All of the lands of the 8,900,000-acre Arctic National Wildlife Range are currently suitable for inclusion into the National Wilderness Preservation System, with the following exceptions . . .

The exceptions were four tracts of land totalling 74,496 acres, including the 69,120 acres subject to selection by Katovik villagers under the Alaska Native Claims Settlement Act. The remaining three tracts totalling 5,376 acres were present or former DEW line sites.

Unfortunately, the administration never forwarded this wilderness recommendation to the Congress, but the wilderness is still there.

Senator STEVENS. It did submit to the committee a detailed proposal for a larger area.

Mrs. WILSON. Yes, you are right. Thank you, Senator.

Even a cursory examination of the criteria which Congress has used in establishing wilderness areas shows that the range is a perfect candidate for the system.

I would now like to address the possible alternatives to the Arctic Gas prime route through the wildlife range.

In addition to their prime route, Arctic Gas studied four alternative routes from Prudhoe Bay to the Canadian border:

One: An offshore route.

Two: The so-called "Interior alternative" which goes through the proposed extension of the wildlife range on the south; this route is in a proposed utility corridor designated by the Secretary of Interior in March 1972.

Three: The Fort Yukon route.

Four: The Fairbanks corridor, also called the Alcan highway route. Arctic Gas stated that if they do not get approval for their prime route, they would propose the Interior alternate route, and they submitted data and plans for construction in this corridor as detailed as those for the prime route [II:1305.] However, only generalized data were assembled for the other three routes.

At the time of the debate over the Alaska oil pipeline, the Fairbanks route was considered by the Interior task force and named "corridor E." Interior's EIS on the gas pipeline says, "At that time it was noted that presence of the Alaska Highway would facilitate construction along corridor E: access is available and large quantities of gravel for road construction would not be required; and no unbroken wilderness would be intruded upon." [II:2101]

Arctic Gas gave limited attention to the Fairbanks route, and rejected it in favor of the wildlife range route—presumably because it is about 540 miles longer and would cost more. How much more is open to debate? According to Interior's EIS, Arctic Gas claims that the Fairbanks route would cost $2.2 billion in Alaska—which is $1,700,000 more than their prime route. The difference is due to the difficult terrain in the Brooks range and the additional mileage. [II:2126]

Since then a variety of cost estimates have been floating around, and I think the safest thing to say is no one knows for sure what the cost differential between the prime route and the Fairbanks route would be. One estimate by the Interior Department's December 1975, report to Congress on "Alaskan Natural Gas Transportation Systems" says that the total capital required for the project using the Fairbanks route is $6,525,000,000 as compared to $7,117,000,000 for the Arctic Gas route is the entire flow goes to the Midwest. Obviously the figures vary depending upon the assumptions on which they are based, and we do not have expertise to derive these figures for ourselves.

Although Interior's draft EIS gives a considerable amount of information on the proposed Fairbanks alternative, we believe that more precise information is needed particularly on the comparative costs. But I would like to emphasize that there is no way to put a specific price tag on the value of the Arctic National Wildlife Range—except to say that it is priceless.

After evaluating the various routes proposed by Arctic Gas, the FPC staff said in their draft environmental impact statement, "the Alaska Arctic route of the Arctic Gas system should be constructed along the proposed Fairbanks corridor alternate route." [FPC I–255] Thus, in effect, the FPC staff rejected the Arctic gas route through the wildlife range.

Obviously, there is another major alternative that proposed by El Paso Gas. This was the focus of the FPC's impact statement. The staff did not make a choice between El Paso and the Fairbanks corridor, but indicated that they will do so after reviewing comments on the draft EIS.

I think everyone recognizes that no matter where the pipeline is built, it will have enormous environmental impacts. Interior's draft EIS said: "It is emphasized that no pipeline route from Prudhoe Bay—including the LNG alternative systems—meets all major locational factors in Alaska. Therefore, there will be significant adverse impacts on the existing environment and the expected social and economic structure of Alaska." [II:1312]

As most of you probably know, the El Paso proposal is quite different from the Arctic Gas proposal. The pipeline would go from Prudhoe Bay along the existing oil pipeline corridor to the south coast of Alaska. There the gas would be liquefied and shipped by tanker to Point Conception, Calif.

There has been considerable debate over the ultimate destination of the gas. The trans-Canada routes would bring the gas directly to the Midwest. El Paso would supply gas to the Midwest by displacement. Under El Paso's proposal, the Alaska gas would be used in California, thus freeing domestic supplies that normally go to the west coast so that they could be used in the Midwest and East instead.

Both El Paso and Arctic Gas plan to use displacement in order to utilize existing pipelines and keep costs down. Whether displacement is realistic or not has been debated, but new evidence emerging from the FPC hearings tends to demonstrate that it could indeed be a viable method of gas transportation.

There is also considerable dispute over shrinkage—in other words, how much gas do you use in transporting the rest of the gas to its destination. Arctic Gas has criticized the El Paso project for its supposedly higher shrinkage percentage, which is caused by the energy used to liquefy and transport the gas to California. Development of a new and more efficient model of an LNG plant has led Interior Department researchers to predict in the December 1975, report to Congress that the shrinkage figures for the two proposals might very well be similar.

As I mentioned earlier, the cost of each project is also being debated. According to a study by the Aerospace Corp., the net economic benefits of the El Paso proposal and Arctic Gas prime route are approximately equal. In fact, their figures show that the Alcan route actually realizes the highest net economic benefits. Those figures are in the table I referred to earlier.

We are not in a position to give definitive answers about engineering problems. But we do have considerable expertise on the environment. Both the Fairbanks alternative and the El Paso proposal have two considerable environment advantages over Arctic Gas prime route: (1) They utilize existing corridors; and (2) They do not traverse and destroy the wilderness and wildlife of the Arctic Range.

Obviously, one of the questions which is foremost in everyone's mind is how long would the various routes take to construct? According to Interior's DEIS, Arctic Gas did not prepare a construction schedule for the Fairbanks route, but they evaluated it on approximately the same overall schedule as that of the prime route. The EIS estimates that construction in Alaska of both routes would take at least 2, probably 3 years [II:2125]. The total construction time for both projects will be approximately 5 years.

It is our understanding that the El Paso project would take about the same amount of time.

However, we believe that Arctic Gas has been overly optimistic about the timing of their proposal.

The Interior DEIS points out that Arctic Gas' construction schedule is highly idealistic and based on unproven assumptions:

Interior's DEIS also said of the Arctic Gas route:

Likewise, the entire proposal contemplates arctic construction of 195 miles of buried pipeline in Alaska and 297 miles in Canada during a single winter season where darkness, low ambient temperature (—65°F) and low wind-chill factor (—90°F) pose special problems for equipment and workers. The Applicant's contingency plans do not address what would be done if the proposed, highly idealized, and presumptive construction schedule could not be met. (II :643, DOI DEIS)

Interior's DEIS also said of the arctic gas route:

The major part of the system does not go beyond the current state of the art in engineering, except in the Arctic and subarctic reaches through Alaska and Canada where the proposed burial of a chilled pipeline has never been done. The chilled pipeline concept, while achieving the purpose of maintaining permafrost conditions, creates problems such as frost heave and interference with stream flow, thereby disturbing the river regime and interferring with surface and subsurface water flow by developing an ice bulb around the pipeline. Design criteria for the Arctic and subarctic conditions are not considered adequate; therefore, further efforts are needed to prevent pipeline failure in order to mitigate adverse environmental impacts. (DOI–DEIS Executive Summary, page 19)

In addition to engineering problems, there are diplomatic problems to be resolved. No one questions the good faith of the Canadians. But the fact is that under Canada's constitution, the provinces could legally block a pipeline if they choose. Since there is a proposal for an all-Canada pipeline, called the maple leaf project, which would transport gas from the Mackenzie Delta-Beaufort Sea to points in Canada, this possibility cannot be overlooked. Certainly, it could create delays.

Further, Canada has not yet settled its native claims in the Northwest, through which the Arctic Gas route would pass. James Wah Shee, president of the Indian Brotherhood of the Northwest Territories, has stated that native people will go to court to seek at least a temporary halt to the project if the Government fails to settle the native claims before granting pipeline rights-of-way.

We are well aware of the need to assure future supplies of natural gas for our Nation and for the Midwest and Northeast, but regardless of which route is chosen, construction of a project of this magnitude will take a number of years. Hastily considered legislation preempting administrative proceedings and judicial review will not bring gas to the American consumer any quicker, but it will have devastating environmental effects.

We believe that the Fairbanks Highway alternative deserves further analysis and review so that it can be compared with the other two proposed routes. If your purpose is to assure more direct delivery of natural gas to the Midwest or Northeast, the Fairbanks route would do it. In our view either the Fairbanks route or the El Paso proposal would be preferable to a route through the Arctic National Wildlife Range which we absolutely oppose.

Several bills have been introduced to deal with this complex problem. Senator Gravel's bill, S. 2510, truncates the FPC and other proceedings and requires that a decision be made by June 30 of this year. Senator Stevens' bill, S. 2778, mandates an all-Alaska route. Senator Mondale's bill, S. 2950, mandates the Arctic Gas route, requires the necessary permits to be issued 60 days after passage, waives procedural requirements such as the National Environmental Policy Act, and severely limits judicial review.

The administration has recently sent up legislation which would sit up a timetable for the decisionmaking process and leave the decision up to the President with the consent or dissent of Congress. It does not mandate a particular route.

Of the various proposals, we believe the administration's is the most reasonable although it needs a number of changes. We strongly oppose S. 2950 because it mandates the Arctic Gas route, waives NEPA and commits other signs which are grievous in the eyes of the environmental community.

We do not object to legislation designed to assure that the necessary proceedings do not drag on ad infinitum. We believe that the FPC proceedings can be completed promptly and the requirements of NEPA met, without delaying delivery of the gas to the Midwest.

However, we feel strongly that the Alcan Highway route should be considered as an alternative, and the necessary steps taken immediately to gather whatever additional information is needed to compare it with the other proposals. Then, and only then, can the Congress and the President make an intelligent decision which takes into account the public's interest in preserving a magnificent and unspoiled wilderness as well as the public's need for natural gas.

Thank you, Mr. Chairman.

Senator STEVENSON. Thank you.

Does that complete the prepared statements?

Mrs. HELLER. Yes, sir.

Senator STEVENSON. As I understand your position, none of you are opposed to the delivery of the Prudhoe Bay and North Slope gas to the United States. You are simply for the least objectionable mode for bringing the gas down.

One of you was explicit on that point; I don't remember who it was. That is, I think, right, and it is realistic, too. This is the first support that the procedural answer has received in the hearings today. And that is the way I lean at the moment.

In fact, the proposal originated in the Commerce Committee. It should be possible to develop a procedure that could provide adequate representation for all environmental interests, the interests of the States which some of you mentioned, and provide for judicial review which the administration proposal does not.

But I wonder when it is going to be possible to, regardless of the procedure, produce an answer that will not be very objectionable to you? You accept the need to take down the Alaska gas. At some point the Canadians are going to be faced with exactly the same thing. They are going to be faced with the same reality, and they are going to want to get their gas, probably out of the Beaufort Bay.

You say at this point that of all of these evils, it appears the Alcan Highway route and the El Paso project are the most desirable because they don't require a pipeline across the wilderness area. But to bring out the Mackenzie Delta gas, let alone the Beaufort Sea gas, a pipeline would have to be built through the wilderness area. As Mr. Boyd mentioned, it doesn't matter whether you go from Prudhoe Bay to the Mackenzie Delta or from the Mackenzie Delta to Prudhoe Bay, unless you build, as Mr. Blair was suggesting, a subsequent transportation system in the Mackenzie corridor, the corridor proposed by Arctic Gas.

My question to you is whether you are considering the long range, including the Alaskan environmental implications of a tentative decision now to support either the Alcan route or the El Paso route, when offhand it looks to me as if we will be faced with the same kind of decision down the road, except next time it will be Canadian gas and oil. And then, if so, we face the possibility of still more construction, namely, between Prudhoe Bay and Mackenzie Delta, or another Canadian pipeline down the Mackenzie Valley corridor, or maybe all of these, depending upon the resources that are delivered from the Beaufort Sea down through the Mackenzie Delta across Canada.

Mr. EVANS. May I take a start at that?

I think those are all very important points to consider.

It appears to me at various times in our national life we have consciously made specific decisions not to develop certain resources because of their scenic or wilderness value. I refer to my own experience in my own State of Washington, where various efforts have been made to preserve the forest. There may have been a need for timber, but people felt it was better to leave it intact for other values. If the events occur in Canada, and we don't have very much control over them, if they do occur and there is a gasline authorized on the Canada side, and we can't affect that too much, that makes it, in my mind, even more important the reality of protecting what we have left in the Arctic wildlife range.

Senator STEVENSON. The only way, then, that you could get Prudhoe Bay gas out without the pipeline across the range would be to take either the El Paso project or the Alcan Highway.

Mr. EVANS. I think that is our position——

Senator STEVENSON. I just want to get it straight. You are pointing toward a decision which produces a trans-Alaska route, plus El Paso, or Alcan.

Mrs. HELLER. Senator, if I may, I don't think so.

That's not necessarily the option. If the Foothills project was approved, that could hook up to existing pipelines, and, second, there is another option. And that is to build a spur up to the Mackenzie Delta from the Fairbanks route. It seems to me the real question here about the Mackenzie gas is how much is up there, and we still really don't know. There is a tremendous variety of figures. And why plan on a tremendous Alaskan pipeline before you know what is really there?

Mr. EVANS. It is a big thing as we see it. Up there is the last kind of country like it that can be protected, and I refer to similar decisions we have made in other times in our national life not to violate such places because of their higher values.

Mr. COOKE. Senator, I think that the Alcan Highway route could safely handle the Prudhoe Bay gas, and if you make a conscious decision to not cross the range with any type of pipeline, you are then confronted with building a pipeline similar to the Foothills project. At this point the reservation in the Mackenzie Delta are not nearly as substantial as they are in the polar project. It appears more likely the Canadians would tap that source first.

Incidentally, they could take the Mackenzie reserve with a separate pipeline, if the Beaufort Sea came into existence.

Senator STEVENSON. If the Beaufort Sea gas comes into existence, and the expectations are high, then you have the economic justification for the Foothills project or a trans-Canada pipeline.

If not, and the Beaufort Sea gas doesn't materialize, then economic justification exists only for a pipeline from the Mackenzie Delta to take the Canadian gas out of gas taken out of Prudhoe Bay across the wildlife range.

Mr. COOKE. You mean back from that side, return it back that way?

Senator STEVENSON. Yes, east to west.

Mr. LEVINE. I am David Levine, and I am working with Mr. Evans on this matter. As I understand the thrust of your question, Senator Stevenson, is are we looking just beyond the immediate need to defend the wildlife range, and the answer is very clearly yes. And it is the prospects of future developments that is also a justification for defining the range.

If you look at this in perspective, the North Slope of Alaska, Prudhoe Bay has already developed, PET–2; there is an increased exploration program there, and we critically need an area left free of development for biological research to compare the pristine areas with the already developed areas. And the decision on whether or not, or how Canada would develop its Mackenzie Delta resources is sometime in the future. And how that should be done can mean a much wiser decision if they have this type of information that can be gained from research in the wildlife range.

Mr. COOKE. We simply think if you run the pipeline through the wildlife range, that that is a foot in the door for the further development within the wildlife range. And the wildlife range does not have wilderness protection designated statutorily by the Congress. That is something we are seeking in legislation. The Interior Department did not recommend wilderness designation, they recommended wilderness study. We will be seeking that. That will be incompatible with the fact that that exists there now.

But no pipeline in the future, if that statutory designation is given, could cross that wildlife range. And the Canadian decision would have to be their own.

Senator STEVENSON. I understand that. But there will be pressure to get that gas out, as there is now from Prudhoe Bay, and it will either come down across Canada itself, or if the economics aren't there, the pressure would mount to hook up with the pipeline out of Prudhoe Bay.

Mrs. WILSON. Mr. Chairman, one thing that hasn't been mentioned is that there is a Canadian proposal for an international park, wildlife range, adjacent to our wildlife range, only on the Canadian side. I don't know whether that is going to have an influence or not. But if it does, obviously I would assume that the Canadians might not, if they are really serious about their proposal, want that pipeline through their park or wildlife refuge, either.

The other point I wanted to make is the definite need for more precise information on, for instance, Is it feasible in some way to build a spur, if you built the Alcan route? Should a spur be constructed at all? These are the kinds of things that we just don't know, we don't have the capability to economically analyze all of these things, but we think that information ought to be on the table to help make the decision, and that is why we keep beating the drum for that being considered as an alternative, because we just don't have the information, in any real concrete form now.

Senator STEVENSON. Senator Stevens?

Senator STEVENS. I am going to yield to Senator Mondale. He has a deadline.

Senator MONDALE. I have a meeting of the Intelligence Committee. I have to go to.

Mrs. Heller, are California environmentalists in favor of LNG tankers landing in southern California?

Mrs. HELLER. I think it is fair to say that environmentalists in California are somewhat split on this issue. And they are working fairly closely with the State on this. There is a great deal of controversy about the safety aspects of LNG. Some environmentalists in California have taken an absolute position against the Point Conception site because it is a fairly pristine area.

On the other hand, there are very few people who think, environmentalists or otherwise, I don't know anybody who feels LNG facilities ought to go into populated areas. There is a great deal of feeling in California against LNG facilities at Los Angeles or Oxnard.

Senator MONDALE. If, as expected, the Alaskan gas reserves prove to be in the neighborhood of 75 to 100 trillion cubic feet rather than the 25 trillion cubic feet that has been proven already, what would be the consequences to the southern California coast of these greatly increased traffic levels?

Mrs. HELLER. LNG traffic?

I think the consequences would be quite significant. There is a great deal of tanker traffic there now, and very little control. We don't have in California the kind of vessel traffic system they have, for example, in Seattle.

Senator MONDALE. If you had to choose between Arctic Gas and El Paso, would you automatically choose El Paso?

Mrs. HELLER. I wouldn't choose either at the moment. I simply don't think there is enough information on which to base such a decision at this time.

Senator MONDALE. Mr. Evans, if it could be established that there are ways of substantially mitigating damage to the range as Arctic Gas says that it can, would you nevertheless oppose the project through the range?

Mr. EVANS. As I say in my statement, we feel the problem is so severe, that it is not a question of mitigation, it is a fundamental land use question. So far, the main thing they have proposed is to switch from communication towers to satellite systems. That can't mitigate the fact that we still have a large permanent industrial facility involving many machines and facilities of other types throughout the range.

They have talked about mitigating the compressor noise, but its noise is still extremely substantial. I would be willing to see more information on this, but all of the information to date, and all of the efforts they have made that claim mitigation, just don't change the basic problem.

We think it is fundamentally a locational problem.

Senator MONDALE. So you are not saying you oppose the construction through there if it could be substantially minimized then? You are saying it is your judgment that it cannot be, but you are not saying that if it could be established that it could be substantially minimized, that you would automatically oppose it.

Mr. EVANS. I think any kind of ground or underground location of a pipeline there is essentially unmitigable. I don't see any method. I just don't see it, I don't see how it could possibly be done. I see nothing to indicate any effectual mitigation which would remove the fact that it is an industrial facility in the range.

Mr. COOKE. Senator, might I comment on that?

Senator STEVENSON. Go ahead.

Mr. COOKE. The word "mitigation" is the type of word that I just don't feel comfortable with. It implies that some given action is going to have adverse consequences. And it only argues for being able to limit those consequences.

Senator MONDALE. Yes. What I am getting at is that the Gas Act, particularly, claims that they have tested techniques that would substantially obviate the concerns that you have expressed.

What I wanted to learn is whether you were interested in reviewing that possibility or whether your position is that you are convinced there is no way of doing so.

That was my question.

Mr. COOKE. I think the rationale for putting it through there would be, as I say, in my statement, what economists have called "self-optimization," finding the best way to do something that should not be done at all.

The issue here is basically a land use issue, trying to find out what the highest and best use of range is. And that use in this case is wilderness. That is the way it has always been. Everything that exists up there exists only because of that.

Senator STEVENSON. Is it an officially established wilderness area?

Mr. COOKE. No, it is not officially designated.

Senator MONDALE. Thank you, Mr. Chairman.

Mrs. HELLER. Could I raise a point here? I would like to recall a conversation we had a few years ago, when the Alaskan pipeline bill was being discussed. We were talking about the potential for a third pipeline that would come to the Midwest and I said I had heard a rumor that it might come through the boundary waters area and your words when I said that were "Over my dead body."

Senator MONDALE. We have made arrangements to bring it right around.

Mrs. HELLER. Yes, I know. But I think the issues are the same. I have very close ties to Minnesota, and I have never been to Alaska, but I think the feelings about the wildlife refuge in Alaska are much the same as the feelings of many people here for boundary waters canoe area.

Senator MONDALE. Thank you, Mr. Chairman.

Senator STEVENS. Mr. Chairman, I know my colleague has to leave, but I have a copy of the proposal for the wildlife refuge, because I wanted to see if it mentioned the transportation corridor south of the range reserved at the time the withdrawal was made for the oil pipeline.

This proposal would extend the refuge to take in, the corridor south of the range but the company had available to it the concept of going south of the range and ignored it for the same reason. When I first saw the Arctic proposal, I told them, and they know it, that they would never get through the Arctic Wildlife Range.

I believe that they have done themselves a great disservice by insisting on going through there.

Senator MONDALE. I understand the environmentalists are even more opposed to going south of that.

Senator STEVENS. That is right. This proposal now proposes to add to the Arctic Wildlife Range that area to the south. But at the time that proposal had not been made.

Let me ask you this: In the event that a decision was made to ignore your advice and go through the Arctic Wildlife Range, have you contemplated what action your groups might take?

Mr. EVANS. That is a dreadful prospect to consider, I guess, we hope we don't come to that. But we have talked with our Canadian friends about such a prospect.

As you know, we work closely with Canadian environmentalists in any event, and attached to my statement is a copy of a resolution that came out of a joint United States-Canada meeting a year ago, where we spent almost a whole day discussing this question, and they felt as strongly about it as we do, the impact on the area.

There are other examples of this cooperation. In the Ross Dam issue in my State of Washington, we worked closely with the Canadian environmentalists, too, and while we have taken no formal position about what we would do, our discussions have gone into this aspect a little.

I would assume we would want to talk with the Canadians again about this.

Senator STEVENS. I see Mr. Callison is in the audience, and I think Mr. Callison, along with Mr. Brower—who else was involved in that? He was the head of the Sierra Club, now the head of the Friends of the Earth, David Brower.

Mr. Brower was at the Institute and Brower was head of the Sierra Club, and Mr. Callison was here with the wildlife management group.

Mr. CALLISON. At this time, when you and I worked so closely, I was with the National Wildlife Federation.

Senator STEVENS. I think those three people had more to do with the Arctic Wildlife Range than anyone realizes. I think people forget the Arctic Wildlife Range was created at the time of Public Land Law 82, which was revoked. That order had kept the whole Arctic withdrawn during the period of the war. And Mr. Callison and others helped work this out at that time.

It was our understanding then that the Arctic Wildlife Range would not be invaded, except in national security considerations. If the range is crossed now by the pipeline, what would be your position with regard to seismic exploration and developments of the oil and gas potential of the range itself?

Mr. EVANS. Well, as you infer, obviously our position is against any kind of activity there which detracts from the wilderness and wildlife values there, starting with the pipeline and going on down or up, we would certainly be strongly opposed to that, too.

Senator STEVENS. I am not being facetious, because the indications are there is probably a great oil and gas reserve and if the national security requires it, we might have to look at it. Right now we don't see that with the resources that are there.

Mr. EVANS. I understand that. I said earlier that the parks and refuges are also a part of the American heritage, part of our way of life, and we set these areas aside, even though they do contain natural resources.

Senator STEVENS. At the time the Arctic Wildlife Range was created I was assistant to the Secretary of Interior. We had before us an independent case that there would be a comparable area on the other side, the Canadian side. Do you know what the status of that is now? It has been a long time coming. It has been almost 20 years and they have not completed their side. Is that still a viable objective?

Mr. EVANS. My understanding is that it is involved in the native claims question, as are so many other things in that part of Canada right now. I have seen proposals around 1969, 1970, 1971. Maybe someone else knows more.

Mrs. RICH. I think that the status of it is much as Mr. Evans described it. I would like to bring to your attention, and perhaps submit it for the record, a letter from the Canadian Arctic Resources Committee to me which reiterates their strong support of the natural values in this area, and the damage that any pipeline coming across from Prudhoe Bay would do to the values up there. This in the context of future potential for park designation.

Senator STEVENS. My understanding of the Beaufort Sea activity is it will be many miles out from shore. It means actually drilling through the icecap. One of the substantial problems is the mobility of that cap, and the State Department has asked for reassurance as to what exploration companies would do if they had a blowout.

The chairman and I were discussing that last week in Canada also. But the pipeline could come ashore at Prudhoe Bay as easily as it could come ashore at the McKenzie River Delta. I really do not think that the Beaufort Sea potential ought to be criteria or any part of the consideration in the sense that it has not been drilled yet, although there are such proposals.

I don't have any other questions. I think, Mr. Chairman, as I have told representatives of these organizations before, that I hope that Congress will heed these comments because whether we agree or disagree, I have learned that these organizations have the potential for expressing their points of view in many forums, and I think the potential for delay if we do not listen to you is greater than if we do.

Incidentally, I want to rename that Arctic Wildlife Range the Seaton Natural Wildlife Refuge in memory of Secretary Fred Seaton. I hope some day we will get that done.

Mr. CALLISON. I think, Senator, that would be fitting recognition of the great conservation achievements and service of the late Secretary Seaton.

Senator STEVENS. I appreciate that comment. I think he made more total constructive contribution to the future of our State than any other Secretary and that he was dedicated to making that a wilderness area in the very beginning and that is what it is in essence. Thank you, Mr. Chairman.

Senator STEVENSON. I don't have any more questions at the moment. If we do have more, we will get in touch with you and keep the record open. With that, we will recess until 9:30 tomorrow morning.

[Whereupon, the committee will adjourn at 3 p.m., to reconvene Thursday, March 25, 1976, at 9:30 a.m.]

TRANSPORTATION OF ALASKAN NATURAL GAS

THURSDAY, MARCH 25, 1976

U.S. SENATE,
COMMITTEE ON COMMERCE,
U.S. SENATE,
COMMITTEE ON INTERIOR AND INSULAR AFFAIRS,
Washington, D.C.

The committees met at 9:40 a.m. in room 5110 of the Dirksen Senate Office Building, Hon. Dale Bumpers presiding.

Senator BUMPERS. The committees will come to order. We will continue the hearings on the Alaska gas pipeline which we continued from yesterday.

Our first witness is Mr. Eric R. Zausner, Deputy Administrator of the Federal Energy Administration.

STATEMENT OF ERIC R. ZAUSNER, DEPUTY ADMINISTRATOR, FEDERAL ENERGY ADMINISTRATION; ACCOMPANIED BY ROBERT GOODWIN, DEPUTY ASSISTANT GENERAL COUNSEL FOR INTERNATIONAL AND RESOURCE DEVELOPMENT PROGRAMS; AND BRUCE PASTERNACK, DEPUTY ASSISTANT ADMINISTRATOR FOR POLICY

Mr. ZAUSNER. With your permission, Mr. Chairman, I would like to submit my prepared statement for the record.

Senator BUMPERS. We would welcome that.

Mr. ZAUSNER. I would also like to summarize the key points in that statement and then answer any questions you may have.

The FEA is obviously very concerned, as is this committee, about increasing domestic natural gas supplies. Natural gas today comprises about 30 percent of the total U.S. energy needs, a very crucial element in the overall energy supply picture.

While the administration feels that new natural gas deregulation is the single most important element in a comprehensive natural gas policy, we, at the same time, feel that tapping and bringing to market the vast natural gas supplies in Alaska is also a very crucial element. The estimates of the Federal Government indicate that we have approximately 30 trillion cubic feet of proven reserves in Alaska, and that undiscovered recoverable reserves could exceed 75 trillion cubic feet.

The key, of course, is the transportation system to deliver this gas to the lower 48 States. Your committee has heard the testimony already on the two competing routes, as well as some other alternatives which have been mentioned.

Either proposed system has the potential to deliver to the U.S. markets somewhere between .8 and 1.2 trillion cubic feet a year by 1985, possibly sooner.

That, of course, translates into a reduction in oil imports of over a half million barrels a day. So it is a very crucial element in achieving our goal of energy independence.

Our experience with the Trans-Alaska oil pipeline indicates that there are very significant possibilities for delay, due to the present structure of the approval process. There are a large number of agencies which have to issue permits or other kinds of approvals. The details are in my testimony. But there are significantly more agencies to consider than just the FPC. And it is quite possible that, as in the case of the Alaskan oil pipeline, very significant delays could occur, both in that approval process and in litigation procedures which are possible after decisions are reached on any one of a large number of different issues.

Those delays not only can slip the date when we get the gas, which is very important to us, because the sooner we get it, the better. We are going to desperately need all available supplies.

Second, it is quite easy to picture a delay of, for example, 5 years, which could increase the costs 40 percent over the estimates that the competing alternatives have surmised.

So the delay is not only a delay in terms of the national energy goal but also increased consumer costs. So we feel it is very important to get an expeditious decision on this.

The administration looked carefully at the two proposals and some of the other alternatives. We understand the FPC process even now is scheduled to be completed by the end of this year. We feel that, given the information we have, the changes that are still going on in the estimates of the cost and even the individual systems themselves, suggest to us we can't today make a decision among the alternative routes.

There is more information that is needed before a wise public policy choice can be made.

Nonetheless, it is necessary to assure the decision is made as quickly as possible, and that once it is made that construction can proceed as quickly thereafter as possible without undue delay.

In response to that the President proposed in his energy message this year the National Gas Transportation Act of 1976, which Senator Fannin has introduced.

That act is not a piece of legislation which makes an explicit choice among the alternatives, but instead sets up a procedure defining time limits thus assuring an expeditious decision-making process and, thereby, insuring the beginning and completion of the pipeline.

I will touch on a couple of the main elements in the bill quickly.

First, it requires the FPC to complete its current proceedings and transmit a determination to the President by January 1, 1977. That, I understand, is consistent with the time table they are now on and hope to meet.

Other Federal agencies, as the President determines, will be required to submit reports and recommendations on that FPC determination within 1 month, or by February 1, 1977. They would look at a large number of issues, some of which the FPC can in fact determine quite well, others which other agencies like for example the Department of Defense on national security or State Department on the status of the Canadian negotiations will be much better able to determine.

The President would then as soon as possible select or make a determination on the specific route. It could be either of the two proposals we now see, or it could be some modification to those or something else.

His decision could be made no later than August 1, 1977, although we are hopeful it could be made sooner than that.

Then that decision would be before the Congress for 60 days.

If the congress did not take action to disapprove, then all relevant agencies would be required to issue the required permits and certificates as quickly thereafter as possible.

The Federal Energy Administration is required to act within 30 days. And all other agencies would have to expedite their actions.

And judicial review of all of those actions except for constitutional issues would essentially be barred from litigation.

We feel this kind of process would strike a balance for all of our desires to get the decision made as rapidly as possible, but balancing that desire against the need to have all of the needed information and a conscious weighing of the alternatives at the appropriate time and a role for both the Congress and the President in what is a very important national issue.

With that, Mr. Chairman, I am prepared to take any questions you might have.

Senator BUMPERS. With the consent of the other members, I would like to limit questions to 5 minutes for each member and then we can come back for another round if it is necessary. But let me ask all of the members to confine their initial questioning to 5 minutes.

Senator Fannin.

Senator FANNIN. Thank you, Mr. Chairman. We are pleased to have you here this morning, Mr. Zausner, and your testimony is very valuable.

When the Senator from Arizona did introduce the legislation you referred to, it was not with the idea of having any delays, but with the feeling that something should be done and that we have been talking for a long, long time. It is hard for this Senator to feel that —and I have said this before—that we could go through Canada and solve all of the problems we have within the time period that has been designated, and we all recall the problems we went through when we talked about the crude line.

Of course the Senator from Alaska is more familiar with that than anyone else here.

But we are facing a very similar problem, but my question to you is whether or not we could not be taking steps or if work could not be done that would lessen the time element regardless of the choice of routes?

In other words, we have so many programs that just one procedure follows another and another and another. Is there a dual track we could follow that might be helpful in getting this done?

First, do you think we will eventually need both pipelines?

Mr. ZAUSNER. That is a question dependent of the amount of reserves we find. As I understand it, there appear to be adequate reserves to justify roughly 1 trillion cubic feet a year to be transported by one pipeline.

I think it would depend on what additional reserves were found before you could make a judgment as to whether two routes are needed.

Senator FANNIN. When you say it could exceed 75 trillion——

Mr. ZAUSNER. Yes, sir; that is the undiscovered potential recoverable reserves.

Senator FANNIN. But it is not just a guess, it is an estimate with specific information available to you, is it not?

Mr. ZAUSNER. As I understand it, that is an estimate made by the Geological Survey, which is not necessarily based on any drilling or production. It is an estimate based on geological characteristics. I might add that there is uncertainty about those numbers. In some cases, such as on the coast of Florida, where they expected significant reserves, we found none.

Senator FANNIN. Yes. Then to my question of what steps can we be taking that would lessen the time element that is involved? Because I think that is the most important fact.

You have said we are talking about an increase of 40 percent in the delay that is involved. What steps could we be taking now to assist?

Mr. ZAUSNER. Senator, we looked at that quite closely and we felt it would be very difficult to speed up the process between now and the end of the year, with the FPC getting the remaining information it needs to reach a determination.

Our desire was to speed up the process as much as we could once the FPC had finished its factual findings, while still providing an opportunity for both the President and the Congress to make a decision.

To me the key, Senator, is not whether we can shorten the year to 9 months from today when the final decision will be made, but to try to expedite the interminable delays which are very likely if there is no legislation which precludes them.

To me the key is not whether we can get this down to 9 months instead of a year, but to make sure, once we agree on the route, we don't have another 5 or 7 years of litigation and other forms of delay afterwards.

I think some form of process legislation such as the legislation submitted by the President would in fact assure that that pipeline could begin construction in 1977 or 1978.

Senator FANNIN. Of course the Senator remembers the stipulations in the legislation that finally was approved on the crude line, and that is why I was asking if there was something we could contemplate doing or even be doing that would assist in cutting down the length of time. I know this study will bring out the benefits and detrimental effects of one line over another. But I know we have had a great deal of discussion regarding what would happen with the product going into the west coast and the feeling of many of the midwest and the east that would consider this unwise.

As it has been explained to me, the movement would probably be almost as great eastward if the line did go into the west coast, as the programs that have been advocated. Is that correct?

Mr. ZAUSNER. The whole approach of the El Paso route, as I understand it, is to assure displacement and movement of comparable quantities of gas eastward. I don't think anyone disagrees that, regardless of where the line lands in the lower-48 States, we know where the gas is needed, and that is one thing that involves a technical determination by the FPC with respect to the ability of those proposed lines to satisfy that need.

On the surface, there is no technical reason to believe the gas can't land on the west coast and end up in the east coast markets. Like crude and other products, we can produce resources in one area and use them in others. So there is nothing inherently unusual about a program that brings the gas first to the west coast and then have it end up in the east.

Senator FANNIN. I think it is very important that the public realizes that, because I think there is a feeling generally speaking that if it goes to the west coast, that the east will suffer, the midwest would suffer, and I would hope that we could alleviate that.

The Senator from Arizona is very concerned about the time element and what we are going to be able to do from the standpoint of the end product.

Senator BUMPERS. Senator Mondale?

Senator MONDALE. Mr. Zausner, the Administration bill indicates it would probably take until late 1977 before the President and the Congress have completed their action on the Alaska gas transportation system.

Then there is a possible court appeal. So aren't we really talking about 1978 or as much as two years from now before a judgment would be reached and be final?

Mr. ZAUSNER. That could happen, Senator.

However, that would still allow the pipeline, to be begun very quickly and probably, by the early 1980s, we would have that gas.

As I indicated to Senator Fannin, we could argue and everybody can come to a different decision over whether you can do that in a year and a half, or a year and 9 months. Some people might argue it may take 2 years to do that.

To me the key, though, is to get that decision firmly made, whatever the period is, and then preclude litigation and other delays which could add another 5 years on to the end of 1978, if such legislation weren't present.

Senator MONDALE. I don't think there is any dispute on this committee that a decision affecting the delivery of this gas must include a remedy such as that imposed in the oil pipeline dispute, which terminates the interminable delays that might otherwise follow.

I gather that it would be intolerable for this country to have a delay of several years with respect to what may be the most important unused natural reserve of energy left in this country. We do have to move it.

My question is why do we in effect pursue a process that could bring us into the mid 1978 period, which is entirely possible as you have agreed? Isn't there a way—it seems to me you have two pretty clear proposals, at least, which the commercial community feels are possible, one Gas Arctic, one El Paso.

Wouldn't it make more sense for the Congress simply to get that decision out of the way?

Mr. ZAUSNER. No, sir, I don't believe it would. For instance, just in the last 30 days there has been a major change in one of those proposals, affecting the distribution system in the lower 48. Those pipeline proposals are still undergoing significant modification by the proposers and Mr. Dunham, who testifies next, can explain the facts that he is trying to obtain in his hearings.

It has been our technical judgment—that that decision can not be made now in terms of the available information. We do need the time remaining between now and the end of the year for the FPC to continue and finish the hearings and evaluate those proposals.

Then it would take a few months after that, Senator, for both the President and the Congress to make a decision.

That effectively puts you into August of 1977.

Senator MONDALE. Plus court appeals.

Mr. ZAUSNER. There is no way, as I understand it, Senator, to preclude constitutional appeals. In other words, there has to be available a way for constitutional appeals, but not litigation on the administrative decision itself.

Senator MONDALE. But the beauty of a congressional decision is that the constitutional grounds are very, very nil, because due process protection surrounding political judgments by the Congress are well-recognized to be limited. Whereas a proceeding before the FPC, an administrative proceeding, could attach to them all of the traditional due process protections accorded in those proceedings, which could take a long time to resolve.

Mr. ZAUSNER. I agree. That is exactly what the legislation would avoid. Essentially what we have provided in our legislation is a 60-day period for those constitutional appeals to be filed.

Senator MONDALE. To be filed. But how about their resolution?

Mr. ZAUSNER. As I understand it, there is no way, which to limit the constitutional review process.

Senator MONDALE. My question is why don't we do it now?

Senator BUMPERS. Your time is up, Senator. Senator Stevens.

Senator STEVENS. Senator Mondale said this is similar to the oil pipeline situation and I think from the point of view of trying to prevent delay it is the same. But don't you perceive a difference between a provision in legislation which terminates the right of judicial review after litigation is instigated and has been underway for 3 years, and a provision which would prevent litigation at all?

Mr. ZAUSNER. I do believe there is a difference. This legislation, unlike the Alaska oil pipeline legislation, is attempting to set up the process at the beginning, rather than after you are already embroiled in a dispute.

On the other hand, I think there are adequate safeguards to allow people to make their cases before the reviewing agencies, the President, and the Congress.

That period of time and that process provides ample opportunity for our elected officials to make those decisions after hearing everybody's views. Once those decisions are made, further litigation is inappropriate.

While it differs from the oil pipeline case, I still think it is a fair process.

Senator STEVENS. I have serious reservations about the constitutionality of closing the courts to any challenge on environmental or other grounds, before the courts have been approached.

It is one thing to say you must terminate litigation because we have decided the factual issues. It is an entirely different thing to say there are no legal issues involved and therefore you cannot have access to the courts.

I think we have to be very careful about any provision that could be interpreted as closing the courts to any challenge on the basis of constitutionality of the law or on legal issues in and of themselves.

On the factual issues we can substitute our judgment for the courts. But I do not think we can substitute our judgment for the interpretation of the law or for the constitutionality of the law we passed.

Mr. ZAUSNER. Senator, we reviewed that quite carefully with the Justice Department and compared it with the Trans-Alaska oil pipeline case and it is their view that it is not a constitutional question. The way it is drafted in our legislation is, in fact, consistent with what was passed in the oil pipeline legislation.

Senator STEVENS. I drafted that, after some 80-odd meetings with various experts in legal matters throughout the country, and the Justice Department. I think we are going to have to be very careful. I don't disagree with the idea we should limit the period of time involved in judicial review. But I seriously question whether we can limit judicial review in that sense.

As I understand it, you made the statement that it is entirely consistent with the provisions outlined in the administration bill that the President, on the basis of the advice he receives from all of the executive agencies, could mandate a route which is not covered by any of the applications. Is that correct?

Mr. ZAUSNER. Yes, sir; it is.

Senator STEVENS. And it would even go to the extreme, I take it, of a delivery system which might involve the methanol project we heard about yesterday?

Mr. ZAUSNER. Yes, it could, in theory at least.

Senator STEVENS. The President has the choice of a delivery system. So if I am correct, this is the first time either this Government or the Canadian Government has faced the question that was mentioned yesterday, and that selecting a route which accommodates the public interest as a whole, and not just the interests of any individual applicant in competition with another applicant?

Mr. ZAUSNER. I would hope that is exactly what the process would yield, be it one of those routes or some modified alternative.

Senator STEVENS. As a matter of fact, it could envision using parts of both applications, couldn't it?

Mr. ZAUSNER. Perhaps.

Senator STEVENS. And there could be a choice of two pipelines?

Mr. ZAUSNER. Yes, sir. The idea is to provide the broadest discretion for the President to weigh the FPC decision and all of the other information he has available before reaching a decision, and then to have the Congress review that decision.

Senator STEVENS. Some people have suggested a route which takes a portion of the gas to be liquefied, another portion of the gas down the Fairbanks corridor to join with the Alberta Gas Trunk line system. That too would be possible?

Mr. ZAUSNER. I think any one of those alternatives might be possible.

Senator STEVENS. Any combination of systems to deliver the gas to what we call the South 48 would be consistent with the administration approach as far as the total discretion we grant the President under this proposal?

Mr. ZAUSNER. Yes, sir.

Senator STEVENS. Thank you, Mr. Chairman.

Senator BUMPERS. Senator Stevenson?

Senator STEVENSON. Isn't it true that the procedures for judicial review were modeled after those in the recent railroad reorganization legislation and have already been upheld in the courts?

Mr. ZAUSNER. I will let Mr. Goodwin respond to that, Senator.

Mr. GOODWIN. We considered that approach, Senator, but the one adopted in the legislation follows very closely, almost verbatim, the judicial review provisions contained in the Alaskan oil pipeline legislation. And it is not similar to the railroad reorganization Act which contained provisions for a special court.

We have not created a special court.

Senator STEVENSON. The point is we do have another model and it is in the Railroad Reorganization Act.

I thought you had incorporated that. I think it is a model that we can be reasonably confident is constitutional.

Mr. ZAUSNER. Yes, in the sense that there was an approach to limit the types of judicial review and set up an expedited process and do many of the things we are trying to do in this legislation, it is a model and it is useful.

We feel it was not appropriate to set up a separate court.

Senator STEVENSON. How does the procedure which you suggest contemplate resolving the financing questions?

Or, to put it slightly differently, how do we get some assurance that the financing questions are going to be resolved satisfactorily before we adopt a procedure that doesn't give us such assurance?

Mr. ZAUSNER. That is a very good question. There is always the possibility that these pipelines might not be able to be financed privately.

We are hopeful that if there is an expeditious process, if investors can count on these pipelines being completed, whatever the decision is, if there is a tariff provided that makes the project economically viable, then they can probably be privately financed.

I would hope that over the course of the next year while we are gathering this information and waiting for the FPC decision that the President and the Congress would focus on the financial arrangements problem as we get to the point where we reach the decision question.

Obviously there is nothing in this legislation which can guarantee that all things will fall into place in a way that would allow the financing to be provided.

At this point we are hopeful that, if the tariffs are correct, and, if the possibility of interminable delays in litigation are removed, financing can be provided by the private sector.

Senator STEVENSON. I suppose the answer to that question depends partly on the Congress, and what, if any, action it takes with respect to the administration proposal and other proposals to create any mechanisms for the financing of energy projects.

Much of the emphasis, at least in the public discussions, has been on research, and on the replication of demonstration plants. In the proposals themselves, as I understand them, the administration could also make financing available to the pipelines.

Mr. ZAUSNER. I think what you are referring to is the Energy Independence Authority, which is intended not to subsidize these kinds of projects, but to the extent that private financing could not be obtained, that kind of Authority would be able to provide guarantees or insurance or other kinds of financial mechanisms to make sure it was built.

I don't think now is the appropriate time to make a specific decision on whether this one can or cannot be financed privately.

I hope it can. The President agrees with the concept of having a broad financing mechanism which could have the flexibility to support this type of project if it was determined to be critical and couldn't be financed any other way.

Senator BUMPERS. Senator Stevenson, your time is up. Senator Johnston.

Senator JOHNSTON. Mr. Zausner, this bill you are talking about, is it drawn up?

Mr. ZAUSNER. Yes, sir, it has been introduced by Senator Fannin. It is S. 3167.

Senator JOHNSTON. It envisions having the FPC make the determination, which you say may be in the form of a certificate of convenience and necessity.

Do you have in the bill any specified findings of fact that the FPC would make, for example, on such matters as financing?

Mr. ZAUSNER. I would feel better deferring the details of that question to Chairman Dunham from the FPC, but it is my understanding that they are going to have to make a finding on a large number of factors—the capital and operating cost, likely over-runs, construction schedules and possible delays, extent of reserves and their deliverability, the environmental consideration, financing capabilities, and so on.

In other words, we would expect that the FPC, depending upon what they deem appropriate, would do a very comprehensive analysis, such as they are now undertaking.

Senator JOHNSTON. Once those findings of fact are presented to the President, who coordinates it for the President?

Mr. ZAUSNER. That is his own determination. He has a lot of agencies who are going to be providing inputs. I am sure he will be requesting information from the State Department, the FEA, Interior, and the like.

Senator JOHNSTON. You don't mean to say the President himself is going to personally contact them? Surely he must have somebody in charges, doesn't he?

Mr. ZAUSNER. We are going to give him the flexibility to use who he wants. But he has a number of alternative staff groups he could use to combine all of the information that the FPC and the other agencies provide.

Senator JOHNSTON. What you are really saying is that hasn't been decided yet?

Mr. ZAUSNER. If you asked me today, I suspect that it would be the Energy Resources Council who would pull all that together, combine all of the agencies' views. But as to a year from now, I am not sure who it would be. He has many alternatives.

Senator JOHNSTON. I think it is the most central problem in the whole energy field today, and that is we have got no energy policy, we never have had one, and we have been talking about one for a long time, and we still don't have anybody in charge of energy.

I asked that same question of Governor—I forget which Governor; he was Secretary of Interior and we have had so many—but I asked him do we have an energy policy and there was this long-embarrassed wait, and he said, "Well, I don't guess we do," and I said, "Who is in charge of it?" and he said, "Well, I don't know. We all kind of do a little bit of it."

Mr. ZAUSNER. Senator, I couldn't disagree with you more. We have in the administration a very good group to coordinate energy policy in the Energy Resources Council. It provided the President with a comprehensive assessment of his options, put forward a comprehensive energy policy in two state of the Union messages, two energy messages, which included over 20 pieces of legislation that I am convinced, if enacted, would result in a comprehensive energy policy. It is not for lack of coordination or proposals by the administration that we don't have in place today a comprehensive national energy policy.

Senator JOHNSTON. The Energy Resources Council is the parent organization of FEA and Interior on matters of energy?

Mr. ZAUSNER. It is the group which directly advises the President and coordinates his energy policy.

Senator JOHNSTON. Who is the chairman of that?

Mr. ZAUSNER. Secretary Elliott Richardson, and the executive director is Administrator Zarb.

Senator BUMPERS. Senator, your time has expired. I believe you have a plane to catch, Mr. Zausner?

Mr. ZAUSNER. I have a meeting downtown.

Senator BUMPERS. Let me ask you one question along the lines of Senator Johnston and Senator Mondale's questions.

The administration bill sets out a timetable for all of these things to occur. One, by allowing the FPC to in effect make a decision which now under legislative authority it has the right and duty to make, we are prolonging the time for making that decision by then bouncing it over to the President to either accept or reject the FPC recommendation.

Two questions: Why not just let the FPC make the recommendation? And, two, if we are going to proceed along the lines of the administration bill, isn't it true that the President will be subjected to all kinds of lobbying efforts from both within and outside of the administration?

Mr. ZAUSNER. Yes, sir.

Senator BUMPERS. Which could in effect torpedo a very laborious job that the FPC has already gone through?

Mr. ZAUSNER. I might, Senator, add that the Congress has review authority.

Senator BUMPERS. I understand, we have 60 days. But we don't know who has lobbied the President to change his mind and on what line.

Mr. ZAUSNER. It is a good question, Mr. Chairman. In other words, today without any legislation the FPC would make a decision. There are a number of other agencies that would have to also issue permits. Then there would be a laborious and possibly extended period of litigation, with no decisionmaking mechanism by either the President or the Congress which could preclude a 5- or 10-year delay in getting started after the FPC makes their decision.

At one extreme you could say that when the FPC made its decision, there could not be any litigation.

We considered that alternative. But it is our view that such a large national decision does not warrant the precluding of all forms of litigation. The decision is much broader than the questions which the FPC has to weigh.

Senator BUMPERS. Congress didn't have much trouble making that decision on the oil pipeline, once the embargo hit.

Mr. ZAUSNER. That is true, Senator. But the key here is to avoid getting into that situation. Incidentally, that was before the embargo I believe.

Senator BUMPERS. Yes, it was.

Mr. ZAUSNER. The key here is to get legislation set up. If we can get process legislation this session, which gives both the President and the Congress the right role, whatever they might be, we will be much better off than to wait until early in 1977 and then start from scratch on such process legislation.

I would argue that one way to save time is to pass this legislation now geared to when the decision is made, rather than waiting until the decision is made and then starting all over again.

Senator BUMPERS. Thank you.

Senator STEVENS. You seem to equate this with the oil pipeline, and with due respect, the chairman does too, in my understanding of his questions.

The issue there was the right-of-way and the adequacy of the right-of-way law. You haven't found any inadequacy of any law that pertains to this pipeline, have you?

Mr. ZAUSNER. No, that is true, Senator.

Senator STEVENS. We could follow this procedure through if we had time and get to a final determination through the Corps of Engineers, through FPC, and through the Congress under the Right-of-Way Act. The Right-of-Way Act is going to bring this to

Congress anyway. It is larger than 24 inches, so it has to come to Congress.

Mr. ZAUSNER. I think the point is that while the right-of-way issue was the one that ultimately stopped the pipeline, there were a number of people who had an interest in stopping that pipeline permanently and who were looking for any alternative legal way to do it.

When I look at this pipeline, leaving aside the right-of-way question, and all of the permits and administrative decisions that have to be made by a large number of agencies, there is very significant possibility for protracted litigation, independent of the pipeline right-of-way question.

Senator STEVENS. But this is different, isn't it, because the FPC could well come out with a decision that the pipeline has to follow the Fairbanks route that the environmentalists want. If that happened, it would be the Arctic consortium, the international oil companies which would take us to court.

In the oil situation, the pipeline was already under construction in 1969 before NEPA was passed. The Court found in 1970 that NEPA applied to the project, even though it had been started. The FPC was not even involved.

We have an entirely different circumstance here in my opinion of trying to foreclose all litigation, or shorten all litigation from a myriad of potential parties, rather than trying to deal with one piece of litigation that was already underway.

I do think the constitutional issue is much different.

Mr. ZAUSNER. I feel very strongly, and so does the administration, that while this is not an exact parallel to the oil pipeline issue, that much the same kind of events would evolve. There are enough people who will be disappointed with any decision, and there are enough legal remedies that could be used to try to thwart the process we now have and delay it inevitably. Those delays are so significant that while they are different than the Alaskan oil case, we need a piece of legislation which does the same thing for this gas pipeline.

Senator STEVENS. I don't disagree, but I want to be sure the chairman understands, I don't want it to be like draining the swamp, because then you don't know what is left there. Remember the old story about the alligators?

If we are going to have a limitation of review, it has got to be such that we don't have such a prolonged constitutional issue that is worse than the delay you would have had if you went through the original thing.

Mr. ZAUSNER. Just to use your analogy, what the legislation is trying to do is not get us in the position of trying to drain the swamp when you are up to your neck in alligators, but trying to avoid getting into the swamp in the first place.

Senator BUMPERS. Mr. Zausner, you seem to have a unique knack of sparking the curiosity of the committee members. We have two more questions here.

Senator MONDALE. Mr. Zausner, this is not a question, but I think you are absolutely right, that wherever you have an administrative proceeding it is inevitable that constitutional rights obtain to those proceedings, due process protections have traditionally been accorded under the constitution to administrative proceedings. It is different when the Congress, through the exercise of its plenary powers, mandates a decision.

We surely have this power. Because there the due process protections are only those that permit people as citizens to petition the Congress.

It is much different, far more susceptible of termination than the other way.

I had this question, however. Is it not true that today across the Northern tier of the United States, Northwest and Southwest, that there are a great number of communities and States heavily dependent upon existing exports of Canadian gas?

Mr. ZAUSNER. Yes, sir, about a trillion cubic feet of gas.

Senator MONDALE. That is right. Is it not true that if the Canadians can tap their reserves of gas in the delta region, that we would be in a better position to argue with the Canadians in favor of a more liberal exportation policy of gas from existing reserves?

Mr. ZAUSNER. I have a hard time, of course, trying to second-guess the Canadian Government. It is my understanding that both with respect to oil and gas, in recent years their own domestic consumption has been growing and their own ability to tap and bring to market their reserves is growing, so there has been increasing pressure on them to curtail exports.

I couldn't tell you honestly whether tapping the Mackenzie Delta, 3 or 4 trillion cubic feet of gas, would in and of itself appreciably change their domestic needs.

Senator MONDALE. Don't you think if they had more gas available from their own reserves to serve Canadian needs, that we would be in a better position to argue with the Canadians that they ought to continue to serve the communities now dependent upon them than in the absence of those reserves?

Mr. ZAUSNER. Certainly, Senator.

Senator MONDALE. I think that is one of the strongest arguments for pursuing the Arctic Gas pipeline. It is the only option which affords that possibility.

Thank you, Mr. Chairman.

Senator BUMPERS. Senator Johnston.

Senator JOHNSTON. Mr. Zausner, I am curious about the Energy Resources Council, because I frankly had not heard of it before.

Are you telling us that Mr. Richardson is the top energy man now in the administration, as head of that Council?

Mr. ZAUSNER. Yes, sir. The Energy Resources Council was established by statute passed by the Congress.

Senator JOHNSTON. And Richardson as the head of that Council, is considered to be the chief energy man of the administration?

Mr. ZAUSNER. Yes, sir. He is the Chairman of the Energy Resources Council.

Senator JOHNSTON. And that is where the final energy decisions you would expect to be made, this and others?

Mr. ZAUSNER. Today that body contains the staff group of Cabinet officers and other people who weigh the alternatives, and submit recommendations directly to the President.

Senator JOHNSTON. To the extent that we have an energy czar, Mr. Richardson would now be that czar?

Mr. ZAUSNER. I guess you could say that, yes, sir.

Senator JOHNSTON. Thank you.

Senator BUMPERS. Mr. Zausner, we thank you very much.

[The statement follows:]

STATEMENT OF ERIC R. ZAUSNER, DEPUTY ADMINISTRATOR, FEDERAL ENERGY ADMINISTRATION

Mr. Chairman, Members of the Committee: I thank you for the opportunity to appear before you today to discuss the Alaskan Natural Gas Transportation Act proposed by the Administration. When FEA testified before this Joint Committee last month, we stated that it is essential that Alaskan gas be made available to the Continental United States as soon as practicable, especially since we project that natural gas shortfalls will significantly increase in the future. Today, I am prepared to discuss our proposal to achieve this result.

Natural gas remains a vital source of domestic energy. It accounts for about 30 percent of the U.S. total energy consumption and about 40 percent of non-transportation needs. Yet, domestic marketed production, which peaked in 1973 at 22.6 trillion cubic feet, has declined over the past two years. About 21.6 trillion cubic feet were produced in 1974, as compared to an estimated 20.1 trillion cubic feet in 1975.

While the Administration believes that deregulation of new natural gas is the most important action that can be taken to reverse this alarming trend, it is also imperative to assure that all possible secure sources of additional gas supply are developed, including, of course, the estimated 26 trillion cubic feet of proved reserves in the Prudhoe Bay area of Alaska's North Slope.

Alaska contains one of the largest known U.S. areas of undeveloped natural gas. In addition to currently proven reserves, there are an estimated 76 trillion cubic feet of undiscovered recoverable gas resources. We estimate that by 1985 the 0.8 to 1.2 trillion cubic feet of Alaskan gas production could replace about 500,000 barrels of oil per day, a significant impact on achieving energy independence.

The Nation's need for these additional supplies of natural gas indicates that the gas reserves in Alaska' a North Slope be developed and transported to the "Lower 48" States at the earliest practicable time and in an economically and environmentally sound manner. The longer we delay, the more expensive such a project will be. Assuming that the cost of each year's delay in commencement of construction is about seven percent, a delay of five years would increase costs about 40 percent over and above initial cost estimates of between $9 billion and $12 billion.

Finally, the impacts of delay would encourage some U.S. gas customers to accelerate switching to more expensive alternate fuels, depletion of "Lower 48" natural gas would continue.

Two proposals dealing with the transportation of Alaskan gas are now before the Federal Power Commission—the trans-Alaska or El Paso proposal, and the trans-Canada or Arctic Gas proposal.

Both of these transportation routes involve difficult economic, environmental and foreign policy considerations. These concerns are not insurmountable and, indeed, must be resolved quickly if delays in construction are not to inflate the ultimate costs of the systems, which appear to be economic at the present time. Further, we must not lose sight of the cost to the American consumer and American industry if we are forced to replace this valuable source of energy with more expensive alternate fuels.

The El Paso Route proposes 809 miles of pipeline paralleling the Alyeska oil pipeline corridor to a gas liquefaction plant and terminal in Gravina, in Southern Alaska. From there, the liquid natural gas would be shipped by cryogenic tanker to a receiving terminal and regasification plant in Point Conception, Southern California. Although this Alaskan gas would initially be introduced at the West Coast, El Paso expects to make increasing supplies available to the Midwest and the East Coast by displacing West Texas and New Mexico gas which would otherwise supply West Coast markets. This would require construction of additional pipelines in the "Lower 48" States, and extensive FPC review and approval of revised systems.

The Arctic Gas Route proposes an estimated 195 miles of pipeline eastward from Prudhoe to the Canadian border, 2430 miles of a Canadian line to Caroline Junction in South Alberta and, then, two branches of pipeline leading into the Western and Eastern regional markets.

Only one of these systems or some modifications to them, of course, can receive approval. What concerns us here is the length of time which may be needed to reach all of the decisions which are necessary to reach a decision. Our experience with the Trans-Alaskan Oil Pipeline Authorization Act demonstrates our ability to assure a decision which carries out the public interest.

To illustrate some of the areas of potential delay, I would like to reiterate for the Committee some of the actions which are expected to be necessary:

FEDERAL POWER COMMISSION

Issue a certificate of public convenience and necessity for the construction and operation of the transportation system (including the allowable tariff).

Authorize gas sale by Prudhoe Bay gas producers.

Issue certificates of construction of related pipelines by other companies for distribution of gas in the "Lower 48" States.

Approve agreements, including quantities and price, between parties affected by proposed displacement, if the El Paso proposal is chosen.

INTERIOR DEPARTMENT

Permits for rights-of-way over Federal land, both in Alaska and the "Lower 48" States.

ENVIRONMENTAL PROTECTION AGENCY (AND STATE)

Permits for discharge of liquid waste into waters of the State—if relevant.

CORPS OF ENGINEERS

Permits for river crossings and for dredging of river bottoms.

COAST GUARD

Various approvals regarding construction and operation of liquid natural gas tankers for El Paso project.

OTHER FEDERAL AGENCIES

Federal Maritime Commission, Public Health Service, Maritime Administration, Federal Communications Commission.

INDIVIDUAL STATE APPROVALS

Alaska authorization on the Natural Gas Maximum Efficient Rates (MER) of production. Any other State authorization or permits regarding roads, sewage, coastal zone impacts, etc. Some States may institute additional certification requirements to minimize adverse effects.

As can be readily seen from this listing, the potential for delay is substantial. For this reason, we are pleased to discuss with you today legislation proposed by the Administration which would expedite the decision on making Alaskan gas available to the rest of the Nation. The "Alaskan Natural Gas Transportation Act" would ensure complete coordination of all executive and independent agency determinations, and will assure that the public and the Congress have the opportunity to fully participate in the decision-making process. Most importantly, this legislation will provide a mechanism to obtain a final decision on this vital issue as soon as possible, but no later than October 1, 1977. Equally important, it will endure that the detailed technical, financial and environmental studies will be completed so that the public and the Congress will have all available information to review the decision.

The bill would work as follows: The Federal Power Commission would be directed to complete its review of proposed transportation systems and make a determination to the President by January 1, 1977. The FPC is already engaged in comprehensive hearings on Alaskan gas transportation proposals, which, as Chairman Dunham has testified before this Committee last month, they expect to complete by the end of the year. The FPC determination may be in the form of a certificate of convenience and necessity or such other form as the Commission deems appropriate. Therefore, this bill in no way preempts the FPC's fact finding role.

The final Executive Branch decision would be made by the President, after obtaining such information and recommendations from other federal agencies as the President deems appropriate. Since these reports would be due by February 1, 1977, one month after the FPC makes its determination, federal agencies would have adequate time to address all issues raised by the FPC. These agency reports will provide information with respect to issues related to national energy policy, transportation safety, foreign policy considerations, national defense, natural resources, and financing. In fact, many federal agencies have already contributed to the current FPC proceedings.

The President would then make a decision as soon as possible after he receives the agencies' assessments, but in no event later than August 1, 1977. To provide even further opportunity to ensure full consideration of all factors in this decision, the Congress would then have 60 days in which it might review and act upon this decision. If, after the congressional review, no action has been taken to overturn the decision, the Federal Power Commission and other relevant agencies are mandated to promptly issue the necessary certificates, permits, leases, rights-of-way, and other authorizations.

To ensure adequate environmental safeguards, no authorizations may be issued unless a "final" Environmental Impact Statement has been completed. In addition, the bill would limit the scope and timing of judicial review, consistent with constitutional safeguards, so that lawsuits by private parties will not hamstring expeditious construction of a system that the President and the Congress have agreed is in the national interest.

Mr. Chairman, these provisions of the bill are in many ways similar to those adopted by the Congress in the Trans-Alaska Pipeline Authorization Act of 1973. This legislation is no less urgent, and we commend this Committee for its interest in addressing this important issue.

Thank you.

Senator BUMPERS. Our next witness is the Chairman of the FPC, the Honorable Richard Dunham.

Chairman Dunham, you may proceed.

We always welcome summarization of testimony, but it is up to you.

STATEMENT OF RICHARD L. DUNHAM, CHAIRMAN, FEDERAL POWER COMMISSION; ACCOMPANIED BY DANNY J. BOGGS, ASSISTANT TO THE CHAIRMAN; AND DREXEL D. JOURNEY, GENERAL COUNSEL

Mr. DUNHAM. I have submitted my testimony to the committee, so I will try and summarize a couple of major points.

The four bills before you have a common goal, namely, the establishment of procedures to expedite the selection and construction of a system for the transportation of natural gas from the North Slope of Alaska to the lower 48 States.

The bills differ on how best to achieve this result.

I believe that the best way to reach an expedited and reasoned decision on a transportation system for the Alaskan natural gas is embodied in S. 3167. That bill would permit the FPC to conclude its proceedings on the issues before us and to reach a determination as to what outcome will best serve the public convenience and necessity.

Now, these proceedings have been going on since April 1975 and are scheduled to be completed by the end of May 1976.

In discussing the status of our proceedings, I emphasize that the record has not yet come before the Commission for decision, and I express no opinion on merits. My comments are in the nature of a status report in my role as an administrator of the Commission.

We believe that this proceeding, which is now underway—and we have had testimony from more than 100 intervenors—is a sound means of testing the proposals put forth by the applicants and is developing, in addition, a complete record for decisionmaking.

The important point I want to emphasize here is that the hearing process has led to agreement on a number of refinements in the applications, and suggestions for other changes which are under serious consideration.

In that sense, I think all parties would agree that the two proposals have been improved substantially by the very process of the proceedings undertaken before the Federal Power Commission.

For example, as a result of the proceedings, the Arctic Gas system proposal now contemplates that the Eastern leg would terminate at Kankakee, Ill., rather than in Pennsylvania. The proposal for the western legs of the same system has been altered and refined.

Western LNG's originally proposed terminal for receiving tanker shipments from Alaska at Point Conception would have been one of the several facilities on the west coast to be used for various LNG importations.

The staff proposal to combine certain of these facilities is under consideration in the proceeding.

As these examples show, the hearing process provides considerable opportunity for agreed-upon refinements which would be lost if a single decision by fiat were made.

It is also my belief that without a complete record as established by the Commission proceedings, any other method of arriving at a decision will actually tend to delay rather than expedite a final determination.

A decision made without such a record would be much harder to defend under even attenuated judicial scrutiny. Therefore, I believe a precipitous decision on legislation which would abort these proceedings and mandate a particular conclusion on the pending applications before this FPC proceeding and process is completed would not be in the public interest.

As the Commission has consistently stated, we expect to be able to render a decision by December 1976, so the January 1, 1977, deadline in S. 3167 should allow adequate time for the Commission to establish an adequate record and reach a reasoned determination based on the record.

The hearings are presently proceeding consistent with our timetable, and the participation of all interested parties has been encouraging. Except for the Department of State, which has entered into the record the testimony before you of Julius Katz, which covers most of the relevant points, all Federal agencies whose participation has been requested have testified, or will appear.

A recent procedural conference indicated that the preparation and cross-examination of the final environmental impact statements can occur so as to allow the administrative law judge to close the record and commence his consideration in accordance with the original schedule. We expect the final Interior environmental impact statement to be submitted before April 1, and the final FPC staff environmental impact statement should be available at about the same time.

Cross-examination of witnesses on these statements can begin shortly thereafter.

In summary, I believe S. 3167 best preserves the aspects of reasoned decisionmaking on a factual record, while providing for the broader areas of judgment by the President and Congress.

I would urge you to support that bill.

Senator STEVENSON. I understand Senator Stevens and Senator Johnston have to leave early, so I will call on them.

Senator STEVENS. Thank you very much, Mr. Chairman.

Mr. Chairman, I notice that we have some restriction as far as what we ask you about opinions, but I hope we are in order to ask you about facts.

My colleague from Minnesota just mentioned the possibility of increasing gas to the northern tier States if the Arctic pipeline is approved. I have here the text from the Natural Resources and Public Works hearings on the estimates for energy, mines, and resources from Canada. It is dated May 29, 1975. Mr. Wilder, who is the chairman of the Canadian Arctic Gas Pipeline, Ltd., testified at that time and I quote: "We have said many times before, but it bears repeating that Arctic Gas Pipeline is not dependent upon any increase in exports of Canadian Gas. Moreover, I do not anticipate that any Delta gas will be surplus to Canadian needs and thus we do not anticipate that any of that will be available for export."

Now, my question to you, in view of the statements made by my colleague here today, has there been any representation to our FPC by Arctic Gas that is contrary to this?

Have they represented to you that if the Arctic Gas pipeline is approved, that we can anticipate greater exports of Canadian gas to this country?

Mr. DUNHAM. I have not read the record in the proceeding, so I could not directly answer that. But I am sure that question has been covered in the proceedings without my actually having seen it.

Senator BUMPERS. One of your colleagues is shaking his head no.

Mr. JOURNEY. Part of the problem you are speaking to has been developed on the record. If you would like, for the purposes of these hearings, I can extract what was said in the administrative record and submit it to you.[1] I think that would be the best way to do it.

Senator STEVENS. I think it would be very helpful if you could. I certainly hope this matter is not decided on the basis of an anticipation in this country of increased Canadian gas exports.

---

[1] See p. 1839.

Senator MONDALE. Would the Senator yield?

I did not say that. What I said was we want to encourage the Canadians to continue current exports from existing reserves. Their NEB report shows they are going to be in short supply by 1981 or 1982 under the existing reserves. If you could add the Mackenzie Delta reserves, tap those, with the Arctic Pipeline, we would be in a better position to argue for continued exportation of gas from existing reserves.

That is all I said. I am not talking about an expansion of exports.

Senator STEVENS. I am sure my colleague can argue very strenuously for almost any proposition, but so can I. I would like to have that, if the chairman will allow it, and present it in the record here.

Senator BUMPERS. Certainly.

Senator STEVENS. As I understand your statement you say—and I think we can understand this—that you have started the procedure and you would like to complete it.

Mr. DUNHAM. Yes, sir.

Senator STEVENS. I also understand you to say, and correct me if I am wrong, that you do understand that there are other agencies involved in the decisionmaking process and, therefore, you support the concept that is in the administration's bill.

Is that correct?

Mr. DUNHAM. Yes, that is right. I would emphasize particularly those aspects of international relations, national security, and national defense, which might not properly come directly into our proceedings as a matter of record. Those are the points I particularly emphasize.

Senator STEVENS. I see.

My final question is, have you ever run into a situation where you had an application to go through a wilderness area pending before you?

Mr. DUNHAM. Oh, yes, I am sure we have.

Senator STEVENS. Have you invaded such wilderness areas with pipelines before?

Mr. DUNHAM. Yes.

Senator STEVENS. I would like to have a listing of the instances in which that has taken place and the time at which it took place.

Mr. DUNHAM. Yes, we will supply that.

Senator STEVENS. Thank you.

Senator BUMPERS. Senator Johnston?

Senator JOHNSTON. I have no further questions.

Senator BUMPERS. I understood you and Senator Stevens had to leave at a quarter of—you have no questions.

Senator Mondale?

Senator MONDALE. Mr. Chairman, would you agree that more than 95 percent of the evidence to be presented in this case has already been publicly heard and cross-examined before your Commission? And the additional evidence will be presented and cross-examined during the next 5 or 6 weeks?

Mr. DUNHAM. I would hate to specify in terms of 95 percent. A great deal has. Some of the important elements, as I referred to in my statement, the environmental impact statements have not.

Senator MONDALE. But the overwhelming portion of the evidence has been heard?

Mr. DUNHAM. Yes.

Senator MONDALE. Now, all you are doing is having such additional evidence that remains, plus cross-examination, and that would take approximately 5 to 6 weeks.

Mr. DUNHAM. Yes, that is right.

Senator MONDALE. So the next 8 months would not produce any new factual evidence, but would be used only for briefing and decisionmaking?

Mr. DUNHAM. Well, two aspects: the period before that will be time for the judge who heard the proceedings to prepare his decision. If, during the course of that period of time some new important piece of information becomes available, it can be addressed, either by him or later on by the Commission itself.

Senator MONDALE. Have you had—are you aware of any such evidence?

Mr. DUNHAM. No. We do expect to hear something from the Canadian Government.

Senator MONDALE. Are there any matters that will be considered by the Commission that are not on the public record, or will be on the public record in the next month or so relating to this case, exclusive of those decisions concerning contracts for purchase of the gas and so on, that may or may not be resolved within the next year or so.

Mr. DUNHAM. Yes, that is right. There could be.

Senator MONDALE. Mr. Chairman, the environmental staff of the Commission recommended that the gas transportation follow the Fairbanks corridor. Was this recommendation made with any basis for believing either that the Canadian Government would approve this route, or that the private industry would actually build a pipeline along it?

Mr. DUNHAM. No, sir. We do not know as yet the position of the Canadian Government.

Senator MONDALE. Was it made on the basis of any evidence that has been filed before the Commission?

Mr. DUNHAM. Well, the FPC staff prepares independently an environmental impact statement.

Senator MONDALE. But was it made on the basis of any evidence that has been filed with the Commission?

Mr. DUNHAM. It was made as part of the staff's review of the record and the evidence.

Senator MONDALE. The environmental staff in recommending the Fairbanks corridor presumably determined it was desirable to avoid the wildlife range. Yet techniques have been recommended for winter construction and mitigation of environmental effects, in order to minimize the impact of a pipeline on the wildlife range. These techniques have been developed in Arctic conditions by the Arctic Gas study group.

Has the Commission conducted independent tests to determine whether these techniques will work?

Mr. DUNHAM. These are all matters, Senator, that are before us, and——

Senator MONDALE. Yes, I am not asking you to take a position on the merits. I am just asking whether the Commission has conducted independent tests to determine whether these techniques will work?

Mr. DUNHAM. I don't know—independent, you mean with our staff, or relying upon the testimony of other people?

Senator MONDALE. Yes.

Mr. DUNHAM. I do not know that. I would assume it is largely relying upon other people's studies or reports.

Senator MONDALE. Does the Commission reject the validity of the Arctic Gas testimony without conducting its own, or at least observing firsthand the tests carried out by that consortium?

Mr. JOURNEY. Senator Mondale, if the purport of your question is whether the staff did independent fieldwork in Canada on this, I believe the record will show that the staff did not.

Senator MONDALE. In Canada? Or in Alaska?

Mr. JOURNEY. Well, the FPC staff did do fieldwork in Alaska on the environmental questions involved in the pipeline. If you would like for me to get from the record exactly what was done, I would be happy to supply it.

Senator MONDALE. It is the contention of the Arctic Gas consortium that they have developed and tested techniques which dramatically minimize the environmental risks that have been posed.

In your environmental impact statement those arguments were rejected. I wanted to know to what extent you evaluated and sought to determine the accuracy of the Arctic Gas consortium's findings and tests? I gather you didn't conduct your own, so upon what was that recommendation based?

Mr. JOURNEY. Senator Mondale, part of what you are talking about will come out on the cross-examination of the final environmental impact statement. It is now being prepared. The testimony will start about April 12. If you would like, I will extract from the record and from the statements as they go in, the precise amount of work that was done on this. I think it tends to be an overstatement to say that the staff did not do its independent work. I think that it did do a good bit of work on this. I would like to supply that for the hearing record.

Senator MONDALE. Thank you, Mr. Chairman.

I have a few extra questions I will submit for the record.

Senator BUMPERS. Fine. Thank you very much.

Senator Stevenson?

Senator STEVENSON. Thank you, Mr. Chairman. On the question of Canadian gas imports I would like to follow up where Senators Stevens and Senator Mondale left off. Last week in Ottawa we were told by Canadian official that they could not give us any assurances, because they do not know the extent of the McKenzie Delta and the Canadian Beaufort Sea resources that will at some point come onstream. They did say that the possibility of continued or increased natural gas exports to the United States would be enhanced by a transportation system that could bring down whatever those resources are in both the McKenzie Delta and the Beaufort Sea.

Now I can say this safely because Senator Stevens is not here, but if he was here I suspect that his rejoinder would be that both the Beaufort Sea and the McKenzie Delta could be hooked up to a trans-Alaska pipeline and the Candian gas could be brought down that way.

But then the Canadians would respond by saying that, in order to continue or enhance exports to the United States, we will have to find a way of bringing that oil or gas back into the Canadian interior and that might require still another pipeline in from, for example, Prince Rupert. So I think both sides are right, and it would be unreasonable to expect the Canadians to give us any ironclad assurance.

I think all Senator Mondale was suggesting was that the possibilities of maintaining Canadian exports would be enhanced by a transportation system which would make it possible to bring down the Canadian gas from the Mackenzie Delta and the Beaufort Sea. And what is said with respect to gas applies also with respect to oil, because it is apparently less expensive to build an oil pipeline in an existing corridor. So, if oil is discovered in the Beaufort Sea, less resources would be necessary to justify construction of a pipeline in the same corridor. This might also mean that an additional amount of Canadian oil would be available to the United States.

Mr. Dunham, S. 3167, which you have indicated support for, requires all of the various agencies to make their recommendations to the President on February 1, 1977, but the FPC, as I understand it, makes its recommendation to the President on January 1, 1977.

Mr. Dunham. Yes, sir.

Senator Stevenson. Now, wouldn't it be better to reverse that, or to somehow provide for the reports of all of these other agencies before the FPC makes its recommendation? Wouldn't the FPC, as the lead agency, be in a better position to make a recommendation if its recommendation followed the input from all of the other agencies?

Mr. Dunham. This bill contemplates two separate stages. As I pointed out, all of those agencies, with the exception of the Department of State, have appeared or will appear before our agency in this proceeding.

Now we will take and, if you will, consolidate, evaluate, weigh, trade off, and so forth, and come up with a determination. Then what I characterize as a second stage, is contemplated in reaction to our determination.

The President would then ask, I would assume, did we weigh properly the testimony of DOT, did we weigh properly the testimony of FEA in terms of energy and so forth? It is kind of two stages.

They have all appeared before us with one exception, the Department of State.

Senator Stevenson. Well, is it contemplated that their participation before the FPC has ended, or if this bill became law, would they come back to the FPC?

Mr. Dunham. Well, they have all appeared before us, or will, before the administrative law judge reaches his initial decision. Unless it is sent back for some other reason, there would be no other opportunity for further testimony before the ALJ. The Commission itself could address inquiries in one way or another, and briefs could be filed.

This bill does not stop them from coming before the Commission in its current proceedings, if that was the question.

Senator STEVENSON. As I understand it, the procedures established by this bill contemplate consideration of more options than are embodied in just the applications before the FPC. The Alcan Highway route, for instance. Wouldn't the FPC hear from the agencies again?

Mr. DUNHAM. You mean if there was a radical departure from the FPC decision or determination or recommendation, whichever word, if the President rejected that?

I assume he could send it back to the FPC, although that is not contemplated in the bill. I really don't understand the question.

Senator STEVENSON. Maybe I don't understand this bill.

Is it your understanding that under the bill, the FPC would only exercise its traditional responsibility?

Mr. DUNHAM. Yes.

Senator STEVENSON. Namely just act on these applications?

Mr. DUNHAM. Except it puts the President and Congress into the action before we issue the final certificate. Under the present law we could proceed with our existing proceedings, and issue a final certificate of public convenience and necessity, which could be quite different from the original applications, involving any modifications and compromises we wanted to impose.

The President's proposal here is to give him an opportunity to review and evaluate two things:

One, the other aspect that we would not properly have before us such as national defense and international relations. He could then modify it in his judgment or change or agree with our determination.

Then Congress itself has another opportunity beyond that for input.

So it is visualized as an interruption of the final FPC determination, or the final certificate, I should say, also.

Senator STEVENSON. How then does this procedure give adequate consideration to options which are not now embodied in applications before the FPC, such as the methanol option or the Alcan Highway option?

Mr. DUNHAM. Well, the methanol and the Alcan Highway and other alternatives have, as I understand it, already been introduced as possibilities within our proceedings.

Now there is nothing in the existing law which mandates that we issue a final certificate and license on only those two applications.

We can modify, condition, not issue any license, in other words, discard both applications.

There is no real limitation upon the matter. We could not issue a license on the methanol alternative, as I understand it, because that is not under our jurisdiction.

But we could refuse to issue a license—I am not suggesting we would, because I have not looked at or evaluated anything in regard to the proceeding—but we could refuse to issue a license on the two applications before us, thereby leaving the door open to any other alternative.

Senator BUMPERS. We need to move along. I have just a couple of questions.

Is there any precedence for the President reviewing a decision of the FPC?

Mr. DUNHAM. I believe not.

Do you recall any?

Mr. JOURNEY. Not in the context of this particular bill, but you will find in part I of the Power Act a procedure whereby the President may get involved in FPC licensed projects decisions taking over hydroelectric projects during wartime.

The President and the FPC do relate under Executive Order 10485, an order under which the FPC exercises the delegated executive authority to control facilities at the international border. The FPC does it in conjunction with the State Department and Defense Department.

Senator BUMPERS. Is there any precedence for effectively setting a timetable for the FPC within which it will make a decision?

Mr. DUNHAM. I know of none.

Senator BUMPERS. Can you make a decision in the absence of a prior decision by the Canadian National Energy Board?

Mr. Dunham. Well, I don't know. It would be possible to make a decision even if we don't have a reaction by them.

Senators BUMPERS. So, if you are under a mandate of January 1, 1977, and you don't have that information, we have big problems.

Mr. DUNHAM. Not necessarily.

Senator BUMPERS. Pursuing the line of questioning of Senator Stevenson's in permitting all of these other agencies to give you their input now, rather than waiting until you make a decision and refer it to the President, and allowing the agencies like State, Defense, Transportation and so on to go over to the White House and sit down in the Oval Room and whisper in his ear what their opinions are, why not let them whisper in your ear before and get that all done? Is there any reason why that could not be done?

Mr. DUNHAM. No. 1, of course, they couldn't whisper in our ear.

Senator BUMPERS. I was being facetious.

Mr. DUNHAM. First, they all come before our proceedings. Then, as I understand the bill, the President may require reports from such agencies as he deems advisable. There is no quarantee that a specified list of agencies get to provide him with reports.

I suppose your question would be should Departments have two bites at it. They did appear before our proceedings; and, of course, the President, in making his considerations, is not precluded from having advice from anybody that he wants to. The bill merely permits him to ask for a report from Interior or DOT or somebody else, but he also may not choose to do so.

Senator BUMPERS. If the ultimate power to approve or disapprove the FPC decision is going to lie with Congress, why not just let the Federal Power Commission, why not just change the bill to let the Federal Power Commission make its recommendation to Congress?

We would eliminate about 6 months time here. Everybody is talking about expediting procedures.

Mr. DUNHAM. Well, I wouldn't want to comment too much on that part of it, but primarily the international relations aspect is a responsibility of the President, at least initially.

Senator BUMPERS. The point I think Senator Stevenson was talking about a while ago, and I tried to pursue, is if the FPC has before it all of the opinions of just about everybody it would normally hear from and makes what I presume will be a hopefully objective decision, and then either just let that decision stand, as it would now in the absence of any legislation, or allow the Congress 60 days in which to approve or reject the FPC's decision.

Mr. DUNHAM. Two comments in that regard.

Under the Natural Gas Act, we cannot take into consideration anything that is not on the record. And there are some elements——

Senator BUMPERS. I am not suggesting you take into consideration anything not on the record.

Mr. DUNHAM. I understand. But there would be no way, I assume, where we could discuss on a completely open record, some aspects of what may be national defense or national security considerations or international relations considerations. Those are not the types of things that are subject to the evidentiary process.

So we would have to think that there are some elements in regard to these proposals that are important from both national security and international relations, but we could not and properly should not take into account. So in some way that element has to be put into the process. Whether that is the President and Congress or only Congress or only the President is another matter.

Senator BUMPERS. Thank you very much.

Senator MONDALE. Isn't it the case that these proven reserves and potential reserves constitute the largest known untapped energy reserves in the country?

Mr. DUNHAM. In the United States, yes.

Senator MONDALE. So this may be one of the most important energy decisions under American control to be made in the next 25 years.

Mr. DUNHAM. That is right.

Senator MONDALE. In that light, don't you think the Congress representing the country ought to have more to say about it than just vetoing, the right to veto by a vote of both Houses a decision made by a single person?

Mr. DUNHAM. Well, I——

Senator BUMPERS. Do you want to take the fifth amendment of that.

Mr. DUNHAM. Yes.

Senator MONDALE. They say the Congress decides, but actually under the proposal we have a right to veto by both Houses, vote up or down a delivery system designed by the President.

And the choice for the Congrss would be, "Do you want gas or don't you want gas?" And anybody who votes against that will not only not be reelected but would probably be impeached.

Thank you, Mr. Chairman.

Senator BUMPERS. Before we continue, a whole series of questions could be asked about whether the administration has actually considered the policies of the country in regard to the use of the gas or are we just saying we need the gas and therefore let's get it down here.

I would like to explore the whole concept of the administration policy for the use of the gas, as well as the cost.

Thank you very much, gentlemen.

[The statement follows:]

STATEMENT OF RICHARD L. DUNHAM, CHAIRMAN, FEDERAL POWER COMMISSION

Thank you for the opportunity to present the views of the Federal Power Commission on the legislation before the Committees with regard to the transportation of Alaskan natural gas to the lower 48 states.

The four bills before you have a common goal, namely, the establishment of procedures to expedite the selection and construction of a system for the transportation of natural gas from the North Slope of Alaska to the lower 48 states. The bills differ on how best to achieve this result.

I believe that the best way to reach an expedited and reasoned decision on a transportation system for the Alaskan natural gas is embodied in S. 3167. That bill would permit the Federal Power Commission to conclude its proceedings on the issues before us and to reach a determination as to what outcome will best serve the public convenience and necessity. As I stated when I testified before you on February 17, 1976, the hearing procedures now underway before the Commission are, in my opinion, the best available means to consider thoroughly the issues involved, test the evidence presented by cross-examination, and allow all interested parties the sense and the reality of contributing to the decision. The hearings began in April 1975, and are scheduled to be completed by the end of May 1976.

In discussing the status of our proceedings. I emphasize that the record has not yet come before the Commission for decision, and I express no opinion on the merits. My comments are in the nature of a status report in my role as administrative head of the Commission.

The hearing has included the testimony and cross-examination of witnesses representing not only the competing applicants, but more than 100 intervenors as well. This has proved a sound means of testing and improving the proposals put forth by the applicants, and is developing a complete record for decision-making. The hearing process has led to agreement on a number of refinements in the applications, and suggestions for other changes which are under serious consideration.

For example, as a result of the proceedings, the Arctic Gas System proposal now contemplates that the Eastern leg to be built by Northern Border would terminate at Kankakee, Illinois, rather than in Pennsylvania. The proposal for Western legs of the same system has also been altered and refined. Western LNG's originally proposed terminal for receiving tanker shipments from Alaska at Point Conception would have been one of several facilities on the West Coast to be used for various LNG importations. A staff proposal to combine certain of these facilities is under active consideration in the proceedings. As these examples show, the hearing process provides considerable opportunity for agreed-upon refinements which would be lost if a single decision by fiat were made.

It is my belief that without a complete record, as established by the Commission proceedings, any other method of arriving at a decision will actually delay rather than expedite a final determination. A decision made without such a record would be much harder to defend under even attenuated judicial scrutiny. It is for these reasons that I believe that a precipitous decision on legislation which would abort these proceedings and mandate a particular conclusion on the pending applications before this FPC proceeding and process is completed would not be in the public interest.

The selection of a transportation system for Alaskan natural gas is unique in the size of the project and the complexity and nature of the issues involved. The final decision must consider aspects of national security, international relations, and the relationship between these and total national energy needs. The Federal Power Commission does not have primary responsibility in these areas, nor all the relevant information to consider properly these aspects in its determination. Therefore, as I pointed out when I last appeared before you, review of the Commission decision before final certificates are issued would be appropriate. Both Congress and the President have responsibilities that could properly lead to action differing from the Federal Power Commission's judgment. Such review could result in a new and different decision, modification of the FPC determination, or endorsement of that initial determination.

I therefore support S. 3167, which provides that the Commission complete the pending proceedings and transmit to the President a determination thereon by January 1, 1977. The President would then make the final decision, which would lay before Congress for 60 days. I believe that such a process would be a satisfactory way to reach a final determination on this question of vital significance to the whole nation.

As the Commission has consistently stated, we expect to be able to render a decision by December 1976, so the January 1, 1977, deadline should allow adequate time for the Commission to establish an adequate record and reach a reasoned determination based on the record.

The hearings are presently proceeding consistent with our timetable, and the participation of all interested parties has been encouraging. Except for the Department of State (which has entered into the record the testimony before you of Julius Katz, which covers most of the relevant points), all Federal agencies whose participation has been requested have testified, or will appear. Representatives of the North Slope Gas Producers are scheduled to testify early next month.

A recent procedural conference indicated that the preparation and cross-examination of the Final Environmental Impact Statements can occur so as to allow the administrative Law Judge to close the record and commence his consideration in accordance with the original schedule. We expect the final Interior EIS to be submitted before April 1st, and the Final FPC Staff EIS should be available at about the same time. Cross-examination of witnesses on these statements can begin shortly thereafter. This should allow time to complete the cross-examination and close the record by May 26, 1976, the date originally indicated in the FPC's proposed timetable.

S. 2510, S. 2950 and S. 3167 all limit the scope and accelerate the timing of judicial review, consistent with constitutional safeguards. Judicial review under present law would likely consume much time, during which construction would be impossible. If a determination is made that the public interest requires that the natural gas be transported to the lower 48 states at the earliest possible time, these limitations of judicial review would be in the national interest.

In summary, I believe S. 3167 best preserves the aspects of reasoned decisionmaking on a factual record, while providing for the broader areas of judgment by the President and Congress. I would urge you to support that bill.

[The following information was subsequently received for the record:]

FEDERAL POWER COMMISSION,
Washington, D. C., April 12, 1976.

Hon. HENRY M. JACKSON,
Chairman, Senate Committee on Interior and Insular Affairs, U.S. Senate, Washington, D.C.

DEAR CHAIRMAN JACKSON: Transmitted herewith is the corrected transcript of my appearance before the Committee on Interior and Insular Affairs on March 25, 1976. Also enclosed is the Commission's Staff response to the questions posed during the hearing upon which information was to be supplied at a later date.

(1) Development of certain aspects of the evidentiary record in the Arctic Gas Pipeline proceeding. The Commission's answer is set forth in Attachment A hereto.

(2) Whether there is natural gas production from or natural gas pipelines present in lands designated as wilderness areas pursuant to the Wilderness Act of 1964. The response to those questions is set forth below.

Since the passage of the Wilderness Act of 1964, no natural gas pipelines have been granted permits to cross lands which were designated as part of the

National Wilderness Preservation System. Prior to that time, two pipelines were constructed on lands subsequently designated as wilderness areas. The Commission issued a certificate in 1959 to Transwestern Pipeline Company to build a pipeline in part of the Bitter Lake National Wildlife Refuge in New Mexico, which was designated on October 23, 1970 as the Salt Creek Wilderness. Chandeleur Pipe Line Company received permission from the Commission in 1963 and 1969 to construct pipeline facilities across the Breton National Wildlife Refuge in Louisiana, which was designated as the Breton Wilderness on January 3, 1975.

As to gas production in wilderness areas, there are instances of such activity, but generally the Commission does not keep its records in such a manner that would permit a ready identification of those sales subject to Commission jurisdiction that commenced in a wilderness area. In addition, some sales from production in such areas would not be made in interstate commerce and would not, therefore, be on file with this Commission.

The United States Geological Survey maintains records on all payors of royalties to the United States based on hydrocarbon production on federal lands, but the information is not identified by type of land, such as a wilderness area. If the U.S.G.S. were provided with a complete legal description and maps of the wilderness areas, it might then be possible to delineate the gas production located in wilderness areas. Mr. Russell Waylen, Chief of the Division of Conservation of U.S.G.S. should be able to provide the Committee with assistance in this matter.

Sincerely yours,

RICHARD L. DUNHAM,
Chairman.

Attachment A

During the hearings on the Arctic Gas Pipeline, a question arose as to the extent of the FPC evidentiary record on the question of increased Canadian gas exports and we agreed to supply you with an extract of the record on that issue. The record reflects that the Section 3 Import Application by Columbia Gas Transmission Corporation, Michigan Wisconsin Pipe Line Company of America, Northern Natural Gas Company, Panhandle Eastern Pipe Line Company and Texas Eastern Transmission Corporation in Docket No. CP75–257, which has been consolidated with Docket No. CP75–96, states as follows on page 5:

"Applicants propose to export such gas as they will ultimately obtain under contract from producers on the north slope of Alaska and import that gas in addition to such gas as they will finally obtain under contract from producers in the Mackenzie Delta-Beaufort Sea area of Canada."

Despite the language of the application, no evidence has yet been adduced for the record to show importation of Canadian Mackenzie Delta gas by the Applicants in Docket No. CP75–257.

In addition, the record reflects testimony of foreign gas in transit through Canada. That testimony was presented by Mr. John R. Brady of another natural gas company who testified at Tr. 11,365 to Tr. 11,368 concerning Northern's arrangements to transport gas purchased in the Tiger Ridge Field in Montana (see Northern Natural Gas Company, Docket No. CP70–69, *et al.*). Mr. Brady testified that Northern's gas obtained in Montana is transported north across the international border, thence through Trans-Canada Pipeline and redelivered at Emerson, Minnesota by Consolidated Natural.

The record also contains evidence on the legal status of foreign gas in transit through Canada. The Testimony of W. B. Williston, Canadian Barrister and Solicitor, has been presented by El Paso Alaska Company.[1] His professional opinions include the following:

(1) An emergent shortage of energy supplies within a province could require the diversion of natural gas to local uses even if the gas only flows through the particular province and was never produced nor scheduled to be sold within said province. (Exhibit EP–100 page 30, Tr. 8180, 8399–8553).

(2) It is within the power of the Federal Government of Canada to expropriate a pipeline or the gas within it (Exhibit EP–100, page 33, 8445–8449).

---

[1] It should be noted that Arctic Gas has not yet had the opportunity to submit answering testimony to Mr. Williston.

(3) Under the Emergency Energy Supplies Act it would be possible under certain conditions to divert gas destined for customers in the lower 48 states to Canadian users and also pre-empt pipeline capacity. (Exhibit EP-100, pages 36–38, Tr. 8455–8461, 8520–8521).

A question arose as to the FPC Staff's participation in evaluating the environmental questions involved in the proceeding. The record and extent of staff's past and future involvement is as follows:

I. Extent of FPC Analysis of Fairbanks Corridor:

1. A review of the information supplied by Arctic Gas in their environmental report (Item by Reference AA–Q) and responses to a series of deficiency questions from the FPC and Department of Interior's staff.

2. A review of the Department of Interior's Environmental Impact Statement on the Fairbanks Alternative.

3. A review of the Alaska Environmental Impact Statement and consultation with Interior officials on this subject.

4. Field trips to Alaska as listed below which not only included visiting various parts of the route but also consultations with various public officials and other interested parties. Local hearings were conducted in Juneau, Anchorage and Fairbanks in conjunction with the Department of the Interior on January 6–11, 1975.

(1) August 19–23, 1974.

(2) November 13–18, 1974.

(3) June 23–27, 1975.

Mr. Michael Sotak and Mr. Lee Brennan of the FPC Staff were principally responsible for the coordination of the Staff Fairbanks analysis. These gentlemen are scheduled to testify in the El Paso Alaska Hearings and attached hereto are copies of their biographical sketches which will be made a part of the record in this proceeding.

Cross-examination of the FPC Staff's Environmental Impact Statement should begin in late April or early May. It should be remembered that under our responsibilities imposed by NEPA we must examine all alternatives from an environmental point of view. Under the Natural Gas Act, a certificate can only be issued if the proposal is within the public conveneince and necessity. This means, of course, that any decision we make as to which proposal or route should be certificated will be based not only on environmental factors, but on a great multitude of factors including engineering, gas supply, financing, etc. At the present time the Commission's Staff has not identified the Fairbanks Alternative as the best route considering all factors, not just environmental ones (Tr. 17, 674–17, 677).

Senator BUMPERS. Mr. Fay, please proceed.

STATEMENT OF JAMES FAY, CHAIRMAN, MASSACHUSETTS PORT AUTHORITY, CAMBRIDGE, MASS.

Mr. FAY. Mr. Chairman, I have prepared some written comments which I have submitted for the record. I would be glad to add a few remarks to highlight some of these points.

The Port of Boston is presently the only port in the United States which now receives LNG in significant quantities as imports. The LNG to Boston comes from Algeria, and is received in a privately owned terminal in Everett, Mass. which borders on Boston Harbor.

My remarks have been addressed to the hazards associated with accidental spills of LNG, either on water or land, from shipment by ship or storage in large tanks on shore.

Mostly my concern has been related to the hazards of fire, as it will possibly injure people or cause their deaths.

In the system that is under discussion for transshipment of Alaskan gas to California, the terminals in Alaska and in California I understand are located in areas where the population density is low; certainly much lower than in the crowded harbors on the east coast where several terminals are now under construction or consideration. So for that reason there is certainly less to be concerned about in terms of potential damage to people.

However, because of the possibility of accidents that would release large volumes of LNG, which forms a vapor very rapidly, and can be set on fire, and which would burn very quickly, thought has to be given to the effects upon the facilities themselves. The possibility of both fire and explosion raises the question as to whether there might be significant interruptions to the use of those facilities in the system which involves such a potential hazard.

I leave it to you to think about how that consideration should enter into the choice between the routes. But I think it is fair to say that the LNG route involving liquefaction, storage, shipments by vessel, restorage on land, and gasification involves a chain of facilities which is more likely to be subject to interruption in case of an accident than an overland gas pipeline system.

Finally, let me say that the LNG shipping and storage facilities siting is a matter of great concern, especially on the east coast where those facilities have been proposed to be built in or near areas of high population density. Nevertheless, I think even in the case of the facilities in Alaska and in California, the question of safety hazards associated with those facilities is one which States and local jurisdictions would want to have a significant input in regard to the final decision.

I would recommend to you that the States and cities involved should be consulted before a final decision is made to go ahead and install such new and relatively untried systems.

Thank you, Mr. Chairman.

Senator STEVENSON. Thank you, Mr. Fay.

[The statement follows:]

STATEMENT OF JAMES A. FAY

I am Dr. James A. Fay, Professor of Mechanical Engineering at the Massachusetts Institute of Technology. Among my principal areas of expertise are fluid mechanics, combustion and explosions. In recent years I have engaged in research on air and water pollution problems, especially the disperson of air pollutants in the atmosphere and the spread and evaporation of oil and LNG spills on water. I also presently serve as Chairman of the Massachusetts Port Authority and am a member of the Environmental Studies Board of the National Academy of Sciences. In these latter capacities I have become aware of the environmental and safety hazards associated with the transportation of very large volumes of liquid hydrocarbons by ocean-going vessels. Also, the problem of siting landside facilities for unloading these vessels and storing their cargoes is one that has received close attention by the Massachusetts Port Authority.

Liquefied natural gas (LNG) is one of the most hazardous hydrocarbons now being transported and stored in large quantities in the U.S. Because it is so cold it requires that special materials and unique structural features be used in the vessels and shoreside tanks used to transport and store it. To reduce evaporation losses, these structures are made usually large. Many of these new designs have not been adequately tested.

If LNG is spilled on the surface of the water or on land, it will vaporize very quickly forming a cold cloud of vapor which hugs the ground very much like a fog bank. Mixing of this vapor with air produces a combustible mixture which can easily be ignited. The ensuring combustion would be very rapid and would give off intense heat radiation. If such spills were to occur near heavily populated areas, the potential damage to life and property could be enormous.

Let me outline the fire hazards associated with a substantial LNG spill. For example, suppose an LNG supertanker should collide with another vessel in a channel in a harbor. Within a few minutes the entire contents of a single hold of the supertanker, amounting to 10,000 tons of LNG, would discharge onto the surface of water and evaporate to form a low lying, pancake shaped cloud of LNG vapor. This cloud would be about a mile in diameter. The cloud would slowly drift downwind, mixing with surrounding air in the process and forming an ignitable mixture. At a distance between ½ mile and 6 miles from the point of the spill (depending upon atmospheric conditions) the vapor cloud would be more susceptible to ignition by a spark or flame. Almost the whole cloud would burn if ignited at this point. Naturally, since it would be at ground level it would set on fire all combustible materials within several square miles. If the cloud were not ignited at this point, but were to drift further downwind it would not cease to be inflammable in some portion until it had travelled a distance of 5 miles to 50 miles, the exact value depending upon atmospheric conditions. There is no doubt that a spill of this size in the inner harbor of a major port could result in a catastrophic fire in the surrounding land areas.

Some claim that a spill resulting from a ship collision would most certainly catch fire at the source. Even if this were to happen, the resulting fire would cause radiant heat damage to all persons exposed within a distance of 3½ miles from the location of the spill.

It has even been suggested that the vapor cloud from a spill on water should be ignited before it has a chance to drift ashore where a resulting fire might damage both people and property. If this were done, by accident or on purpose, a giant fireball would form rising a mile into the sky and causing radiant heat burns to people at a distance of up to 6 miles from the source of ignition.

There is a design feature of LNG supercarriers that make it more likely that a large volume of LNG would be spilled in a ship collision than if a tanker were carrying oil. In very large crude oil carriers the vessel is subdivided by both transverse and longitudinal bulkheads typically providing 15 separate tanks to hold cargo. Most LNG supertankers, however, have only 4 or 5 cargo holds. A collision piercing one of them would discharge a higher percentage of the vessels total cargo than would be the case for an ordinary oil carrier.

It has been claimed by the importers of LNG that the collision of an LNG supertanker with another vessel in a harbor will be impossible since the U.S. Coast Guard will prevent movement of all other vessels in the harbor when the LNG supercarrier enters it. Given the pressure for a quick turn-around of the LNG tanker, and the inadequacies of communication and ship traffic control in U.S. harbors, the possibility of a mistake leading to a disastrous collision cannot be excluded.

To reduce evaporation losses and costs of construction, landside storage tanks are constructed on a giant scale. The most recently built tanks are nearly a million barrels in volume, which is the amount of the entire cargo of an LNG supercarrier. Since the rule of thumb for designing shoreside terminal is that the storage capacity should equal twice that of the largest vessel using the facility, a typical modern LNG port facility requires approximately 2 million barrels of storage capacity.

If an LNG storage tank should fail the entire contents would be disgorged onto the ground. If the tank is surrounded by an earthern dike the evaporation rate would be less than if an equal size spill occurred on water. Nevertheless, very large vapor clouds can be formed from such spills and would present the same type of fire hazard previously described for water spills.

Most tanks are said to be designed to withstand natural hazards such as hurricanes and earthquakes but few could not be disastrously damaged by man-made hazards such as an aircraft collision or sabotage. Given the possibly catastrophic consequences of a tank failure, whatever the cause, it would seem wise not to site such facilities near heavily populated areas.

It is clear from the foregoing that there is a serious national safety problem associated with the growing importation of LNG into the United States.

The standards of design, construction and operation of LNG storage facilities have in the past been enforced only by local or state officials whose experience in such matters is extremely limited. The federal responsibility for protecting public safety from the hazards I have described is divided among the Federal Power Commission, the Office of Pipeline Safety, the U.S. Coast Guard and the U.S. Maritime Commission. There does not exist a clear overall mandate such as the Environmental Protection Agency possesses in the environmental area.

While I am not able to suggest specific federal legislation covering the siting of LNG importation facilities, I would recommend that the final approval of a suggested site should not remain with those agencies, such as the Federal Power Commission, whose mandate is to promote the economic interests of the gas industry. Because local and state officials bear the responsibility of coping with the disastrous consequences of an LNG accident, an affected state should have the right to veto a proposed site, as is presently the case for deep water port facilities.

I am not opposed to the importation and distribution of LNG. It is a clean fuel and a necessary fuel, especially in view of our national energy shortage. However, the siting of unloading and storage facilities near the heavily populated areas of our major harbors constitutes a major safety hazard for millions of urban Americans. The necessity to supply energy which we all need must not be used as an excuse to endanger the lives and property of some who happen to live or work near waterfront areas.

I believe it should be possible to locate sites along our coast where modern and safe LNG facilities could be built yet which would not threaten any significant number of people with the disastrous consequences I have previously described. It may be that these facilities would be somewhat more expensive than those that have already been built in the heart of our major ports, but if so it would be a worthwhile investment in protecting the public from the fire hazards of LNG.

[The following information was subsequently received for the record:]

EL PASO CO.,
Houston, Tex., April 21, 1976.

Hon. HENRY M. JACKSON,
Hon. WARREN G. MAGNUSON,
Chairmen, Committees on Commerce and Interior and Insular Affairs, U.S. Senate, Washington, D.C.

DEAR MESSRS. CHAIRMEN: During the hearings on the transportation of Alaskan natural gas before the Senate Committees on Commerce and Interior and Insular Affairs held on Thursday, March 25, 1976, statements were made by Dr. James Fay regarding safety of LNG transportation and storage largely unsupported by evidence and made without reference to any probability of occurrence.

During my appearance before this Committee on March 24, I discussed the advantages of our Trans-Alaska Gas Project and referred to the matter of LNG safety. The subject of LNG safety was also covered in the statements of Mr. James T. Curtis of the Department of Transportation during his appearance on February 17.

In view of some of the conflicting statements given before this Committee on this issue I thought it would be helpful to bring to its attention a recent publication regarding LNG prepared by a disinterested party—the U.S. Coast Guard. The publication, dated February 1, 1976, is entitled "Liquefied Natural Gas—Views and Practices, Policies and Safety." It was prepared to present the current U.S. Coast Guard views on practices and policies for the transportation by water of liquefied natural gas. The publication contains five sections and two appendices and among the subjects covered are the hazards of LNG. Although the publication, which I have enclosed for the convenience of the Committee, speaks for itself, I believe the summary of the portion of the study dealing with LNG hazards bears repeating:

"There must be no doubt that LNG is a hazardous commodity, although not the most dangerous being shipped today. It is precisely because of the danger of this cargo that first the Coast Guard, and then others, have studied this material. From these studies, some of which are ongoing, the Coast Guard believes that the nature of the cargo, LNG, does not present an unacceptable risk in its transportation in maritime commerce."

Respectfully submitted,

HOWARD BOYD,
Chairman of the Board.

Senator STEVENSON. The next witness is an old friend and I am especially pleased to welcome him here today: Marvin Lieberman, chairman of the Illinois Commerce Commission.

STATEMENT OF MARVIN LIEBERMAN, CHAIRMAN, ILLINOIS COMMERCE COMMISSION

Mr. LIEBERMAN. Thank you very much, Mr. Chairman, for the opportunity to be here.

The Illinois Commerce Commission is the State agency charged with regulating public utilities, including natural gas distribution companies in Illinois.

I will summarize my prepared remarks and try to be brief.

I do want to emphasize that the views I express as to the route are those of our Governor, Dan Walker. But the views on the other issues the committee wanted some information on, the full cost-of-service all-events tariffs, the workability of displacement proposals, the apportionment of Alaskan gas, are my views as a member of an independent regulatory body, not necessarily the views of any of my fellow commissioners or the Governor.

The Governor supports the trans-Canada route basically because he is thoroughly convinced it will better serve the lower 48 States. The transportation of natural gas is the most efficient mode of movement of that product, and I know this committee has probably heard yesterday various estimates about the efficiencies of the proposed delivery systems. The latest figures that I have are that the trans-Canada route would be about 6 percent more efficient than the El Paso route.

I would just like to point out that although this doesn't sound like much in terms of a percentage, on a yearly basis that would heat 301,000 average single-family residences in the State of Illinois. So the efficiency of routes is a very prime consideration, I think, in this committee's deliberations.

Dr. Cicchetti, in 1972, wrote a book about the Alaskan pipeline, and the hazards of the transportation of LNG. I will not get into that now.

I mention the book in my statement, and I would recommend to the committee. I think he goes into some of the items Mr. Fay has just mentioned. There are proglems with either route. I think the Governor of Alaska has suggested that because of some of the territorial claims of the natives, that there might be—there would be a delay in the construction of the Arctic Gas route. The El Paso route has similar uncertainties, since the coastal zoning board must approve the facilities on the coast of California.

I don't know that that agency is noted for any speed in reaching a conclusion on matters of such importance, either.

So, in summary—and I realize this is quite brief, and I will respond to any questions. Governor Walker feels that the trans-Canada route better serves the public interst of the country.

Moving on to the full cost-of-service all-events tariff, it is my opinion that that tariff is unwise, unnecessary, and not in the public interest. And tht particularly applies to the El Paso tariff, the differences having been described by Charles. These tariffs would impose all of the risk of this project upon the rate payers. The imposition is justified by some as necessary to raise the capital needed to complete the project.

It strikes me as an anomaly in a private enterprise system for the financial community to suggest to attract private capital, the venture must be totally risk-free for the investor, while the consumer most totally bear the risk of cost overruns, interruption of service, or failure to complete the project.

Capital investments of this nature have always been attended by some degree of risk. Removing all risk is not, in my opinion, a prerequisite to attract the necessary capital. If it proves to be, then it seems to me the appropriate means is to go to some type of Federal guarantee and not shift the entire burden onto the consumers of the natural gas.

There are very many problems in doing that: pricing, et cetera. But part of the reason for bringing the gas to the lower 48 is to solve a national problem. So there is a national interest that can be addressed by Washington, if private capital isn't available to complete the project.

I would doubt that the gas distribution companies in Illinois selling at retail would even submit a proposal to our Commission to approve an all events tariff, particularly the El Paso-type tariff, and even the Arctic gas tariff. I believe this to be true, even though our Commission has been very liberal in allowing companies under its jurisdiction to participate and expend great sums of money in exploration advance payment programs, SNG project storage, et cetera. But we have specifically rejected tariffs that would have allowed those costs to be automatically flowed through to the rate payer. The company had to assume some of the risk. We have never rejected putting any of those projects into a rate base at the appropriate time, I might add. But we did not provide for automatic passthrough.

It seems to me that management, in its decisionmaking functions, must assume some responsibility for incorrect and imprudent decisions; that this responsibility exists makes for better management, to the extent it is removed, the quality of management declines. I think the all-events tariffs is analagous to an unrestrained taxing power, and that should not reside in a nongovernmental body, answerable only to shareholders who assume none of the risk.

Now, I recognize the difference between the two proposed tariffs. I think that if the tariff could be worked out with some reasonable risk, say a 30- to 60-day interruption would be assumed by the rate payer, or the consumer; that would be acceptable. Beyond that, I would think the engineering capability of this country should be such to reduce interruptions of a longer period of time to a minimal chance, and therefore, that type of risk should be assumed by the transportation company.

In the apportionment of the Alaskan gas, I would suggest—I know this is probably unacceptable to most of the participants in this heaving—that the pipeline, the transportation company, become the sole buyer. I think that would eliminate a great deal of the problems that were seen in the advance payment program in the Prudhoe Bay area. That advance payment program was recently terminated by the FPC I believe, because of the difference in the bargaining power or the fact that there is no bargaining power on one side. I think it is fair to say there was some overreaching in the negotiations for that Prudhoe Bay gas.

I hope some mechanism would be worked out where the bargaining power would be leveled out so that the rate payers would not bear too great a cost: in bringing gas from that area to the lower 48.

I think Congress must be careful not to get into a situation where it is allocating gas. There are areas of the country that are adding —with all deference to my fellow Commissioner from California—I would like to say they are adding load across the residential, commercial, and industrial sector.

I have a chart that shows their gas pattern in California and their public service commission just issued a 10-year forecast. They are adding load in the face of a projected decline in supply. Now, that implies to me that they are hoping for some type of national allocation program to bail them out. I think that would be unwise. It would punish the states that have taken self-help measures, such as Illinois. We spent a lot of money on these self-help projects and the rate payers are paying for them. Perhaps apportionment on the basis of end use, and on the curtailments that have occurred since the shortages have set in might work. I might add there are shortages. For the first time, yesterday in Illinois, the Commission issued an order curtailing firm customers in the southeastern part of the State, and curtailing some customers up to 40 percent of their supply because of the lack of pipeline deliveries. It is a serious problem. And I think the allocation is an important consideration of this whole project.

The displacement problems, I think that can be worked out. There are more problems, obviously, with the El Paso situation than there are with the Arctic gas. But I would think that displacements, if the price mechanism worked, and I recognize the problems that Dr. Cicchetti mentioned, but I think that if those could be worked out, displacements will not pose that big a problem.

I would hope the project would move as quickly as possible.

[The statement follows:]

STATEMENT OF MARVIN LIEBERMAN, CHAIRMAN, ILLINOIS COMMERCE COMMISSION

My name is Marvin Lieberman. I am Chairman of the Illinois Commerce Commission which is the State agency in Illinois charged with the responsibility of regulating public utilities including natural gas distribution companies.

I wish to thank the Committees for giving the State of Illinois and myself the opportunity to present our views on the legislative proposals to facilitate the construction of an Alaskan natural gas transportation system.

As to which route would be the most desirable means of transporting the natural gas to markets, I will be expressing the views of Governor Dan Walker; however, on subjects such as full cost-of-service all-events tariffs, the workability of displacement proposals, and apportionment of Alaskan gas, I will be expressing my own views as Chairman of an independent quasi-judicial commission and not necessarily the views of any of my fellow Commissioners or the Governor.

ROUTE OF TRANSPORTATION SYSTEM

Governor Walker supports the trans-Canada route as it will better serve the entire lower 48 states. In addition and of extreme importance, this proposed route will maximize the available gas to ultimate customers. Transportation of natural gas by pipeline is the most efficient method of delivery. It is estimated that 7% of the gas in the Arctic gas pipeline project will be used to fuel turbine compressors. To transport the gas in the El Paso LNG project, 13.3% of the gas will be used for transmission, liquefaction and shipping.

This difference of 6.3% is quite significant.

The El Paso project envisions the movement of up to 3.5 billion cubic feet per day of Prudhoe Bay gas. This appears to be somewhat optimistic and 2.25 Bcf seems more realistic. Using this latter figure, a savings of 6.3% amounts to approximately 51.1 billion cubic feet per year. This is enough natural gas to heat 301,000 average size single family residences in the State of Illinois.

Dr. Charles J. Cicchetti in a book published in 1972, Alaskan Oil: Alternative Routes and Markets, points out the hazards of tanker traffic in the shipping of oil between Alaska and California. Those problems are multiplied significantly when the transportation of LNG is undertaken. A substantial spill of LNG could have catastrophic results. In addition, the reliability of the El Paso supply route is subjected to the uncertainties inherent in the collective bargainning process between the carriers and the longshoremen and other affected unions.

Naturally there are problems with any route. The governor of Alaska has suggested that the natives of the Yukon and Northwest territory may impede the construction schedule of the Arctic gas pipeline because of their claims to land. The El Paso LNG project is subject to similar uncertainties since the California Coastal Zoning Board must approve of LNG docking and expansion facilities along the coast of California near Point Conception.

In summary, Governor Walker feels the trans-Canada route better serves the public interest of this country.

FULL COST-OF-SERVICE ALL-EVENTS TARIFFS

It is my opinion that full cost-of-service all-events tariffs are unwise, unnecessary and not in the public interest.

These tariffs would impose all risks of this project upon the ratepayers. This imposition is justified by some as necessary in order to raise the tremendous amount of capital needed to finance this project. It strikes me as an anomaly in a private enterprise system, for the financial community to suggest that to attract private capital the venture must be totally risk free for the investor while the consumer must totally bear the risks of cost overruns, interruption of service or failure to complete the project.

Capital investments of this nature have always been attended by some degree of risk. Removing all risks is not, in my opinion, a prerequisite to attract the necessary capital. If the risk is totally unacceptable to private investors, then the risk should be assumed by the federal government through some form of loan guarantee program and not by natural gas customers.

Although I have not surveyed the gas distribution companies in Illinois, I doubt that they would even submit a proposal for a full cost-of-service all-events tariff to the Commission for approval. I believe this to be true even though the Illinois Commission has been receptive to allowing companies under its jurisdiction to participate in exploration advance payment programs and SNG projects; but the Commission has specifically rejected tariffs that would have allowed the automatic recovery of these expenses through the purchased gas adjustment clause.

Management, in its appropriate decision making function, must assume some responsibility for incorrect and imprudent decisions. That this responsibility exists makes for better management; to the extent that it is removed, the quality of management suffers.

The full cost-of-service all-events tariff is analogous to an unrestrained taxing power and that power should not reside in a non-governmental body answerable only to its shareholders who assume none of the risk.

WORKABILITY OF DISPLACEMENT PROPOSALS

Displacement problems are most acute if the El Paso LNG project is selected; however, considering the vast network of pipelines in the United

States and the fact that many are operating under curtailment, it is reasonable to assume that displacement does not pose a serious problem. The present plans for the trans-Canada route minimizes the need for displacement, and therefore the problems, since it provides for pipelines to both California and the Midwest. To the extent that there are problems, there will be sufficient lead time to find solutions.

APPORTIONMENT OF ALASKAN GAS

This is a critical area and one in which there are serious difficulties to overcome. These problems can be minimized if the pipeline company was designated as the sole purchaser of the gas from the producers. This would eliminate some of the problems which arose during the bidding for Prudhoe Bay gas prior to the termination of the advance payment program by the F.P.C.

The distribution of the gas in the lower 48 states could be based on company contracted commitments prior to shortages. The concern should be with protecting the requirements of existing customers since new customers may have the ability to use alternate fuels.

This method indirectly reflects the influence of population and heating degree days and it will also give due recognition to distribution companies which anticipated the shortage of natural gas, planned ahead and provided additional storage capacity, engaged in exploration, constructed SNG facilities and took other self-help measures.

In most cases, the ratepayers in the various states are paying for these self-help measures. Any allocation or apportionment of Alaskan gas must not penalize the states that took constructive steps to alleviate the effects of natural gas shortages within their borders.

Finally, I would urge that the federal government refrain from allocating gas based solely on need without end use consideration. At least one state, and it is not Illinois, is adding load across its residential, commercial and industrial sectors.

At the same time, the future supply curve is predicted to go in the opposite direction.

I can only conclude that that state is betting on a future national allocation program, directed from Washington, to rescue it from the problems its present policy is leading toward.

An apportionment or allocation program should not be used for this purpose and I would suggest that Congress would rue the day that it decided to undertake this type of allocation program.

Thank you for the opportunity to be present today.

Senator BUMPERS. Our next witness I am especially pleased to welcome, because among other marks of his greatness he was elected Governor of his State at the same time I was elected Governor of mine.

Patrick Lucey is one of the ablest chief executives in the country, the Governor of the great State of Wisconsin, and I am very pleased to have him here.

I am advised this is supposed to be a panel. But you are on first, so fire away.

STATEMENT OF HON. PATRICK J. LUCEY, GOVERNOR, STATE OF WISCONSIN; ACCOMPANIED BY CHARLES CICCHETTI, DIRECTOR, WISCONSIN ENERGY OFFICE

Governor LUCEY. Thank you, Mr. Chairman and members of the committee.

I am delighted to have this opportunity to come and appear before you. I certainly don't come as an expert, but I do have an expert with me whom I will introduce in a moment.

But the question of natural gas, price and supply, is one that is certainly not taken lightly in Wisconsin. The State's prospects for economic growth depends to a large extent on the allocation and the transportation of this country's natural gas reserves.

As Wisconsin Governor, I very much appreciate this opportunity to express our judgment about the best choice for the country in this critical decision. As I mentioned, Dr. Charles Cicchetti is with me, he is the director of the Wisconsin Energy Office. He's an economist and has become a very thorough student of the whole question of the transportation of Alaskan energy resources to the lower 48.

During the controversy over the Alaskan oil pipeline he established himself as an expert in energy transporation and he has done a detailed analysis of the Alaskan natural gas proposals that I am sure you will find helpful.

After this brief statement, we will both be available for your questions. I am sure all of us read with interest a week ago the news story about the American Petroleum Institute report that for the first time in history, in a 1-week period, this country imported more petroleum products than it produced.

The news tended to overshadow a report of the same day by the FEA which in my judgment is of no less significance than the disturbing announcement by the petroleum institute.

According to news accounts, the Federal Energy Administration conceded that the crude oil pipeline now under construction will bring Alaskan oil to the one place which needs it least, California. Unless a natural gas line can be converted to move the oil to the Midwest and to the East, or unless a new transportation system can be devised, the FEA said much Alaska's oil may have to be left in the ground or sold abroad.

For years, many people opposed the Alaskan route, not just because California was virtually self-sufficient in energy and would not need Alaskan oil; the Midwest and East would. Now that the Federal Government finally has recognized the miscalculation, the pipeline is almost half built. It is too late to do anything about it.

Mr. Chairman, we must not make that same mistake with Alaskan natural gas. Let us decide now to bring the gas where it is needed most. And let the Congress—not the FPC, the FEA, or the Interior Department—make that decision.

The industrial and agricultural center of this country needs a steady supply of energy for economic recovery and development. Wisconsin and other Midwest States have begun to adjust to higher energy prices. We have begun to realize the importance of energy conservation. Yet even though economic recovery has started, most of us still are alarmed about the prospect of inadequate natural gas supplies in the future.

We know it is naive to think each year will be warmer than the last. We know steps must be taken today to guarantee our energy security tomorrow.

In 1981, just 5 years from now, Wisconsin's natural gas need could exceed its supply by 40 percent or more. Even under a "best case" estimate—an estimate which assumes expansion of Texas offshore gas and a new major coal gasification project and which, optimistically, excludes any growth in demand—Wisconsin will have a 10-percent gas shortfall in 1981 if Arctic Gas is not available.

To meet clean air standards—and Wisconsin has been a natural leader in this regard—many industries have turned away from oil and coal to natural gas. For such customers, a certain supply of Arctic Gas is the only way to meet an inelastic demand and still maintain environmental quality.

Wisconsin is not prepared to turn its back on the environmental progress of the last decade, and natural gas is an indispensable part of that progress.

Wisconsin's desperate need for natural gas is not unique. In fact, our sense of urgency is less than that of other States. Without Alaskan gas, the economic stability of many States will be threatened unless they are willing and able to switch to ever more expensive and uncertain oil imports. Alaskan gas will be expensive. But facing the 1980's without it will be far more costly.

By 1978, when Alaskan gas first is available, the price of OPEC oil, adjusting only for modest inflation, may be at $15 a barrel—perhaps even more if the market will bear it. There are hidden costs as well. It would be necessary, for example, to pay an additional charge for oil storage and acquisition as insurance against embargoes.

Just adjusting the cost of imported oil for inflation and storage and insurance costs probably would mean that even at $4 per 1,000 cubic feet—almost double today's price—Alaskan natural gas will be far preferable to greater imports.

But the cost of Alaskan gas is not the only consideration, nor even the most important. The future of Candian gas sales to the United States must also be considered. Today, those imports fill about 30 percent of Wisconsin's gas needs.

When the decision on the Alaskan crude oil pipeline was being made, we argued that it would be a mistake not to involve the Canadians because a unilateral decision could mean a loss of Canadian crude imports. As with so many other aspects in the pipeline question, the potential loss of Canadian crude was ignored.

The Midwest already is experiencing the regrettable impact of that oversight as Canada continues to curtail its crude oil exports to the Midwest.

If we once again ignore Canada's interest—this time in selecting a natural gasline route—we can expect a similar loss of Canadian gas exports. Whether this country rejects Arctic Gas development altogether and imports even more crude oil, or whether it selects the wrong route for the natural gas, we all will pay a heavy price.

We cannot afford to be wrong again.

In the oil pipeline controversy, there was a choice between an all-land transportation route through Alaska, or through Canada, and the pipeline-tanker system ultimately selected. The choice is much the same in the natural gas controversy—and the significance of the decision for this country will be just as great.

For environmental, security, economicp and energy conservation reasons, the all-Alaskan route should be rejected. When a careful accounting is made, the all-land system makes the most sense for this country and Canada.

Selecting the wrong route from Alaska—the all-Alaska route—will involve substantial costs. The gas would have to be moved through a complicated, expensive, and wasteful process—including pipeline transport, liquefication, tanker transport, and regasification—to bring gas to the Midwest and east coast markets which for now and the foreseeable future will need it.

The all-land pipeline routes under consideration also would avoid the additional administrative and capital costs of displacement, and every region of the country and Canada would have access to Alaskan gas. The temptation to export our Alaskan energy resources foolishly would be avoided. The gas would be available where it is needed at the lowest possible cost, least environmental damage, and greatest efficiency.

Congress is in the best position to weigh the evidence and bring this issue to a quick resolution. The cost of a delayed decision has been estimated at $1 million a day, a cost that ultimately will be paid by the American consumer.

The questions of financing and tariff guarantees are troublesome. But they can be solved, perhaps by having the government assume responsibility for some of the financial risks involved. However, we should remember that if some risk is assumed by taxpayers, it is highly questionable whether consumers should be asked to pay the higher rates associated with equity finance, rates which are as much as 60 percent higher.

I hope the Congress will reject the all-Alaskan route proposal and instead make a final choice between the Mackenzie Valley route or a route which first transverses Alaska to Fairbanks and then follows the Alcan Highway. Either pipeline route would bring the gas to the States which need it. Either has substantial environmental benefits.

The Alcan has a slight environmental advantage over the Arctic Gas pipeline while the Arctic Gas primary route down the Mackenzie has the added benefit of picking up Canadian gas.

Wisconsin could support either choice, but it could not support any other proposal—not in its own self-interest, not in this country's self-interest.

Senator BUMPERS. Governor Lucey, thank you very much.

I think you have dramatized a point that has been talked about here some, but really hasn't had the impact it should, and that is the Canada route brings the gas to where it is going to be needed and the other process, of course, means a conversion, plus the tanker fleet that is going to be required, with the possible environmental problems with those accidents at sea, plus the fact that California is self-sufficient, and either this gas or the gas it replaces is still going to have to be transported to the same places and the cost of that transportation over a period of 20 to 30 years—I don't think that has been calculated by any of the witnesses who appeared before this committee.

Senator MONDALE. Gas Act in particular estimates $500 or $600 million a year.

Senator BUMPERS. to transport it inland? I had not heard that figure.

I just have one other brief question, Governor.

Are you familiar with the all-events tariff proposal?

Governor LUCEY. The all-events——

Senator BUMPERS. All-events tariff proposal.

Governor LUCEY. I am afraid I am not.

Senator BUMPERS. I wouldn't want to pursue it with you.

Governor LUCEY. I think Charles can respond to that.

Senator BUMPERS. We will wait until the other panel members testify and we can come back to that.

Senator Stevenson.

Senator STEVENSON. First of all, I want to join with you, Mr. Chairman, in welcoming our friend Governor Lucey to this committee.

I was going to ask the same question about the response of Wisconsin to a full cost of service all events tariff. But I can wait too. It raises serious financing questions.

Governor LUCEY. Let Charles answer that.

Mr. CICCHETTI. I think what has to be kept in mind in considering the all events full cost of service tariff is the distinction between the Arctic Gas proposal and El Paso proposal, because they are not the same thing, although they both have ingredients that are the same.

There are two fundamental differences between them which although technical led me to at least believe that the Arctic Gas proposal is acceptable, where the El Paso proposal would not be.

One difference is that the Arctic Gas proposal would not go into effect unless the gas was flowing. The El Paso proposal as I understand it would include the events that gas never was delivered out of the North Slope of Alaska, and the costs that were expended would be expected to be paid by those consumers who might have received the gas.

So there is no risk, or virtually no risk at all in the El Paso proposal, whereas the Arctic Gas Co. retains risk, because if the gas is never produced, the all events tariff doesn't go into effect. And that is a very important difference.

A second difference is that we are told that displacement really will take care of the midwest and east coast gas consumers. That is if El Paso is built, the gas will ultimately be moved eastward where it is truly needed.

I can't conceive of how State regulatory commissions would handle the job of an all-events tariff in the El Paso proposal on the displacements. Who would pay for the gas if it was never delivered, but a displacement agreement had been made? Those customers who were actually receiving west coast gas, or the west coast customers who were supposed to receive the Alaskan gas?

An earthquake could interrupt the flow of the gas on El Paso. We can't lose sight of the fact that the Interior Department anslysis of earthquake danger to the oil line, in fact they expect one major earthquake that will disrupt the flow of oil during the next 20 years. If that same disruption occurred on natural gas, who would pay the all events tariff? States like Wisconsin, that we would be receiving gas from the west coast, or from gulf States instead of having it flow the west coast, or west coast gas consumers who were actually interrupted. I don't see how that kind of difficulty could ever be resolved.

For those two reasons I think we can accept the all-events full cost of service tariff that Arctic Gas has proposed, but I don't see how anyone can accept the El Paso proposal because of those differences.

Senator STEVENSON. That is a very important statement, because without State acceptance it becomes very difficult for us to see how the pipeline will be financed.

Just one question for you, Governor. The Congress obviously cannot mandate the trans-Canada route. It is a Canadian decision. So we have another proposal which is designed to lead to the right route and that may very well be a trans-Canada route, but this other proposal says instead of mandating something we can't mandate, we will establish a procedure which, in harmony with the Canadian agencies, will lead to the most economical system for the transportation of natural gas to the users who need it most.

It is a procedural response, and neutral, but presumably if the merits do, as you suggest, weigh heavily in favor of the trans-Canada route, it would lead to a trans-Canada route. It is a procedure that is intended to be synchronized with the Canadian procedures, so that neither has to go first at the risk of being embarrassed by the other. Neither would run the risk of being perceived as putting pressure on the other, with possible adverse reactions.

By suggesting that you are in favor of the Trans-Canada Arctic Gas project, are you also saying that you would be opposed to such a procedural response to this problem?

Governor LUCEY. Well, I recognize that we are getting involved here in international relations and I suppose that there is some limit as to how much the Congress can go in mandating the trans-Canada route. But I would certainly hope that the Congress would go as far as it can and I think really the Congress was somewhat hoodwinked by the Nixon administration concerning the crude oil pipeline, because the Canadian position, the information about the Canadian position was withheld from Congress until after the vote.

Senator STEVENSON. Well, if he were here—again I find myself in the position of speaking for Senator Stevens—he would respond quickly that on our visit to Ottawa last week we were told that if Congress had mandated the trans-Canada route for the pipeline there would still be no pipeline under construction.

I heard them say that, and behind these decisions there are not only procedures to comply with, but national sensitivities, such as Canada's native claim problems. All of these problems have to be resolved in varying degrees before we can make the decision here.

Governor LUCEY. Were they suggesting that affirmative action by the Congress would have a negative effect on them, or simply that Congress mandating alone wouldn't do the job?

Senator STEVENSON. I don't want to put words in the mouths of Canadian officials, and I don't think they were saying that exactly. But you do come away with the feeling that if the United States or the Congress mandates the Canadian route, there is a danger that, due to nationalist tendencies in Canada, the Government would be harder put to accept such a route as opposed to its own so-called Foothills, or Maple Leaf all-Canadian route for the transportation of natural gas south from the Mackenzie Delta.

So the feeling on the part of some, I think on both sides, is that prudence dictates a harmonious synchronized process, cooperation on both sides, that could simultaneously lead to the right conclusion, which I hope will bring natural gas to the Middle West.

I represent a State that also faces serious natural gas shortages. It may be the best way to get to your conclusion.

Senator BUMPERS. Senator Mondale.

Senator MONDALE. Governor, thank you very much for an excellent statement. I think it states the problems of our region very ably and well.

Yesterday, the Gas Arctic witnesses testified that the Alcan Highway proposal would cost approximately $3 billion more than the Gas Arctic proposal. And that it would be economically impossible for that consortium to proceed, if that were mandated.

Secondly, I think there is a good possibility that the Alcan proposal offers nothing to the Canadians that would justify their approval of the line, since it would go through an area far distant from their potential gas reserves in the delta.

If those things were true, and I believe them to be true, namely that the Alcan Highway may be economically unfeasible, or unattractive to the Canadians, would you then be more likely to support the Gas Arctic proposal as the only option?

Governor LUCEY. Yes, as I stated in the formal statement, we are not taking a position in favor of one or the other. We think there are arguments for the Alcan and for the Arctic route both, and certainly if the points that you make are valid, I think that would make a very strong argument for the Mackenzie route.

Senator MONDALE. Thank you very much.

Senator BUMPERS. Senator McClure.

Senator McCLURE. I think the statement made by Senator Stevenson about the Canadian reaction, that if the Congress had authorized the last Canadian pipeline route, we still would not have a pipeline under construction, is probably correct, although I am not certain we can really say what the course of events would have been if we had taken the other course and our government's full weight and full effort for negotiation with Canada had been marshaled in an attempt to get the other route.

I don't say that from the standpoint that I want to be understood as favoring the one or the other routes, to get back to the argument of which route should be selected, but simply to underscore the difficulty of certainty when dealing with a foreign government that has its own desire, its own priorities.

I assume that the Canadian Government is less interested in the Fairbanks route and the Alcan Highway route than its Mackenzie route, because they have the possibility of picking up Canadian gas in the Mackenzie Delta, and serve the northern Provinces with that route, rather than the Alcan Highway route.

It has greater advantages to them. I would assume that they would hold out for the route that has the greatest promise for them.

Have you had any discussions with Canadian officials; do you have any insight as to what their attitudes might be?

Governor LUCEY. No, I really can't say that we have. We turned over that responsibility to the central government 200 years ago.

Senator MCCLURE. Whether you turned it over to them or not, I don't think we should leave that out. The reason I ask the question is simply this: that almost 3 years ago now, I wrote to Senator Jackson suggesting that in our discussions of energy, which the Congress was just then getting started on, that one of the essential elements of that discussion had to be some understanding with the Canadian Government and suggested that the Congress of the United States, in a rather formal way, sit down with officials of the Canadian Government and determine what they are willing to do and what they are not willing to do.

To this date, that has not happened, although periodically I have renewed my question to Senator Jackson, because I think it is important.

We are somewhat now in the same position that we were then with regard to the oil pipeline.

What alternatives do we have? I don't even know, and I don't know anyone else who knows that if the pipeline is built, that might possibly tap some northern Canadian gas and transport it south, that there is any assurance that any of that gas would be committed to the American market.

Governor LUCEY. We have a feeling it probably won't guarantee any increase, but we also have the feeling if that reserve became available to Canada, that we would have a little better chance of getting the allotments we have now.

Dr. CICCHETTI. This has come up before, Senator, and I think it has been phrased in the language of possibilities and probabilities. Unless the Canadians made a recent change I am not aware of, in terms of their export policies, Canadian exports are a function of their proved reserves and they only count something as a proved reserve if there is a system that makes that reserve potentially available to Canadian gas or oil customers. So, this matter of what will happen to exports, current exports to the Midwest, in terms of natural gas, is known. If the Canadian gas that is now a reserve, but not in the proved reserve formula, unless it is connected into a pipeline system, then this formula itself will say that exports will drop, rather than have it be just a possibility that they might continue.

They could certainly change the formula, but at least right now the National Energy Board has such a formula.

Senator MCCLURE. I recognize that this is correct. But I also recognize that that is subject to change, according to their own perceptions of their own national interest, as indeed I think they ought to adopt a policy in accordance with their own national interest. I am a little puzzled, because you mentioned something about the earthquake hazards. I think there are earthquake hazards associated with each of the routes. If I recall the ranking of the all-Canada route, the Mackenzie Delta route would have the lowest earthquake possibility, but not without one.

The Fairbanks and Alcan Highway route would be the next in order and the all-Alaska route would be the highest earthquake risk. Is that not correct?

Dr. CICCHETTI. That is correct, but the order of magnitude of difference really make ordinal ranging quite deceptive.

In the testimony that I filed with the committee, I have prepared a critique of the Interior Department's analysis of the various routes. That analysis of Arctic gas is much less inclined to point out the earthquake hazards than Interior Department pointed out just 3 years ago in their analysis of several volumes on the oil line.

So, the answer is, yes, ordinarily there is some risk of an earthquake, but there is a risk of an earthquake just about every place in the country, including Washington, D.C.

But, the main center of earthquake activity, or seismic activity in North America is along the southern two-thirds of the El Paso route, and along the entire tanker route, including where the gasification facilities would be located in California.

There is so much more potential and so much greater damage, especially when you look at the California end of the system, that comparing the earthquakes as Interior did, and concluded one is highest, one is in the middle, and one is lowest, when they are so far apart, is to me, an incredible misleading statement on the part of Interior Department.

Senator MCCLURE. I wish you hadn't gotten into the California business, because some of us out West hope everything west of the San Andreas Fault goes off into the Pacific.

The people in California don't agree with that. But despite that fact, there was a very minimal disruption of gas service in California in connection with the last earthquake they had, which was a massive one. So, when you bring in the San Andreas fault and the earthquake activity along that fault, you weaken your argument greatly.

Dr. CICCHETTI. I think the vulnerability along the pipeline route of itself—we are talking about the southern two-thirds of Alaska now—the vulnerability of the location of the liquification facilties, the port facilities, and then still, I don't think people in California are confident all future earthquakes are necessarily known where they will be located. I think you will hear from California witnesses who, I suspect, will express concern about safety, particularly related to earthquakes.

Senator MCCLURE. That argument with regard to the earthquake zones in California is not very persuasive to me, but it may be to others. I am concerned about those earthquake zones in Alaska. I think that is a valid concern, primarily because the restoration of service may be more difficult than it is in California.

The other side of the Canadian availability picture is, if it is Canada's gas, there is a question of price as well as availability. I have many friends, and whatever comment I make now is not in opposition to those friends I have in Canada, but they are not without cause called "blue-eyed Arabs," because the price of Canadian energy is priced at the OPEC cartel level.

And if we have increased supplies of Canadian gas which do flow into the United States, it is going to be at the Btu equivalency of OPEC oil. I don't know how much of your natural gas supply——

Governor LUCEY. About 30 percent comes from Canada. Of course, it is at the unregulated rate. I would submit that to the extent that international prices of energy are at all subject to competition, it sems to me that the availability of North Slope Alaskan natural gas to the Midwest would put us in a stronger position to—a stronger competitive position in dealing with attempts by Canada to increase the price of Canadian gas.

Senator McClure. It hasn't been attempts; they have done it. Eighty percent of our gas in Idaho comes from Canada. We are effectively a deregulated market, and our consumers feel it.

Governor Lucey. Yes; 30 percent of ours is.

Senator McClure. There hasn't been any diminution of the price, as far as Canadian gas is concerned, as far as I can see. They are perfectly willing to keep it in the ground or sell it to us as Btu equivalency, and that is what they are going to do.

The recent election in Canada may have changed things a little, but I haven't seen a change in price. So I am not certain additional availability of Canadian gas is a possibility, although the availability of Alaskan gas, which is still regulated, or if, indeed, it is regulated, I anticipate it would be at a lower price.

I am a little concerned with one statement you made which follows to some degree a statement made by Mr. Zausner in his testimony, that we ought to get the gas down, because that gas has to be used to keep us from having to shift to alternative sources of energy.

You put it in terms of your concern about the environment in your State. I think we all recognize that natural gas is the environmentally preferable fuel. But we also have adopted as a national policy the attempt to get natural gas out from underneath utility boilers and industrial boilers.

Do I understand your statement to be that you want to keep as much gas under utility boilers and industrial boilers as you can, so that you avoid the difficulty of dealing with environmental problems associated with other fuels?

Governor Lucey. No, I think not. I think it ought to be on a selected basis. I think one of the worst uses of natural gas is to fuel a generator in a remote area, where other fuels are available.

On the other hand, I think that in heavily concentrated urban centers that we are probably justified in using natural gas, because of the environmental considerations. We also have some manufacturers in Wisconsin that produce material for the space industry, for example, where the impurities of other fuels distort the product in such a way that natural gas is about the only thing they can use.

Senator McClure. I recognize there are some industries who find it very difficult to convert for that reason. But I am very much concerned when we use either the environmental preferability or the price differential as a reason not to shift to alternate fuels.

Of course, that was one of the central debates over the recently enacted Energy Act, in which we maintained the price differential, which makes it much more difficult to get the shift, which I think most people have been seeking that is environmentally preferable as a matter of national policy.

You mentioned remote generating plants. The most remote plants are in clean air areas. The thrust that has been taken by the Public Works Committee and its clean air amendments that will be filed either tomorrow or early next week will take the position that it is just as important to keep the clean air areas clean as it is to clean up the dirty air areas.

And if we do that, you won't find that urban-remote differential that you suggest is an appropriate differential. That will again force a preference for natural gas, unless somebody avoids that preference, as we attempt to shift into coal, for instance, under utility boilers, put stack scrubbers on and all of the rest we do to try to clean up the results of burning coal.

Governor LUCEY. I think in Wisconsin we could make a very strong argument that our reliance on natural gas is not for the generation of electricty. We have, I think, about 30 percent reliance on nuclear and something in excess of 50 percent reliance on coal. And our reliance on natural gas is for peakload only and, as a matter of fact, our reliance on natural gas and petroleum combined are really a very minimal part of our total energy requirements for electric generation.

Senator MCCLURE. I shouldn't take that portion of your statement as being in any way an attempt to keep natural gas under industrial boilers, simply because it is a cleaner fuel?

Governor LUCEY. I guess that would be true; yes.

Senator MCCLURE. I don't mean to put words in your mouth, but I am disturbed when you see in the Government statement, Mr. Zausner's statement, a bias in favor of natural gas because it is cleaner, which we all know, but which I think from a long-term environmental standpoint is the worst of the possible uses of natural gas.

I don't think we want commercial, industrial natural gas usage where we can provide alternative fuels. I would hate to see us predicate our importation of Alaskan or Canadian gas simply because it is a clean fuel to displace the dirtier fuels in industrial use.

Thank you, Mr. Chairman. I have no further questions.

Senator STEVENSON [presiding]. Senator Stevens.

Senator STEVENS. I am sorry. I wasn't here, Governor, when you made your statement.

I have examined it. We have just been signing a fair campaign pledge on behalf of our two committees, both Republican and Democractic Campaign Committees. I would hasten to say that I think, as far as the position of the administration at the time of the oil pipeline amendment, in case you don't know it, the administration did not support that amendment in the Senate and did not support that amendment in the House. It supported it only after the bill was passed.

So, that fight was not an administration fight over the oil pipeline. There was no endorsement of that amendment by the Nixon administration.

But beyond that, let me ask you, and I want to be as respectful as I can, just suppose an Alaskan came down here and you were a Senator from Wisconsin, and we wanted to put a pipeline through some of your beautiful wilderness areas and your forests—I understand you have two wilderness areas, I can't pronounce it, Chequamegon at Park Falls, another at Nicolet; you have the ICH National Scientific Reserve, and the Apostle Islands National Lake Shore—suppose I insisted on putting a pipeline through those wilderness areas when there were other alternatives available. Would you permit us to do that?

Governor LUCEY. I don't think there is any question about it, we are obviously not going to install a trans-Canadian pipeline against the wishes of the Canadian people. I think that has to be something that is negotiated between the two countries.

Senator STEVENS. No, Governor, I am talking about our Arctic Wildlife Refuge. You are supporting a pipeline that goes through that refuge——

Governor LUCEY. Our position in my testimony was that we would support either land route, either one that uses Al-Can Highway, or the Mackenzie Delta.

Senator STEVENS. But you are supporting the Arctic pipeline.

Governor LUCEY. Yes.

Senator STEVENS. And that would go through our Arctic Wildlife Refuge.

Governor LUCEY. You are talking about the Alaskan portion of it?

Senator STEVENS. Yes. I really think that most people have not thought that that Arctic Wildlife Refuge was created at the direct request of the Fairbanks Women's Garden Club. They started it. And they asked that we set aside a portion of the Arctic to protect the flora and fauna of Alaska forever, and if anybody thinks you are going to include that refuge without a battle, I think you better reexamine your hole card.

Governor, I respect your points of view, I think you represent your people well, and I am sure that you are advocating what is in their best interest. On that basis, I welcome you to the committee.

Thank you, Mr. Chairman.

Senator STEVENSON. Thank you very much, Governor.

Mr. Cicchetti will be joined by Leonard Ross, Commissioner of the California Public Utilities; and Marvin Leiverman, Chairman of the Illinois Commerce Commission.

Gentlemen, I will ask you all to summarize your statements. I will enter the full statements in the record. I think we will go through the panel and then come back with questions after that.

Mr. Cicchetti, did you have anything more to add? I'm not sure you got through your full statement.

STATEMENTS OF LEONARD ROSS, COMMISSIONER, CALIFORNIA PUBLIC UTILITIES COMMISSION, SAN FRANCISCO, CALIF.; AND MARVIN LIEBERMAN, CHAIRMAN, ILLINOIS COMMERCE COMMISSION, SPRINGFIELD, ILL.

Dr. CICCHETTI. I can summarize my remarks briefly.

I have three points to make. I have supplied some backup material for the committee to review on two of those points.

The first is that I am convinced, having reviewed all of the material that was prepared by the Department of Interior in their draft report, that when one looks at it and starts making corrections and taking into account some of their inconsistencies, I am convinced there are a lot of reasons why from a national standpoint the all-land system is preferable to the El Paso proposal. Whether that be the all land-system to Fairbanks and then down the Alcan Highway, or whether it be the Mackenzie Valley proposal.

I have provided a copy of my critique of the Interior Department draft report for the committee to review and there are a lot of things I found wrong with it, found misleading about it, and that is made available.

The second thing I have done is to review the matter of tariff and financing. I have indicated already this morning why I believe the all events tariff as proposed by Arctic Gas is more likely to be acceptable to the states that would get the benefit of the gas than the El Paso proposal.

But there a couple of other finance reasons which I think also led me to prefer the Arctic Gas proposal. For one, it takes into account the experience that we have had on the oil route, that is, that costs might escalate. It has a built-in inflation factor in its cost estimates, it has built-in a 25 percent buffer in terms of its plan to raise money for potential cost over-runs above anticipated inflation.

And it seems to me since it is not trying to collect any money at all unless the gas flows, and with no date certain unless the gas starts to be delivered, a good deal of the risk of incompletion or delays will be borne by the stockholders of Arctic Gas, and therefore they have retained considerable risk, and that part of the proposal I particularly like.

The other point is a point with respect to financing, that the El Paso proposal I think has, as I understand it, has so effectively shifted risk away from El Paso, that I have strong doubts whether we should finance it, or Congress should allow it to be financed with equity financing.

Even if we are talking about 30 percent equity and 70 percent debt, if El Paso has to get a return of 20 percent on equity, then we are talking about capital costs which could be 50 or 60 percent greater than if we had an all debt financed project.

I don't generally favor all debt financed projects and I don't know we could ever finance something of this magnitude with all debt. But the serious question remains in my mind that if El Paso or any other pipeline gets rid of all risk, why are we paying a return to equity.

There are more details on the financing matter included in the prepared statement. I guess the Arctic Gas proposal is not without two major problems, however, with respect to financing that I think the committee and the Congress have to consider.

One of these is true also of El Paso, but the other one is unique to Arctic Gas.

First, the risk of how much gas might be in the ground or, indeed, whether there will be a sufficient market for the gas, under an all events tariff is passed on to the wholesale utility customers of Arctic Gas, and if state commissions approve, on to consumers of gas.

I believe that gas produceability or how much gas might flow is a risk that Arctic Gas should bear. One way of having them bear it would be to put some limits on the price of transportation charges that could be collected under an all events tariff to take into account what is a reasonable current expectation made on behalf of the Arctic Gas, of how much gas they think will be produced.

If they have overestimated gas flow, the costs will be up proportionally to that exaggeration. This is too big of a risk, even under an all events tariff to not put a restriction or ceiling on it and I think we have to find a way of making the project feasible, yet realistic when it comes to setting this part of the all events tariff.

I think that is a problem with both El Paso and Arctic.

The second area I have difficulty with Arctic Gas and it is unique to Arctic Gas, is that I am not sure that anybody has carefully examined or even though about—I may be missing information on this—what will happen under an all events tariff to the Canadian portion of the costs that might occur if there was a disruption or interruption in supply.

Or what might happen in Wisconsin if we approve an all events tarrif at the state level, and Minnesota, Illinois don't approve it? In the event Illinois doesn't approve the collection of money when gas is not flowing, will it be passed on to Wisconsin under our all events tariff? Of if Canada doesn't approve the all events tariff, will American consumers pick it up?

It seems to me we have to put some restrictions on these events and they are not totally unrealistic. I don't think they are making the project incapable of financing, but we have to be careful of the parameters of all events, although generally approving the concept.

Finally, the third point in my prepared testimony is I really believe the choice should be made by Congress. I think the experience we had on the oil system showed that an issue as important as this will eventually have to be considered by the Congress rather than to set in motion a set of events that will lead to additional delays, in which nobody gains.

I appreicate the national issues and the delicate negotiations with Canada that you mentioned, but I do think we can lose sight of the fact that if a project is going to cost approximately $10 billion, that even 3 percent per year inflation means the costs will go up a million dollars a day for every day we delay.

Even at a 3-percent inflation is something we probably would all take a great deal of pride and satisfaction in as a national achievement. So that the escalation in costs on either route is something that gives me serious concern and I think we should have Congress set up the most expeditious way of considering all of the facts and all of the evidence and make the decision which I believe they are making now.

So they ought to begin with that notion. I think there are important choices to be made between the Alcan route and the Arctic Gas route. I think that the environmental impacts of going across the Arctic Wildlife Refuge is not as great as the effect of taking away a promise that we have in fact preserved an area, we say we have preserved an area for future generations that will never be developed any further.

The area has had some development in it, it is an area that has a great deal of homogeneity to it. The impact of the pipeline will probably not be all that great under any kind of reasonable measure. But we can't lose sight of the fact that we have made a promise in perpetuity to preserve something, and I think if that fact is weighed against the extra costs, if indeed there are extra costs of going down the Alcan Highway and we decide we want to spend those extra costs, then I think Congress can best make that weighing decision.

I'm not sure that the extra costs stated by Arctic Gas are in fact correct. I think that they deserve additional scrutiny.

The Interior Department has put the cost figures much closer together on the two routes. My own analysis of the oil alternatives put those costs much closer together than the figures that are being talked about.

But I don't know whether the $3 billion is too high or too low, but I think that is something we have to find out about.

So I don't know which of those two routes is better. But I think both of them are far ahead of the proposed El Paso route. And also, further along in terms of being built and it will benefit all regions of the country and I therefore strongly support the all-land trans-Canada system, which ever one might be selected and built.

Senator STEVENSON. Thank you.

I should perhaps point out that the Canadian procedures will take at least a year. The most optimistic Canadian claims indicate the National Energy Board will not complete their decision before the end of this year, and then it has to go to the Cabinet for final decision.

Implementation might even require legislation. So, the only route that Congress can mandate now is the El Paso route. The procedural approach is intended to eliminate delay, but also to permit careful consideration of all of the options.

Dr. CICCHETTI. I recognize that, Senator. I think in response to that, I don't think that Congress, no matter how expeditiously it acts on the subject, will pass any of the legislation much before the year's term we are are talking about in terms of Canadian Government approval.

I believe a misunderstanding——

Senator STEVENSON. It might start all over again in the next Congress. No, we need to act in this session and before the Canadians have acted, or the process begins all over again with the new Congress.

The process that is proposed, of course, also includes the congressional judgment. That is the final judgment. Well, I hope you don't rule the procedural approach out, because it may be the only way to reach your goal.

Dr. CICCHETTI. I certainly don't want my remarks to indicate that I do disagree with the procedural approach. In fact, I think it is the only realistic way of going forward. But in the process I think it is right to concentrate on the Candian all-land systems rather than concentrating on the El Paso system.

[The statement follows:]

STATEMENT OF DR. CHARLES J. CICCHETTI, DIRECTOR OF WISCONSIN OFFICE OF EMERGENCY ENERGY ASSISTANCE

Good day! My prepared comments are brief. I have prepared two rather lengthy reports for your committee and I shall only summarize them, while adding my separate views on related matters. I shall divide my remarks into three parts: The advantages of an All-Land System; Financing and Tariff Matters; and The Policy Choices Before the Congress.

I. THE ADVANTAGES OF AN ALL-LAND SYSTEM

The Department of Interior has prepared a report entitled: *Alaskan Natural Gas Transportation Systems*, December 1975. I found that report to be deficient in many ways, as indicated in my attached comments which I made on their draft version. When a proper accounting is made of the taxes paid to Canada, the net benefits of an all-land system consistently outweigh those of the all-Alaskan LNG system. There are other advantages of an all-land system: (1) Security of flow, (2) environmental, (3) financing, (4) higher throughput, (5) continuing existing flows of natural gas from non-Arctic Canadian sources, (6) avoiding western state coastal development and safety risks from LNG tankers, (7) reducing the need to export any excess gas or to involve Japan in a displacement plan which would most likely be international, (8) avoiding the higher costs of displacement, (9) making it possible to use some current gas pipelines not needed for displacement to ship excess crude oil east rather than exporting it to Japan, (10) a shorter time requirement to meet current western, midwestern and eastern needs because the all-land routes are nearer to approval and financing, (11) redressing current regional energy supply imbalances, and (12) encouraging additional Arctic gas exploration and avoiding gas shrinkage in transportation.

When each factor is considered, while at the same time the distortions made in the Interior Report are discounted, objective analysis requires one to conclude that the all-land Trans Alaska-Canada natural gas pipeline is unquestionably preferable to the El Paso pipeline liquefaction-tanker-gasification pipeline and displacement scheme.

II. FINANCING AND TARIFF MATTERS

Attached is a recent analysis of issues related to financing the various pipeline systems for Alaskan and Canadian natural gas. My conclusions can be summarized as follows:

A. The El Paso financing proposal, which requires a cost-of-service, all-events tariff with prepayment during construction, must be rejected for several reasons:

(1) Risk is shifted entirely away from the pipeline owners and equity finance is, therefore, unwarranted. (Adjusting for this would reduce annual capital costs by as much as sixty percent. But, El Paso would be likely to drop the project before accepting this adjustment).

(2) Displacement, even if it could work, and I have serious doubts which are expressed in both attachments, would result in a very complex gas flow-finance structure. It is inconceivable that state regulatory commissions from coast to coast would ever approve an all-events tariff before the gas began to flow, or to enforce one after a supply disruption occurred under displacement.

(3) El Paso does not appear ready to address the cost overrun problem, and instead prefers to believe that, if state regulatory agencies are confronted with the economic ruin of their gas utilities and/or charging current gas customers higher prices, even without gas flowing, to finance cost overruns, then additional financing will come forward under such bleak circumstances. These are prospects we must avoid.

B. The Arctic Gas proposal is quite different. It would:

(1) retain the risk of late completion,

(2) build in an inflation and twenty-five percent cost overrun buffer,

(3) request federal financing at the commercial rate for any additional excess costs after exhausting all private markets,

(4) purchase business interruption insurance from private sources, and, only if required to sell securities, seek additional coverage at the commercial rate from the federal government.

All in all, Arctic Gas retains some risk while it passes on considerable risk to its utility wholesale customers. State regulatory commissions must decide how to treat this risk transfer *vis-a-vis* their retail customers. However, since construction work in progress and/or prepayment are not part of Arctic Gas' scheme, state regulatory commissions are likely to approve such tariffs as normal practices. Additionally, since displacements are not present and business interruption insurance would be purchased, supply interruptions would not be unduly troublesome to state regulatory commissions under the Arctic Gas proposal.

There are two problems, however, Arctic Gas would appear to bear none of the risk if markets for Alaskan or Canadian gas fail to materialize as anticipated. This could happen because gas producibility has been overestimated and/or demand falls off because prices are too high. Under such circumstances, particularly the former, Arctic Gas should bear some risk. As a specific recommendation, I propose Congress consider making approval of rates of return or capital cost recovery contingent upon gas throughput, perhaps by placing a cost per MCF limit on the transportation charges equal to a value consistent with the next smaller project scale.

Arctic Gas may turn to the federal government for additional financing on a backstop basis. I believe the federal government should keep open the option of financing any portion on an equity, as well as, debt basis. There are, however, some important subtleties as outlined in my attachment B.

The matter of Canadian treatment of an all-events tariff for the Canadian portion of the throughput must also be clarified. It should be firmly established that no wholesale, or utility, or retail end user customers would be responsible for other customers' shares if circumstances lead to an "event" where other customers forfeit or experience bankruptcy.

All in all, the Arctic Gas finance proposal is reasonable. Some matters still must be resolved. I believe it is a workable plan and will be acceptable to state regulatory commissions. I do not believe, though, that the same conclusions can be reached concerning the El Paso financing proposal.

III. POLICY CHOICES FOR CONGRESS

These can be summarized concisely.

A. Congress, after carefully weighing the evidence, should resolve the matter quickly by means of Public Law.

B. If all factors leading to that choice have been weighed in open debate, then judicial review should be restricted.

C. The choice should be restricted to one between the primary Arctic Gas proposal and the so-called Alcan proposal.

D. Questions relating to gas producibility have been raised, and these must be considered *now* in order to avoid overbuilding and overpricing the gas obtained.

E. Restrictions on state regulatory tariff structure discretion must be resisted.

Item C requires additional explanation. The Pros of the Alcan route are as follows:

It avoids the Arctic wildlife refuge,

Gas is available for Fairbanks, but distribution costs may be excessive,

The FPC staff finds it to be environmentally superior to the primary route,

It avoids any delays related to Canadian nature land claim settlements.

On the Con side of the Alcan route:

It is not as far along from a regulatory compliance standpoint,

It may cost more and initially would have a smaller throughput.

The choice is between these two because both would bring natural gas to west coast, as well as Canadian and American gas users east of the Rockies where the need is greatest. In any case, I believe the present Arctic Gas consortium should be selected to finance and construct whichever of the two routes is ultimately decided upon. With energy needs mounting, our foreign energy dependence growing, and with costs escalating more than a million dollars per day, making this choice must be given the highest Congressional priority and be decided before the next heating season begins. I urge your action and offer my assistance to any of you, if that will help to resolve these matters in an expeditious manner. Thank you!

Attachment A

Comments on the U.S. Department of Interior Study: Alaskan Natural Gas Transportation Systems

(By Charles J. Cicchetti, Ph. D., Director of Wisconsin Office of Emergency Energy Assistance, Madison, Wis.)

INTRODUCTION

The controversy over the best way to bring Alaskan oil to market brought into focus a number of significant public policy questions. Based upon the wisdom of hindsight, I believe an even better case can now be made to prove the point that I argued three years ago, i.e., that we selected the wrong route. Today I believe the case in favor of an all-land natural gas transportation system to the gas-short Midwest and East Coast is even stronger than was the case for the all-land oil pipeline system in the early 1970's.

Based upon a recent study sponsored by the Department of Interior, I am outraged to note that we seem embarked upon a path that ignores the mistakes recent history so strikingly illuminates. Especially when current and future events so seriously require good common sense public policy. Specifically, a document has been produced which claims to be objective. But, it is most assuredly biased in favor of a proposed all-Alaskan pipeline-liquefication tanker-regasification system. Even with such distortion, the document can, at best, equivocate and imply the all-land pipeline crossing Alaska and Canada is a tossup when compared to the more technically complex all-Alaskan gas pipeline-tanker system.

The history of the debate over the oil pipelines, which I participated in and which is partially summarized in my analysis entitled Alaskan Oil: Alternative Routes and Markets, was fraught with U.S. Department of Interior attempts to make the two systems appear to be "flip of the coin tossups". My outrage in this current controversy is that this same pattern seems to be developing once again. We in the Midwest and East are probably guilty of presuming that decisions are being made that will bring the natural gas to our hardpressed natural gas short states. Alternatively, the equivocations made by the Department of the Interior may be merely bureaucratic indecisiveness and, therefore, there is no need for concern.

I hope that my political fears and economic criticisms of these recent developments prove to be unfounded. However, the risk is great. California gas utilities are trying to buy up options for Alaskan gas now. Tokyo continues to be supplied with Alaskan liquefied natural gas from Cook Inlet. The problems of gas shortages are growing in the Midwest and East, and I cannot ignore the signals that exist and which are quite obvious when compared to the crude oil debate.

The following comments are my specific reaction to the Department of Interior Analysis.

TIMING

Distorted analysis and summary conclusions made by the Department of Interior resulted in the following inaccurate conclusions with respect to crude oil.

Too close to call on economic grounds,
No clear cut environmentally preferred route,
Timing favored the all-Alaskan route.

The first two were totally prefabricated deceptions. The third was used to justify the Administration's already predetermined choice. In the case of natural gas lines, timing favors the all-land joint Alaskan and Canadian system. Delays favor the all-Alaskan Pipeline-Tanker System. With the passage of time, my fear is that the Department of Interior will once again claim neither is preferred economically or environmentally, and having delayed long enough, the timing advantage will shift to an all-Alaskan Pipeline-Tanker System. Specious national security claims favoring the all-Alaskan alternative will undoubtedly be added and the wrong choice will once again be made.

At present, timing favors going through Canada. The need is great in the Midwest and East. The required studies have been completed. Canada needs to keep its own gas unless its Arctic reserves can be counted upon and only a trans-Canadian gas line can do this. Yet, the Department of Interior all too conveniently ignores these stark realities, and, in my opinion, contributes to the delay.

BENEFIT COST ANALYSIS

The Department of Interior has used an analysis quite similar to the one I developed for comparing the two crude oil systems. Subtracting its costs from benefits it calculated national economic benefits (NEB) for the United States under three scenarios for the two systems. These were summarized as follows.

NEB

[In billions of dollars]

	Alaska-Canada	Alaska-LNG
Base case	$5.4	$5.1
Optimistic case	10.8	7.6
Pessimistic case	4.1	4.6

The implication is that only in the optimistic case can we conclude the all-land system is superior.

The authors of Department of Interior report followed an approach in this analysis that I suggested in my crude oil analysis. Included as a cost for the all-land Alaska-Canada NEB calculations were the taxes paid to Canada. The reasoning behind using taxes paid to a foreign government as a "real" cost in a benefit-cost analysis is that, once paid, these tax receipts can be used to pull goods and services out of the U.S. in exchange for the initial dollar outflow. In the case of taxes paid within the United States such taxes are exchanged between our own citizens and the resource drain from the county does not take place.

I developed and used these same arguments in my own analysis. However, a very important distinction must be made in the case of Canada. Professor Solomon in a recent analysis of the Arctic gas transportation system indicates that the U.S. and Canadian economies are highly integrated. He pointed out that between 1970 and 1973, 68 percent of Canada's imports of goods and services originated in the U.S. while 70 percent of Canda's exports went to the U.S. The capital markets of both countries are closely integrated and many Canadian industries are subsidiaries of U.S. parent corporations.

The importance of these close ties for benefit-cost analysis of the type performed by the Department of Interior is that the real cost calculation due to taxes paid to Canada may be grossly erroneous. The foreign government I used in my analysis was one of the several Persian Gulf exporting countries. The economies of those countries are much less closely interconnected with the U.S. economy. To understand this, consider a case in which a U.S. subsidiary in Canada pays less taxes to Canada because the proposed pipeline starts to pay some provincial and national bills. Clearly the latter cancels the former. With economies such as OPEC nations and the U.S. which are not closely interrelated, this type of offset is far less likely.

A second distinction must be noted. In the analysis of the TAP (Trans-Alaska Pipeline) and TCP (Trans-Canadian Pipeline) crude oil systems, the inclusion of taxes paid to Middle-Eastern countries was equal in both analyses. It, therefore, did not matter unless the question of whether or not to leave the oil in the ground was seriously being considered. In the Department of Interior analysis, taxes paid to foreign governments only enter the cost side of the all-land Alaskan-Canadian system calculations. Since these amount to approximately a negative $800 million ($.8 billion) of the NEB calculations, this one-sided effect is most important. In fact, if this adjustment were not made the Department of Interior analysis would have concluded that the all-land system was always superior to the all-Alaskan pipeline-tanker system.

Rather than an adjustment applied equally for both alternatives, as in my crude oil analysis, the DOI approach is applied to only one and is their entire basis of their no-clear-choice solution. Since the U.S. and Canadian economies are closely inter-tied, whether this calculation should be included at all is a most critical issue. I believe its inclusion grossly overstates the meaning of taxes paid to the U.S. especially since our balance of payments are so closely related to Canada as Professor Solomon has shown.

As a final matter in this regard, NEB cannot generally be expected to tell the whole story. Accordingly, I calculated profits, consumer effects, taxes paid and costs of transportation before taxes, to give a clearer unambiguous comparison of the two crude oil alternatives. When such analyses are undertaken for both natural gas systems, the unambiguous economic advantage of the natural gas system through Canada would be established.

Changing subjects slightly, the benefit-cost analysis omitted several factors. This distorts the benefit-cost analysis, and if these factors were to be included the analysis would favor the all-land system through Canada. First, as indicated above, the all-land system could be built sooner. The hour draws late and the delays caused by the all-Alaskan pipeline-tanker system will cost this nation dearly. This factor does not enter the DOI analysis. Yet, it is most significant.

Secondly, Canada indicated at the height of the TAP versus TCP crude oil debate that without Arctic transportation systems that could bring their petroleum south they would not be able to count their Arctic reserves as "available". They further established a reserve-to-production formula that determines how much crude oil and natural gas can be exported to the United States. If the reserves in the Canadian Arctic are declared available, there will be a greater amount of exports to the U.S. today. The Department of Interior analysis completely ignores this most significant real-world fact. The entire Midwest faces an ever-widening loss of current natural gas and crude oil from Canada if we continue to build our Arctic pipelines through Alaska exclusively for U.S. use with deliveries to Pacific markets. This omission is not neutral, it means a most significant opportunity cost of building the all-Alaskan Pipeline-tanker system (or its equivalent benefit for the all-land system) has been follishly omitted.

This last omission brings us full circle to the foreign tax issue. As the Midwest loses Canadian natural gas we must turn for replacement to either imported liquefied natural gas or crude oil. The most likely LNG suppliers are Algeria and the Union of Soviet Socialist Republics. These economies are not closely tied to the U.S. The taxes are probably greater and much political or national security leverage would be lost. Once again the omission proves to be costly, and, if factored in, the all-land Alaskan-Canadian system would increase in value. If crude oil is the alternative for the lost Canadian exports, the story is similar, since higher tax, not economically interdependent, and politically non-neutral countries in the OPEC block are the most likely suppliers of such crude oil.

It is sometimes suggested that a drawback of any pipeline through Canada is that it would have to be a common carrier. Critics claim that this would mean Canadian natural gas or oil will back out Alaskan natural gas or oil.

I do not think this would be a negative factor. It could be overcome as in the case of natural gas by increasing the diameter of the pipe. It would also increase the life of the U.S. gas reserves; it would reduce the U.S. share of the costs and taxes paid to Canada. Such factors mean that critics of the all-land system cannot have it both ways. If they argue that sharing is bad, and presume it will take place, then they must readjust the benefit-cost calculations to reflect its beneficial effects as well.

The general pattern in the DOI benefit-cost analysis is to omit facts which would lead one to select the all-land Alaskan-Canadian system instead of the Alaskan pipeline-tanker system. The facts that have been included are analyzed in a one-sided manner to reach the same conclusion. My charges are quite serious and so is my outrage. I found a clear-cut attempt to shed favorable light on the worst public policy choice.

REGIONAL IMBALANCES

It is presumed by the authors of the Department of Interior report that, if either route is built, both the West Coast of the U.S. and East-of-the-Rockies regions will receive the same natural gas supplies under either pipeline scenario. This is preposterous for several reasons. As indicated earlier, Canada is an important supplier for the Midwest. If the Alaskan-Canadian system is rejected, Canada will have 1 billion cubic feet less natural gas per day to either sell to the U.S. or to use itself. This represents 40 percent of the throughput of an all-Alaska system. Without it, Canadian suppliers will be forced to cut off U.S. customers at an accelerated rate. This alone means that the DOI displacement analysis is very misleading and grossly inaccurate.

Currently, Alaskan gas is being sold to Japan. I do not know of any proposal for the U.S. to reduce its sales of Alaskan natural gas to Japan in order to supply the West Coast of the United States. As a nation we permit sales to Ohio, North Carolina, and many other states to be abandoned by domestic gas producers. As a nation we find Canada no longer willing to be ignored in the area of establishing continental energy policy, and, therefore, curtailing natural gas sales to this country. Why then, I must ask, should we build a pipeline to a natural gas exporting region of the country when our other regions are so seriously short of natural gas? Ignoring these factors as the DOI has done is indefensible in my opinion.

The last regional analysis criticism that I would like to direct at the DOI report in this regard is that its authors are extremely naive. They draw arrows on a map that shows natural gas being redirected as though some grand master natural gas allocator were making the decision. They totally ignore technical, institutional, legal and political realities when they make things appear to be so simple. Many different corporations would be involved. Some would have different objectives than others concerning new market developments, contractual obligations, price differentials, etc. I do not believe any public official, gas utility, pipeline or consumer in the Midwest and East Coast would for a moment believe the arrow reversals indicated by the DOI displacement concept analysis. We are far less naive than the authors presume.

Another matter is that prices are certainly going to be affected by any such displacements that would take place. If a thorough analysis were performed, it would certainly have to include such price effects in the benefit-cost and/or consumer impact analysis. If this were done, the all-Alaskan line would pale by comparison. Once again, the omission is biased.

RISK ANALYSIS

Before I reviewed the risk analysis, I was suspicious, but not totally convinced that a conscious attempt to obfuscate facts was being made. When I read the risk analysis I became totally convinced beyond any reasonable doubt that the authors' bias was in favor of the all-Alaskan system.

In my book on the crude oil pipeline choice I attempted to put the environmental and risk analysis in perspective along with purely economic issues. The Department of Interior undertook a similar task. Unless I am totally unable to understand their meaning, I find gross discrepancies between our analyses. This portion of my previous work was in dispute with DOI's own analysis of the crude oil systems less than any other portion. I cannot explain these differences, but I shall note them because they are a major part of the charge of distortion, if not deceit, that I believe the Department of Interior must be required to answer.

The construction difficulties considered by DOI have two major weaknesses. They claim that terrain difficulties will be more likely for the Alaskan-Canadian system than the Alaskan-tanker system. When one looks at a physiographic map of Alaska and Canada, this conclusion is more difficult to believe. The most likely trans-Canadian system would be to the east of the Rockies and follow the Mackenzie River valley. An all-Alaskan system would transgress several mountain chains with possible avalanches in the southern system, and seismic activity for the lower two-thirds, posing major problems. A less likely, but not unreasonable alternative, trans-Canadian system would follow the same route as the all-Alaskan route to the south of Fairbanks (thus ensuring that Alaskan city with natural gas supplies) and turn east following an existing highway system. It would avoid the serious physiographic, seismic, avalanche and weather threats of southern Alaska.

Similarly, mistaken comparisons of the weather along the two alternative systems are made. However, the most glaring bias in the Department of Interior risk analysis is presented in their Flow Disruption Analysis. They give both systems low seismic probability and a medium impact for the all-Alaskan system contracted with the Alaskan-Canadian system. They seem to ignore the fact that the southern two-thirds of Alaska and the entire tanker route to the west coast of the United States (if, indeed the gas is to be marketed in the U.S.) is the most seismically active region in North America. There is no known seismic activity of any comparison along the all-land Canadian route. DOI also seems to discount the seriousness of earthquakes for the liquefaction, storage and port facilities in Alaska and the west coast of the United States.

Weather and the problems it poses for shipping is similarly ignored. The record in the hearings held by the House of Commons with regard to passage along the west coast of Canada and through the straights leading to Puget Sound totally refute such an implication. In another matter, third party accidents, because the all-land system is in Canada, are also supposed by the Department of Interior. I believe that the ease with which LNG tankers and liquefaction facilities can be subject to military and accidental interdiction would lead any objective observer to conclude just the opposite.

The Department of Interior analysis omitted obvious facts included in previous Department of Interior analyses of the crude oil system and my analysis of same. The omission was selective and makes the all-Alaskan pipeline-LNG-tanker system appear to be better relative to an all-land line that would supply the gas-short Midwest and East Coast. When similar distortions in the economic analysis were also part of the Department of Interior evaluation, the overall result is either a conscious attempt to tip the decision away from the trans-Alaskan Canadian pipeline, or, to equivocate and to not reach a conclusion that might later prove to be politically embarrassing for a choice not yet finalized.

If either of the above two reasons motivated the Department of Interior distortions, I am outraged. The need for Alaskan, Canadian Arctic and current Canadian exports, which depend upon a viable backup from the Canadian Arctic if they are to continue, in the industrial and agricultural heartland of the United States is unprecedented. Indeed, the very economic recovery of this nation is at stake. Delay caused by equivocation is totally unacceptable and diversion of this much needed natural gas to "Pacific" markets is disastrous.

The economic studies that I have reviewed in addition to the Department of Interior analysis, my own experience in these matters with respect to the crude oil controversy, my discussions with Canadian government officials over the crude oil choice, and common sense all tell me that the more-technically-complex all-Alaskan-LNG-tanker system is unquestionably a poor second choice. The Department of Interior is trying to prove that a real tossup is involved in the choice. This is exactly the false logic applied in the crude oil controversy by the Department of Interior. The next step for the Department of Interior is to point to natural gas emergency, potential delays in Canada and old fashion American independence and to once again build the wrong pipeline-tanker system. The history of the crude oil controversy, and the vindication of the critics of that choice, when needs were growing in the Midwest and East Coast should lead all Americans and Canadians to question the motives of the Department of Interior analysis and to take steps to prevent history from repeating itself to the disadvantage of so many citizens of both great nations. Any lesser response would be irresponsible in such perilous times.

REFERENCES

Alaskan Arctic Gas Pipeline Company, The Arctic Gas Project (Washington, D.C., May 1, 1975).

Cicchetti, Charles J. Alaskan Oil: Alternative Routes and Markets (Baltimore: Johns Hopkins University Press, for Resources for the Future, 1972.

Solomon, Ezra, "A Study of The Economic Impact of an Alaska-Canada-U.S. Gas Pipeline", mimeo, March, 1975, Graduate School of Business, Stanford University.

U.S. Department of Interior and the Aerospace Corporation, Alaskan Natural Gas Transportation Systems (Washington, D.C., June, 1975, Draft).

Attachment B

Financing Pipelines to Bring Arctic Gas to the U.S. and Canada

There is general agreement that, by the time any of the major proposals to bring Arctic gas from the northern regions of Alaska and Canada to gas consumers in the lower 48 and southern Canada is completed, the cost will be at least ten billion dollars. Financing such a project is a chore that even the most optimistic cannot take lightly. The heart of the finance issue for public policy-makers is the assignment of risk in such a venture. There are a number of different forms of risk, as well as a number of different economic entities, who could bear the risks. It is useful to consider some of these choices in order to consider policy options.

Some of the Risks

1. A gas pipeline construction project will be initiated, but will not be completed, or, will not be completed reasonably soon after the expected completion date.
2. Financing the project will be difficult or impossible, if costs greatly overrun current expectations. (Note relationship with 1.)
3. The pipeline will be completed, but a major supply interruption will occur.
4. Customers who are offered the gas will find it to be too expensive and demand will decline, making it difficult for investors to recover their capital outlays.
5. Gas producibility will be less than current expectations and the pipeline will have been overbuilt resulting in much higher prices, economic losses or both. (Note relationship with 4.)

Some of the Potential Risk Takers

1. Stock and bond holders of the pipeline consortium;
2. Stock and bond holders of the wholesale or utility customers, who would purchase directly from the pipeline consortium;
3. Prospective or actual retail customers, who would purchase from the utilities;
4. The federal government, that is, all citizens of the nation whether or not they would consume Arctic gas;
5. State governments, either producing or consuming states;
6. Gas producers, who would sell to the pipeline, if they are not part of the consortium.

Although it is an overstatement, we believe the benchmark for reviewing finance plans is that if government eliminates all private risk, then it is difficult to accept the role of equity finance in such ventures. And, while this is not our final conclusion, we believe aspects of each finance plan must be compared to this norm. At the present time there are at least three proposals to finance the projects and to spread the risk. While we have not completed a detailed study of any of them, it is still possible to outline each, as we understand them, in order to facilitate the policy debate. There are many common aspects of each proposal, but in selecting between the alternatives, the differences are likely to be more important.

A. The El Paso proposal to build a pipeline through Alaska, liquify the gas, ship it on large specially built LNG tankers, and then regasify it, has three principal finance characteristics. The El Paso finance plan is built around a tariff guarnatee and includes: a cost of service tariff, an all events tariff, potential preparyment if the project is not completed on schedule.

Under the El Paso finance-tariff plan risks are borne by either the wholesale utility or end-user retail customers. For example, if the project is not completed on time this risk would be shifted to the wholesale customers of El Paso. If state regulatory commissions approve, this risk could in whole, or in part, be shifted to end-user retail customers. A unique difficulty with the El Paso proposal is that it would utilize "displacement" to move gas from some lower 48 western state sources to midwest and eastern markets. Current western markets would then be supplied with Alaskan gas. Prices are likely to vary considerably because of the high Arctic transportation costs. The customers, receiving the displaced gas would be asked to pay for the proposed Alaskan gas pipeline, even though they would not be receiving the gas directly from Alaska. Devising tariffs to cover all contingencies both before and after displacement is far more complex than when a direct retail customer-wholesale utility-pipeline relationship is established. This increased complexity greatly reduces the possibility of state regulatory commission approval of passing risk on to potential or actual retail customers under displacement arrangements prior to project financing and/or before the gas begins to flow.

To understand this, consider just two contingencies. Suppose western states start to receive Alaskan gas and give up some lower 48 gas to the midwest and there is a major supply interruption. Who will pay for the pipeline while El Paso Alaskan gas pipeline surely is interruted? Does it matter whether displaced gas will be returned to western states during any supply interruption? Similar questions and uncertainties are present, when the contingencies that gas producibility is less than anticipated, or demand drops off, are considered.

B. The second principal alternative being proposed is the Arctic Gas Pipeline trans Alaska-Canada proposal. Its financing propisions are similar yet different than El Paso's proposal. They include: a cost-of-service tariff, an all-events tariff, potential Federal Gofernment backstop financing in the event of large cost overruns, and an option to request that the Federal Government sell Business Interruption Insurance.

It is easiest to dispose of the similar features between the Arctic Gas and El Paso plans. The comparison of these two is most important, because they are the two most advanced proposals. Both would utilize all-events, cost-of-service tariffs. The Arctic gas proposal does not depend heavily on displacement, therefore, assignment of all-events coverage is administratively and politically less complex than the El Paso proposal.

With respect to late completion or noncompletion of the project, El Paso would shift this risk to its wholesale and/or retail customers. The Arctic Gas proposal would not. Instead, the risk would be borne by the financers of Arctic gas. If lateness of completion was related to cost overruns, some of the risk would be shifted under the Arctic Gas proposal. The assignment of risk works the following way:

Arctic Gas has estimated its capital costs by accounting for anticipated inflation.

An additional twenty-five percent of the inflated capital cost is calculated. Equity and debt commitments to finance this level of capital cost are to be made prior to construction.

In the event of cost overruns above anticipated inflation plus the twenty-five percent built in margin for error, Arctic Gas would first seek any needed private capital debt and equity finance.

If private capital is unavailable to complete the project, Arctic Gas seeks a guarantee that the federal government would be a lender of "last resorts" at the commercial rate of interest and payback scheme.

This Arctic gas proposal is intended to reduce or eliminate the risk of incompletion for those who initially agree to finance the project. It differs from the El Paso plan that would permit El Paso to charge its customers for the capital outlay before project completion, including the case in which it is never completed.

The Arctic gas proposal is also superior to El Paso's because it makes provisions for cost overruns at the outset. An additional option might be for the federal government to be permitted to become equity holders for part of any new financing for project completion. This would probably encourage greater attempts to cut costs and seek private financing. On the other hand, if federal equity was purchased, the cost for final gas customers would be approximately sixty percent greater for that portion of additional financing required from the federal government (assuming an approximate 30% equity, 70% debt split with an approximate 15% pre-tax return on the former and 10% return on the latter).

As a purely theoretical matter, principles of public finance which require beneficiaries to pay, would suggest that such higher finance costs are desirable. On the other hand, the midwest and eastern state beneficiaries of Arctic Gas Pipeline are typically taxpayers who have in the past helped subsidize, through higher taxes, federal projects with lower interest rates constructed in other parts of the country, e.g. TVA, Bonneville, Bureau of Reclamation and Corps of Engineer projects. Regional fairness would seem to reject the adoption of a finance plan that would, for the first time, assess a regional federal finance penalty. However, the benefits of joint private-public ownership must also be considered. The matter is complex and it must be carefully considered.

Another aspect of Arctic Gas Pipeline's finance proposal *might* involve the federal government. Arctic Gas proposes to purchase business interruption insurance from private sources before financing their project. Current expectations are that such coverage might be limited to two or three billion dollars. If finance proves difficult at the level of coverage Arctic Gas has disclosed, then it may seek the issuance of federal business interruption insurance at similar rates. In deciding this issue it should be noted that current capital cost estimates would mean that this level of private insurance would exceed more than one year's finance charges.

C. In recent testimony Mr. Gerald Parsky from the Treasury Department testified about financing Arctic pipelines. The finance plan listed some financing methods that they opposed. It also included the following provisions: A cost-of-service tariff, an all-events tariff required to be placed into effect by federal law at the federal and state level, increased equity interest from oil producers, the State of Alaska and others.

Under Treasury's all-events tariff, state regulatory commissioners would be required to pass the risk from utility wholesalers to retail end-users even if gas was not delivered. The constitutionality of such a proposal would undoubtedly be challenged, delaying the projects and leading to cost escalations. The Treasury Department rejected taking any action that would extend federal financial assistance to the proposed natural gas pipelines. Since none are seeking such assistance, except for Arctic Gas' optional backstopping proposal, this seems to be a bit overstated. The Treasury Department requirement, that potential consuming states change their tariff policies in advance, would probably mean that the projects would be delayed, if not totally derailed. The nation's serious gas problems mean that we must not establish criteria that will needlessly delay the Arctic Gas development.

D. CONCLUSIONS

Financing a $10 billion project over thirty years at a 10 percent per year rate of interest with a capacity to deliver 2.5 billion cubic feet per day means that the transportation component of capital cost is $1.16 per MCF. Production costs, taxes, operating costs, etc. would still have to be added to these transportation costs. Changes in capital cost or changes in throughput would have a proportional effect.

Consider a situation in which only 70 percent of the project was financed at 10 percent debt and the remainder was financed at 15 percent before tax equity. This would effectively raise the annual finance rate to about 16 percent, assuming a fifty percent corporate tax rate. The same $10 billion project would have annual finance costs of $1.77 per MCF. For final energy consumers the difference in cost between all-debt versus a debt-equity financed project is considerable. Such a conclusion does not mean that an all-debt financed project is preferable. However, it does mean that the risk assignment question must be carefully examined. Because a project without risk for the organizers and or financers of the project removes a principal reason for end user customers paying the higher price.

If government, wholesale customers (the gas utilities) or retail customers bear all the risk, then the payment of higher rates to risk free equity is highly questionable. The El Paso and Treasury proposals are especially faulted in this manner. They would extract higher prices from gas consumers before those customers receive gas, if in fact they ever do. All risk is shifted. Equity finance cannot generally be justified under their methods. There is, however, a most important exception to help sell bonds to finance the project. Since bond holders have priority in the event of default or bankruptcy, equity finance provides a margin of protection for bond holders. It is, therefore, quite possible that higher bond rates would have to be paid or loan guarantees made, if an all-debt finance project was contemplated.

The Arctic Gas project, in a subtle but certain way, cannot be characterized as having shifted all the risk, while charging a higher price. If the project is late, or not completed, risk is borne by the owners of Arctic Gas. The Arctic Gas proposal does not require state approval of prepayment of the finance changes before the gas flows. The guarantees that are present are between Arctic Gas and the gas utilities. And several of these are subsidiaries of the Arctic Gas consortium. Therefore, some risk is retained by Arctic Gas and equity finance is justified.

This does not mean that Arctic Gas is without problems. Since it is a joint Canadian American effort, the all-events nature of the tariff with respect to Canada's share and interests must be carefully considered. By making gas utilities the major risk takers in the event of shortfalls in gas production, Arctic Gas places a large burden on state regulatory commissions when it would seem better to place some of this risk on Arctic Gas directly. Perhaps this could be done by placing a capital cost ceiling on the transportation charge to bring it in line with anticipated flow rates. However, if ex post we find Arctic Gas overbuilt, that risk should be borne by Arctic Gas and not its customers, who expected a lower price based upon higher load factors. With this one possible exception, the Arctic Gas finance proposal is reasonable. It requires a minimum federal and state government role and spreads risk in an ingenious manner. It stands out above the El Paso proposal in this regard.

An additional note on the finance matter. Regulated gas utilities and gas pipelines typically are financed with a minimum of equity (usually 30 percent). Unlike oil companies who may finance capital prospects with more than twice as much equity, regulated gas companies have very little retained earnings or net worth. This means that as we as a nation consider large Arctic gas recovery profits, the regulated nature of the gas business must be taken into account and creative public policy established. Steps which are poor public policy with respect to other privately owned projects might have to be considered when it comes to Arctic gas development. This important observation makes the Arctic Gas Pipeline Proposal with its minimum amount of government involvement all the more desirable.

Gas from the Arctic will be expensive, as some of this finance discussion has pointed out. But, so is oil as we become more and more dependent on foreign crude oil, which is high priced and has associated with it a high security risk. Even at $3.00 to $4.00 per MCF, it is likely to compare favorably with imported oil. When methods of finance, and tariffs to collect such charges, are considered it is important not to mistakenly get drawn into a choice between "rolling-in" or incrementally pricing Arctic gas. Often such debates wrongly imply that a choice must be made between one or the other. As a practical matter, characteristics of both methods can and should be adopted. The level of gas prices should reflect all the costs of a gas utility. Even if the price of Arctic gas is two or three times greater than average, it must be rolled-in to determine annual gas revenue requirements. However, the structure of gas tariffs can, and almost certainly should, reflect the higher incremental cost of Arctic gas. Undoubtedly, each state regulatory commission will endeavor to strike this fine balance. We urge the committee not to put in any requirement that one or the other must be used, unless the subtle distinction between "level" and "structure" is carefully preserved.

Senator STEVENS. Are you going to hear the whole panel and then ask questions?

Senator STEVENSON. I thought so. Do you have any objection?

Senator STEVENS. No.

Mr. ROSS. Thank you for inviting me to testify in behalf of the California Public Utilities Commission, which represents the interests of California gas consumers on both sides of the San Andreas fault in the FPC proceedings on Alaska gas transportation.

Senator STEVENS. You don't have to be sensitive about that. I hear they had an earthquake last night down in North Carolina.

Mr. ROSS. First of all, we are not self-sufficient in gas; far from it. Only a small percentage of our gas comes from in-State sources.

We will be faced with a curtailment of priority 1 and 2 customers by the early 1980's, perhaps much earlier, depending on Canadian curtailments.

We were one of the first States to lose fuel capacity, at least I am sure we are losing gas under the FPC curtailment rules to other States east of California. I think virtually every State in the Union has a severe natural gas shortage, and it is appropriately approached as a national problem.

We do not believe congressional legislation dictating the routes would reduce delay, although we favor procedural legislation.

The FPC is expeditosly addressing the hugely complex questions involved in Alaska gas transportation. In our opinion the major avoidable delay comes from the failure of the three gas producers in Prudhoe Bay to file gas purchase contracts with the FPC. According to the producers, contracts cannot be filed until the State of Alaska approves a unitization agreement.

We know the producers themselves have not yet reached such an agreement; the March target date has been moved back to July. Alaskan regulatory action cannot then be completed before late fall at the earliest. Thus gas purchase contracts may not be executed before early 1977.

Without purchase contracts, the FPC cannot make an informed choice of transportation route.

Financial institutions, in addition, are unlikely to commit funds for pipeline construction without assurance of State regulatory approval of automatic passthrough the FPC approved rates. And those approvals hinge, in turn, on where the gas is going.

So we think it is essential that gas purchase contracts be filed at the earliest practical date.

On the merits of the proposed transportation system, our own preliminary assessment is that the Arctic Gas transportation route as presently proposed would be preferable.

But we strongly feel that many questions remain to be resolved in the FPC hearing, and we are keeping an open mind as to the ultimate merits of the competing proposals. If the Arctic Gas route were modified as proposed by the FPC, draft environmental statement, its crucial cost and supply advantages would be compromised and our own recommendation might be reversed.

In the event the Fairbanks corridor is chosen, it is possible either choice, El Paso or the Arctic route in the Fairbanks corridor would price the gas out of any reasonable market in the United States. That gas is essential to the United States, but our staff estimates the 1982 cost, assuming a 7-percent rate of inflation, general rate of inflation in the U.S., might well approach $6 for either the El Paso system, or the Arctic system in the Fairbanks corridor.

At that point I think the feasibility of the whole project comes into question.

A crucial factor in our judgment is the superior ability of the Arctic system to pick up the Mackenzie Delta gas for Canadian use. Canada's National Energy Board has recommended severe export curtailments in the event that Canadian frontier gas is not hooked up in time to meet Canadian needs.

We see little prospect that the Arctic islands gas will be developed prior to the late 1980's; thus any failure to connect Mackenzie Delta gas might result in serious export curtailments in the early 1980's, even before the current Canadian export licenses expire.

These curtailments in turn would have a devastating effect on gas supply in California and in several of the northern tier States. Forty-five percent of northern California's gas supply now comes from Canada.

I want to emphasize that we are not assuming any additional exports from Canada. What we are addressing is the possibility of curtailments of existing export licenses.

The Canadian National Energy Board report of last year made clear that Canada's needs will come first in the export decisions, they will take account of American reliance, but their primary concern is to connect up the frontier gas and resolve their own problems.

If that connection is delayed or eliminated, I think there is every probability of a more severe export curtailment.

While connecting the Mackenzie Delta gas to the El Paso system would be technically feasible, we believe it would be unlikely, and, in any event, substantially delayed. It seems improbable that the Canadian Government would approve the construction of an additional, costly segment of pipeline for the Mackenzie reserves and the shipping of those reserves to the west coast of the United States, in return for gas received in eastern Canada by displacement. Even if desired, such an arrangement would undoubtedly require extensive reworking of the draft United States-Canadian agreement on hydrocarbon flow, as well as evidentiary hearings before the Canadian National Energy Board. To date, El Paso has submitted no application to the NEB or the FPC to transport Mackenzie Delta gas and has not done related engineering studies. Thus certification of the El Paso project would make it virtually impossible to connect the Mackenzie Delta gas prior to the expiration of Canadian gas export licenses in the mid-1980's.

Another concern raised by the El Paso project has to do with liquefied natural gas. Two LNG projects involving Indonesia and south Alaska have already been proposed by the Southern California Gas Co., Pacific Gas & Electric, and their affiliates.

Certification of El Paso Alaska would increase California's dependence on LNG to as much as 90 percent of our gas supply by the mid-1980's. Presumably, gas from the Southwest would be backed off and the existing pipelines either abandoned or used for reverse flow. The net effect would be to make California exceedingly vulnerable to any LNG supply interruption, such as a maritime strike.

Tankers for all three potential LNG projects would come through the same coastal shipping corridor south from Point Conception, along with existing oil traffic, future Alaskan oil movements, and liquefied petroleum gas traffic. The wide discrepancy in the results of various existing LNG risk assessments is a source of major concern.

For this reason we urge the Federal Government to embark on a complete engineering assessment of the possibility of offshore siting for LNG terminals. The State of California has modest matching funds available for this purpose.

We have concerns about the proposals of the FPC environmental staff as to modification of the Arctic route. The Arctic Gas proposal includes a western leg which would allow direct delivery of Prudhoe Bay gas to substantial markets in the Western States chiefly by looping existing pipelines. The draft environmental impact statement would drop the western leg in favor of a single "gun barrel" route to the Midwest. Western States would receive their gas by displacement.

I believe this displacement proposal raises many of the same issues the El Paso project raises. No adequate cost or engineering studies have been done to specify the mechanism of displacement or calculate its effect on total system costs.

We estimate it would add $2 per thousand cubic feet in 1980, $2 the price of gas delivered, and we feel such an addition to the cost might render North Slope gas uneconomic for delivery to the north 48 States.

The final issue relates to both competitive systems, the proposal for project financing or all events tariffs. I believe this is a general issue that will affect most of the major energy projects, certainly in the field of synthetic gas, facing the Nation and I think Congress ought to address this in a comprehensive context. Proposals for gasification, for LNG importation from Indonesia. I agree strongly with Chairman Lieberman, I think it is very important to maintain private enterprise in the energy business and that is dissipated by the all-events tariffs. If the investor is not taking a risk, what is he there for? In some cases I believe it is feasible for investors to take conventional risks on these projects, subject to FPC review. For other kinds of projects, I am not sure that applies and in the Alaskan transportation there may be a case for Federal guarantees, but I believe it should be a Federal guarantee, accompanied by incentives to protect against cost overruns.

Because this issue arises so crucially with coal gasification projects, it might be well for Congress to address the comprehensive Federal policy on energy financing and proper incentives.

I might add that the producers in Alaska have apparently refused to contemplate any investment in the gas transportation system at the same time that they have continuously made a case for tax benefits and regulatory benefits on the basis of the need for internal financing of energy projects. And, at the same time, at least some of those producers are now diversifying into other fields. I think it would be appropriate as a condition for the requested and granted benefits to ask whether or not the producers have some obligation to provide some of the financing for a system which will take the product to market.

Thank you very much.

Senator STEVENSON. Thank you. Let me ask you all whether or not you agree with the general proposition on that last point. I think we all agree on the role of private investment. But it may be necessary, as a practical matter, to take some of the risk off investors in order to obtain the necessary financing.

If so, do you all agree that it is better to put that risk on the Federal Government rather than on the ratepayers?

Mr. LIEBERMAN. No, I think there is some risk that the ratepayers could take. I mentioned that I think a risk of 30 or 60 days——

Senator STEVENSON. I said take some risk off. I didn't mean to imply you take all of the risk off.

Mr. LIEBERMAN. That would take a very substantial risk off the investors, some reasonable type of event. A major event I don't think should be imposed on the ratepayers and perhaps then if that is unacceptable to private enterprise, there is a role for the Federal Government.

Senator STEVENSON. That is the proposition—between the ratepayers and the Federal Government. I assume you would prefer the risk to be borne by the Federal Government?

Mr. LIEBERMAN. In that type of situation, considering the national energy situation, I think that is the appropriate way.

Mr. CICCHETTI. The Arctic proposal has a feature that would put some risk on the Federal Government in the sense that if they have a cost overrun above inflation and above the 25-percent buffer and they are not able to get additional funding from the private market to complete the project, they would like the Federal Government to be a lender of last resort in certain circumstances.

It seems to me that is a reasonable risk for the Nation to take, especially when it is recognized that the agreement that Arctic Gas seems to prefer is one which would pay the Federal Government an interest rate equal to the commercial rate, so that even though all taxpayers would be taking some risk, the Federal Treasury would be rewarded at rates higher than it is usually rewarded in terms of interest rates.

Something else for the Congress to consider that is money is made available to Arctic Gas in the event of these cost overruns, it might even consider becoming an equity owner for any portion of additional funding, thus bringing additional return to taxpayers, once the gas starts to flow.

While there are some good reasons for that from both a management standpoint and also to make certain that the company has, in fact, exhausted all opportunity in the private market, since I don't think they would readily go into government partial ownership, the other side of the story is that traditionally when we have had national problems, those regions which are most hit, we have tended to subsidize with lower interest rates, TVA, Bonneville, Corps of Engineers projects down the line.

This would be the first time we did the opposite if we, in fact, charged equity rates to help complete a project that would benefit part of the country. And it is a big part.

But there might be some arguments that say let gas users pay the extra cost. But it is quite different than we have done in the past that I am aware of.

Mr. ROSS. I think there may be a case for spreading some risks across all gas consumers in the country rather than the consumers on one particular system, particularly in view of the problems of allocation that Dr. Cicchetti mentioned in connection with the displacement proposals.

I think that might be true for the development of the technology, like coal gasification, or the analogy of Price-Anderson.

One way of doing that is in effect insuring the risk in advance; another way is a surcharge after the event takes place, after the risk actually occurs.

I think it is really a question of administrative feasibility whether that is more practical and simply having the Federal Government assume the risk to begin with.

If we try to load very, very high risks or high damage of low probability risk on one region, that either the project will be unfinanceable or if that event materializes, the consequences will be so unfair that some adjustment would have to be made afterward anyway.

Senator STEVENSON. Senator Stevens.

Senator STEVENS. I find it interesting, the reference to the risk, and that the investors should take the risk.

The chairman and I just came back from Canada, and their price for natural gas is $2.75 a thousand cubic feet and they said they were going to allow the gas price to draft towards the Btu equivalent of the world price.

What would you suggest in our situation, where we have a regulated price? The average in Illinois, for instance, is something like 50 cents a thousand cubic feet right now, isn't it?

So where is the risk as far as the investor is concerned in something like this?

I think if I am not mistaken, Dr. Cicchetti, you opposed deregulation of natural gas.

Mr. CICCHETTI. That is correct.

Senator STEVENS. Now you are saying you are going to oppose an all-events tariff which would require users, consumers, to pay at least the costs associated with the transportation.

Mr. CICCHETTI. I am not against an all-events tariff. But I am in favor of putting some restrictions on it, and there are two principal kinds:

One is the restriction if the pipeline is overbuilt, and instead of a delivered price of maybe $4 a thousand cubic feet, we are talking about a delivered price, say if it was twice as large as it should be, of $8 a thousand cubic feet, that kind of risk I don't think should be borne by the ratepayers, and should be borne instead by either the pipeline company, or the producers, or some combination.

I am not opposed to an all-events tariff. But I am in favor of an all-events tariff with some reasonable parameters built in.

So I believe some risk should be borne by the ratepayers, some should be borne by the gas pipeline company if they are going to get equity rates of return.

So I am really coming down for a mixed system, which is pretty much what Arctic Gas has proposed.

Senator STEVENS. I understand the points you all presented. You are from Massachusetts, you are from Illinois, you are from California, and you are from Wisconsin.

All of you have very symbolic production, California is now producing the major part of the beef of the country; Illinois is producing a considerable portion of the agricultural products of the country; Massachusetts has similar products, and Wisconsin has similar products.

Suppose you had a half million people in your State that had no beef or no agricultural products at all right now. And you suddenly had great production in your State. Would you consent if I, as an Alaska Senator, came and said: "We want all of it, we want it all brought out right now." Your statistics are all based on 100-percent exports of Alaskan gas.

We have two communities in the State that have natural gas. We have probably the largest reserve of natural gas and oil in the country, and our native people are paying $2 a gallon, $100 a barrel, for fuel oil.

The route that the El Paso line goes through goes through some of the coldest places in the country where their fuel bill is probably four or five times what it is in your areas.

If you represented those people, would you consent to a system that would take the gas out of the top of Alaska, and not make any of it available to any of those people?

Do you really think the Alaskans, who own that gas, and it is State-owned gas, are going to permit the one-third ownership of that 24 to 26 trillion cubic feet to leave that State without meeting those needs?

When we were in Canada—Mr. Blair's proposal was designed to meet first the needs of the Arctic communities.

None of these proposals address the needs of Alaska. None of them. I think that the time is going to come when people are going to wake up to the fact that Alaskans are not going to see the total resources of the State exported without taking care of our needs, too.

We have no industry. We could use this gas as a sort of agricultural base, a petrochemical or pharmaceutical base. Until we see some kind of value added concept for this and a base of meeting Alaska's needs first, I think there will be severe delays.

Even if Congress were to legislate to take the Arctic route, there would be some mechanism for delay of that until Alaskan needs are met.

Mr. Ross. Senator, the Alaskan concerns are obviously paramount and very important.

Alaskan oil is already coming to California. The air pollution consequences of the proposals for transshipment of Alaskan oil across the State of California as presently proposed are the equivalent of the addition of 900,000 more cars in the Los Angeles area.

I think all of the States involved in either the production, the transshipment of this resource have a vital interest.

Senator Stevens. I think we recognize that, and we recognize California doesn't want to be a transshipment point for products going to the other areas of the country.

But I do think that Dr. Cicchetti's analysis and yours are based on a 100 percent export.

Dr. Cicchetti. Senator, one of the statements I made a number of times and I am pretty sure it is in my prepared statement is one of the more compelling arguments for the Alcan Highway is the fact that by going at least half way down in Alaska to the City of Fairbanks, before turning east to Canadian and eastern States for the delivery of the gas, is that Alaska would in fact pick up gas.

I think certainly that is one of the factors that to me at least makes the Alcan Highway worthy of great consideration, because I think Alaska is being put in a position of supplying all of our country's growth in energy, if not making up for some of our shortages without getting any direct benefit, except for dollars.

Certainly the State of Alaska is getting paid. I think what ultimately will have to be decided is what tax might be collected on this gas if in fact it doesn't stay in the State.

Senator STEVENS. We are exploring that, Doctor. I think you might find some new tax theories. We are learning lessons from Mr. Blair.

But even to Fairbanks you are only hitting 10 percent of the Alaskan population. The decision to go to Fairbanks alone with this gas will still leave the whole south central and southeastern populations without gas.

We may have more gas, they are exploring Bristol Bay and other areas, and we would hope you would examine what is going to happen to the gas if there is a smaller deposit of gas discovered in the Bristol Bay or in the lower Cook Inlet or in the GULF of Alaska. Are the economics going to be such that that gas could ever be transported anywhere, even to shore, unless the El Paso route is adopted?

All of those areas would be reachable by short pipelines. Look at what is happening in the MacKenzie Delta. Three trillion cubic feet of gas, minimum, and people say there is not enough gas to transport.

Incidentally, I would urge you to take a look at the Polar route. We were told in Canada that there is already three or four times the potential for the Polar Arctic Islands than there is in the McKenzie River Delta.

The construction of the Polar gas route would bring a surplus of gas into the midwest area. In order to finance the Polar route they would have to have American customers, because just the amount of transportation from the Arctic Islands alone would exceed their total national consumption today.

I think we are running pell mell to decisions that we may not have any control over.

I asked the gentlemen yesterday if they felt that the filing of the Polar gas route application would in fact delay the decision of the NEB on the conflict between the Foothills line and the Arctic line, and the witness said he thought in all probability the NEB would wait and look at that, because the Polar gas route and the Arctic route are mutually incompatible from the point of view of financing.

I appreciate that you are all doing hard work and we are all searching for an answer, but I think sometimes people are looking at the trees and not the forest involved in their problem.

Mr. CICCHETTI. Senator, I would like to ask a question of you, in response, because in trying to determine the solution to this without getting into regional or State differences, one of the issues that keeps coming up in our thinking is the fact that Alaska currently exports LNG from Cook Inlet to Japan.

And in fact to some extent making the argument that we have to get this gas to stay in Alaska that is on the North Slope raises the question whether or not we should examine the exportation.

Senator STEVENS. I am glad you asked that. At the time we discovered the gas field no one would come and make the investment. Only the Japanese agreed to buy it, and they bought it for 20 years at 5 cents a MCF. That was the only way that it could be gathered, because under the law you could not flare it. If you wanted the oil, we had to have a customer for the base. We went out and begged the people of California and other gas consuming States to come and build this plant to take our gas. But everybody had gas coming out of their ears and they wouldn't listen to us.

Now that contract has another 10 years, roughly, to go, and believe me, we don't like to see our gas leaving the country to satisfy long-term contracts, but there was no other alternative.

Let me tell you, currently there are oil wells that are capable of producing in excess of 100 barrels a day on those platforms that are capped because those wells exceed the oil-gas ratio and we have no gathering pipelines to take the gas ashore.

They are being built this summer. And finally California gas utilities have come up and recognized that there is gas in the Cook Inlet.

But don't blame Alaskans for exporting gas. As a matter of fact, just the other way around, my friends, we begged people to come get that gas. Just think, you in effect imply why don't we use that gas, right? The market for that gas is 400 and 500 miles away. It is like having gas in San Diego and telling San Franciscans to come get it in groups of 100 and 150 at a time.

That El Paso pipeline will come through the area where there are very small villages, cities, 150, 500, and they are going to get gas from that line as it goes through.

We don't see any reason to allow Canadian gas to piggy-back our Alaska gas going out through Canada. Why can't we piggy-back our use as the pipeline brings the gas down through our State?

I understand your positions. I think you ought to understand ours. Ours is not one of being opposed to the export of our gas. Ours is one that is opposed to a plan that would exploit our gas, which would not allow us to accommodate the needs of the State.

I begged them, and they have a gas pipeline down, four pumping stations on the oil pipeline route. I begged them to extend that gas pipeline down, to take care of the rail belt in the Fairbanks area. They said no, no, not at all, they wouldn't meet that need, the demand is not high enough.

Well, obviously with the economics involved, the demand may not be high enough to build a pipeline just to satisfy those needs. But we can take a pipeline that goes through the area and built short lines to serve the whole area.

And I think, just as you should have the first claim on your beef, we should have the first claim on gas that the State owns.

This is not Federal gas, offshore gas, it is not on private land, it is State-owned land. I think that before we are through maybe the educational process will mean that some of you will understand we are going to get some rights to use our gas.

I would encourage you to run your computers again on what the seven-eighths of the gas will do for you, because ultimately we are going to use our one-eighth. That will affect your financing of that Arctic pipeline very quickly if you don't have Mackenzie River gas, and mind you, they may not commit their gas for that route.

They may commit to Mr. Blair's route. If Arctic does not have our one-eighth, and does not have the Canadian 2¼ billion cubic feet a day, then the feasibility of the Arctic route is destroyed.

California may well have to decide whether it wants three gasification plants to take what is there, because the small LNG plant is a lot better than a pipeline built to carry almost twice as much as is available.

I hope you understand me; I understand you and as I understand everyone here, I think is an advocate for his point of view, and I think we have to have an advocate, too.

I will yield to my friend from Minnesota who has an ability to be an advocate once in a while, too.

Senator MONDALE. I learned it from you.

I am trying to be the judicial arbitrator.

Mr. Fay, you are the chairman of the Massachusetts Port Authority and also a member of the Environmental Study Board of the National Academy of Sciences, is that correct?

Mr. FAY. Yes, Senator.

Senator MONDALE. You say LNG is one of the most hazardous hydrocarbons now being transported and stored in large quantities in the United States. Is that correct?

Mr. FAY. Yes, sir.

Senator MONDALE. You have testified that present new designs for transportation and storage of LNG have not been adequately tested. Is that correct?

Mr. FAY. Yes. There hasn't really been very much experience, certainly in this country; much less than there has been abroad.

Senator MONDALE. Previously we had been led to believe that LNG was not very hazardous at all. Yesterday I was told this substance was not explosive.

Now I see that this is correct, it is not precisely explosive; however, combustion of vapor from LNG that is released into the atmosphere would be very rapid and would give off intense heat radiation. Is that correct?

Mr. FAY. Yes, sir.

Senator MONDALE. If such spills were to occur in populated areas, particularly, the resulting damage to life and property would be very extensive?

Mr. FAY. That is, I believe, the major problem associated with locating these kinds of facilities in harbor areas, which generally have high-density population near them.

Senator MONDALE. And you testified in your statement which was placed in the record that within a few minutes of a crash with present LNG carriers, 10,000 tons of this substance would be released from a vessel forming a highly combustible cloud of up to a mile in diameter. Is that correct?

Mr. FAY. Yes, sir.

Senator MONDALE. But the carriers proposed by El Paso are about 50 percent larger than any now in use. So the figure would have to be increased proportionately to deal with that proposal?

Mr. FAY. That is right. I used a figure equivalent to one hold of a carrier that would carry about 125,000 cubic meters. I believe El Paso tankers will carry about 175,000 cubic meters.

Senator MONDALE. Now the only thing that could be done with this gas, once it has been released, is to either burn it immediately, which would cause radiant heat damage to people within an area of 3½ miles from the crash, or to let it drift, which could create a hazard to people and property up to 50 miles from the scene of the crash. Is that correct?

Mr. FAY. Yes, sir, under the most disadvantageous meteorological conditions, you could get a combustible cloud that would drift that far.

Senator MONDALE. So once this material has been released, people and property would in all likelihood be endangered, and to a much greater extent if an accident occurred in heavily used waters or near populated areas. Is that correct?

Mr. FAY. Yes.

Senator MONDALE. And with respect to storage, as I understand it, there are potentially severe problems. If there was a failure or an airplane crash or the like, is that correct?

Mr. FAY. I would include among those earthquakes and very high-intensity winds that could damage storage tanks.

Senator MONDALE. And the larger the storage facilities we are talking about the greater the hazard?

Mr. FAY. Yes, and the tanks that are normally designed for these facilities are sufficiently large to take the full cargo of one of those 175,000 cubic meter ships.

Senator MONDALE. Part of the El Paso proposal calls for massive LNG storage facilities at Port William Sound, a major earthquake region. A report of the National Academy of Sciences tells us that during the last earthquake in Prince William Sound in 1964 there was a massive uplifting of the Earth's crust in the sound, measuring up to 38 feet in one spot and up to 50 in another.

What would happen to a LNG storage facility if there were a 50-foot uplifting of the Earth's crust beneath?

Mr. FAY. Well, I would expect you would have a very great likelihood that the storage facility would fail and the LNG would be released.

But a lot depends on the accelerations in the movement of the Earth's crust.

Senator MONDALE. Suppose you had a rupture of one of these large tankers in a major port, while it was unloading. And this LNG gas was released into the atmosphere. And it was ignited by a match or friction or whatever. What would happen to that mass of gas?

Mr. FAY. Well, it would mix with the air and burn at a very high rate. The liquid that would be released would spill out and cover the surface of the water. It boils vigorously, because it is so cold compared to the water, and that forms vapor. When the vapor mixes with air you get a continuous fire, called a pool fire, with a diameter of a half mile or mile, depending upon the size of the pool of LNG.

Senator MONDALE. Would the whole cloud turn into flame?

Mr. FAY. Yes, you would have a fire about a mile in diameter and probably a mile up into the air, and it would burn very vigorously for about 5 minutes, in which case at the end of that time all of the LNG would be consumed.

Senator MONDALE. It is the world's perfect fire bomb, isn't it?

Mr. FAY. Well, it would certainly be a larger and more intense fire than we have ever experienced outside of warfare.

Senator MONDALE. Do you think that the concerns that it might be dangerous are misguided?

Mr. FAY. Under no circumstances. I think that is a very great hazard. People argue that the probability of that happening is so small that we shouldn't be concerned about it.

I think it is more reasonable to consider what would be the consequences of such an accident, and to design and site our facilities in an area where the possibility of that accident happening would have such small consequences that we could stand it.

Senator MONDALE. Thank you very much.

Mr. Ross, in your testimony I understand that California is interested in an Alaska natural gas delivery system that maximizes the likelihood of continued gas exports from Canada.

Is that correct?

Mr. ROSS. That is correct.

Senator MONDALE. And you believe that the Arctic Gas system would offer greater hope in this connection than El Paso?

Mr. ROSS. That is also correct.

Senator MONDALE. And California would tend to favor the Arctic Gas route provided that the western leg were not dropped, as was suggested in the FPC environmental report?

Mr. ROSS. That is also correct.

Senator MONDALE. California also has serious concerns about the hazards of LNG, both from a safety and energy security point of view. Is that correct?

Mr. ROSS. Yes, sir.

Senator MONDALE. Am I correct in understanding that the severity of the safety questions are increased because El Paso proposed a terminal at Port Conception which could increase traffic in an area used extensively for oil and other LNG shipments?

Mr. ROSS. Yes, sir.

Senator MONDALE. Thank you very much.

Mr. Cicchetti, would you consider it a sound investment to spend—I am going to cancel that question.

That is all I have.

Senator STEVENSON. Gentlemen, thank you very much. That concludes the hearing. The record will remain open and we will recess until the call of the Chair.

[Thereupon at 1:55 p.m. the hearing was concluded.]

ADDITIONAL ARTICLES, LETTERS, AND STATEMENTS

THE UNIVERSITY OF TENNESSEE, KNOXVILLE,
Knoxville, Tenn., February 6, 1976.

Senator HENRY M. JACKSON,
Chairman, Committee on Interior and Insular Affairs,
U.S. Senate, Washington, D.C.

DEAR SENATOR JACKSON: I would like to comment on one specific portion of the questionnaire on "Issues Concerning the Transportation of Alaskan Natural Gas," which was prepared for the Committee on Interior and Insular Affairs in January, 1976. My comments apply specifically to section D. Alternatives, item (2), page 6.

My comments are derived from a study directed by me in 1975 entitled "Alaskan Methanol Concept." I have attached a copy of that report, along with a copy of recent correspondence on the same subject addressed to Mr. Thomas Platt of the Senate Staff.

The study was sponsored by the Federal Energy Administration through the Institute for Energy Analysis of the Oak Ridge Associated Universities. The comments are entirely my own, however, and in no way imply an official position by either the Federal Energy Administration or the Institute for Energy Analysis. Specific comments follow.

1. During the past two to three years there has been an upsurge of interest in methanol as a potential fuel supplement in the automotive internal combustion engine market. The term methanol is used interchangeably to mean either methyl alcohol per se, or Methyl Fuel—the latter is a trade name of the Vulcan-Cincinnati Company referring to a mixture of methyl alcohol and smaller percentages of the higher molecular weight alcohols. In this contemplated fuel strategy, methanol might be used as either a blend with gasoline or straight in captive fleets. A successful application in the automotive market might eventually replace 5–15 per cent of the automotive fuel demand. There is still considerable pro and con debate on the engineering, environmental, and economic issues associated with the particular market application. It appears likely that many of these issues may be more clearly defined in the near future by work now underway, e.g. at the Bureau of Mines, Petroleum Research Laboratory, Bartlesville, Oklahoma.

2. An alternative outlet for fuel grade methanol may be as a substitute for number 2 oil in the peaking turbines of the electrical utility industry. From engineering, environmental, and economic viewpoints this particular fuel application appears to be more attractive than would be the automotive application. Under the present national pattern of electrical peak load demands, the potential replacement of petroleum based fuels would be approximately the same as that postulated for the automotive market. If present efforts toward peak shaving are successful, the national demand for peaking turbine fuels would be reduced accordingly.

3. The two preceding comments are pertinent to the potential national demand for a fuel grade methanol that might be produced from Alaskan North Slope natural gas.

4. The presently estimated gross and net production rates for fuel grade methanol from Alaskan North Slope natural gas are shown in the following table, taken from page 61 of the "Alaskan Methanol Concept" report to the FEA.

The national automotive market, at approximately a 10 per cent blend with gasoline, or the electrical utility peaking turbine market as a substitute for number 2 oil in peaking turbines, could absorb the entire Alaskan methanol output in the present decade if that supply were available in the lower 48 states.

[In barrels per day]

	Conversion efficiency (for North Slope synthesis plants)	
	53 pct	61 pct
Gross rate	514,000	592,000
Net rate [1]	364,000	419,999
Net rate [2]	496,000	571,000

[1] Quite conservative case. Uses part of methanol to drive "gas" turbines at all pump stations along Alyeska pipeline, plus distillation losses on a hypothetical homogeneous mixture at Los Angeles. No fuel credits taken for residuals.
[2] Slug flow strategy which eliminates distillation and associated losses at Los Angeles.

5. The engineering state of the art for the synthesis of fuel grade methanol from the Alaskan North Slope natural gas is well in hand and has been for a number of years. The principal problems associated with the synthesis of fuel grade methanol at the North Slope are those related to Arctic construction and operations. These are formidable and should not be underestimated.

6. The alternatives for transportation require considerable further attention. The previously referenced report dealt exclusively with transportation through the Alyeska pipeline along with the contemplated flow of Alaskan crude oil. To be seriously considered, the analysis would require a considerably more detailed study. The owner-operators of the Alyeska pipeline clearly should be participants in any follow on study of this type.

7. The concept of submarine tankers for transport has also been suggested. No analysis of this particular strategy was attempted in the previously referenced study. If an Alaskan methanol strategy is to be seriously considered, the submarine transport strategy should be carefully evaluated along with other potential transportation alternatives.

8. In considering fuel grade methanol as an alternative strategy for bringing the energy content of the Alaskan natural gas to the lower 48 states, a fundamental point should be kept clearly in mind. The various alcohols are the partially oxidized products of their parent hydrocarbons, e.g. methyl alcohol from methane. Thus, there is inevitably an energy penalty associated with the conversion of any hydrocarbon to any alcohol. This comment applies to the analysis of overall energy efficiencies rather than to the mechanism processes themselves.

9. In the evaluation of alternative fuel strategies, careful attention should be given to the questions of engineering processes and operations, environmental issues, economics, and eventual market outlets. In addition, one should give quite careful attention to the "net energy costs" of the proposed alternatives in addition to the traditional pattern of economic cost analyses. This is necessary since price controls and various forms of subsidies may tend to mask the overall relative energy efficiencies of the competing alternatives.

I hope that the preceding comments will be helpful to you and the staff of your committee in their present study. I would be happy to provide additional comments on any of these matters if it would be helpful.

Very truly yours,

CARL O. THOMAS,
Dean for Research.

OFFICE OF THE GOVERNOR,
Indianapolis, Ind., March 22, 1976.

Hon. WARREN G. MAGNUSON,
Chairman,
Committee on Commerce, U.S. Senate,
Hon. HENRY M. JACKSON,
Chairman,
Committee on Interior and Insular Affairs, U.S. Senate

DEAR SENATORS MAGNUSON AND JACKSON: Your invitation to submit written testimony on behalf of the Midwestern states with respect to the Arctic Slope natural gas issue is appreciated. The Midwestern Governor's Conference is made up of the governors of Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, Oklahoma, South Dakota, West Virginia and Wisconsin. In 1972, the governors created a policy advisory committee known as the Task Force on Energy Requirements and Environmental Protection. It is chaired by the undersigned.

The task force began an evaluation of the competing proposals in September, 1974. Its analysis resulted in the following recommendation, which was adopted unanimously by the governors at their annual meeting in July, 1975:

"The Midwestern Governors' Conference favors the trans-Canada route advanced by the Arctic Gas-Northern Border consortium for the delivery of Arctic natural gas to the lower 48 states.

"The trans-Canada proposal would provide natural gas to the Midwest, whereas substantial questions remain as to a favorable impact on the region if the competing El Paso proposal is selected. The trans-Canada route offers greater likelihood of economic and energy efficiency in transporting natural gas than does the competing proposal, which combines movement through a trans-Alaska pipeline with transport by sea to the California coast. The trans-Canada route would appear to involve a lower transportation cost to Midwestern markets, although it should be recognized that transportation costs alone under either proposal will be considerable (in excess of $1 per thousand cubic feet delivered to the U.S.-Canada border or to the California coast).

"The prospect of a trans-Canada natural gas pipeline underscores an earlier recommendation of the Task Force on Energy Requirements and Environmental Protection that the United States and Canada engage in negotiations that will lead to an energy trade agreement between the two countries. Both existing energy relationships and the prospect of bilateral, energy development ventures highlight the desirability of such an agreement. The governors urge the President to move promptly toward an energy trade agreement.

"Either natural gas pipeline proposal would be costly in terms of the demand upon investment capital, tubular steel, and personnel. However, the annual volume of natural gas made available by the construction of the Arctic Gas-Northern Border Pipeline could be about 18 per cent of the 1973 natural gas usage in the 15 Midwest States or 6 per cent of the total U.S. natural gas usage.

"The perspective of proposals calling for delivery in 1980 of Arctic natural gas clearly indicates the need for reaffirmed support of energy conservation efforts, since it is obvious that no one proposal or series of proposals will bring about a short-term solution to the natural gas supply problem. It is important that conservation programs—meaningful in scope—be applied now, while it is still possible to buy time through conservation efforts."

The governors and the task force have continued an active involvement in this matter and our preference for the trans-Canada route remains a priority for this region.

The Arctic Gas proposal will provide direct delivery of natural gas to customers in Canada, the Pacific and Intermountain states and the Midwest. Additional customers in the Midwest, South and East can be served indirectly through the systems of its participating distributors.

Direct distribution in the El Paso proposal is limited to the Western States. El Paso argues that, through exchange and displacement arrangements, other regions would be indirect beneficiaries. However, the task force is not convinced that this would occur, particularly since El Paso's Permian Basin reserves are dwindling. Even the recent Arctic Gas announcement that it plans to terminate the pipeline south of Chicago is of lesser concern because its participating distributors can, in many cases, directly serve the eastern regions. Furthermore, the existing supplies of its distributors, largely originating from the Gulf Coast, are more stable. New gas will augment existing reserves in greater measure than would be the case under El Paso's plans.

The trans-Canada route would be more energy efficient, because there would not be the conversion losses that are involved in El Paso's liquefaction and regasification phases. Fuel consumption associated with supertanker transport likewise would be avoided.

The task force estimates that gas delivered at the United States-Canadian border via Arctic Gas would be 20–30 cents cheaper per thousand cubic feet than gas delivered to California by El Paso. Pipeline delivery to Midwestern users via the Northern Border route would appear to be cheaper than rates associated with the longer routing and displacement concept involved in the El Paso project.

The task force believes that a land route is more secure than one embracing ocean transport. We do not share El Paso's concern that a Canadian route runs the risk of supply interference or interruption. International agreements would be a prerequisite to construction of a trans-Canada route. Indeed, they are progressing favorably at this time. Violating these agreements would not be in Canada's interests because the pipeline would serve Canadian customers and because disruption would jeopardize a tradition of good relations between the two nations. (In 1974, the task force urged that an energy trade agreement between the United States and Canada should be considered as a foreign policy priority).

In recent weeks, we have heard proposals for a third option: a gas pipeline carrying only Alaskan gas to Fairbanks, thence via the Alcan highway to the Canadian distribution system, where it would be transported via the Alberta Trunkline to the United States Markets. Proponents term this option more "buildable" because they argue that it poses fewer problems in routing, less chance of litigation and lower construction costs.

We have substantial reservations about this option. It is rather "ephemeral" in nature; we have no concrete proposal to evaluate. We question the wisdom of postponing an urgently needed national decision to augment our natural gas supplies, based upon a concept that, even in a hypothetical state, appears to have major flaws.

By limiting the source to Alaskan gas, this project removes any incentive for the Canadian government or the Canadian gas industry to participate. The assertion that existing distribution systems in Canada could handle the volumes is a highly questionable one. If additional pipeline capacity is required, the cost-benefit ratio would be materially diluted. Preliminary estimates indicate a higher service cost for this option than for the Arctic Gas-Northern Border proposal. Advocates of the new concept seem to be basing their argument upon a supposition that the reserves on the Arctic Slope are much smaler than Arctic Gas believes them to be. Proof is lacking. Finally, the level of policy change inherent in the adoption of this proposal could snag what appears to be a favorable climate for agreement between the United States and Canada.

There does not appear to be enough promise in this new proposal to justify the delay that would be involved in giving it full consideration.

Although favorable winter weather in many regions may have lulled some into a false sense of complacency, the need to expedite the delivery of Arctic Slope natural gas to the Midwest and other regions of the nation remains a crucial issue. Gas curtailments are retarding economic recovery. Supply projections for the coming years are quite disturbing.

We would urge prompt and favorable action to expedite construction of the Arctic Gas proposal.

Respectfully,

William J. Watt,
Chairman, MGC Task Force on Energy Requirements and Environmental Protection.

Concord, N.H., March 22, 1976.

Hon. Warren G. Magnuson,
Chairman, Senate Committee on Commerce,
Russell Building,
Washington, D.C.

Dear Senator Magnuson: I am informed that you are convening hearings on March 24 and 25 for the purpose of obtaining testimony regarding legislation affecting potential Prudhoe Bay natural gas delivery systems. Because I have made a study of this key energy question, you may be interested in my position—and it is my hope that you will make this communication a part of the hearing record.

I have visited Prudhoe Bay and other hydrocarbon rich areas of Alaska. I am also reasonably familiar with resource development in the North Sea and in other areas of the world. I would first note that bringing the Prudhoe Bay gas to market is the single most important step America can take to help alleviate our energy crisis. There are other steps that can and should be taken, but all of them offer either smaller supplies of energy, or energy on a longer timetable. Therefore, Congress is justified in taking steps to expedite the approval of a system to bring Alaskan natural gas on-stream.

There are presently two systems competing for the right to transport this gas to market. I have personally met with representatives of both Arctic Gas —proposing the all-pipeline system to the west coast, midwest and eastern states—and of El Paso, which proposes a combination pipeline/LNG tanker system for moving the same gas, but to the single destination, southern California.

As a result of my research, I am convinced that the all-pipeline proposal is superior. Arctic Gas has completed voluminous environmental research, whereas the LNG proponents have steadily refused to complete comparable work or file for right-of-way over federal lands with the Department of Interior. The pipeline system could be completed 1–3 years sooner than the LNG system, because its financing plans and capability, its environmental and engineering work are more thoroughly researched and refined.

The Arctic Gas proposal would transport Alaskan natural gas to market for a much lower cost than could the more complicated tanker network—and would use much less of the resource itself than would a system dependent upon pipelining, liquefaction, tanker boil-off and regasification processes.

Neither should our government underestimate the importance of working in cooperation with the greatest friend in the world which America has. The El Paso and similarly devisive Foothills (Mackenzie Delta-only) proposals both rely upon narrow prejudice and misplaced nationalism. It would be tragic if we did not accept the challenge to work with Canada and produce a system whose benefits will accrue to consumers of both nations.

The State of New Hampshire urges you to support the Alaska/Canada pipeline proposed by Arctic Gas.

Sincerely,

MELDRIM THOMSON, Jr.

DEPARTMENT OF COMMERCE,
Lansing, Mich., March 23, 1976.

Hon. WARREN G. MAGNUSON,
Chairman, Committee on Commerce
Hon. HENRY M. JACKSON,
Chairman, Committee on Interior and Insular Affairs

DEAR SENATORS: We in Michigan who are concerned with future energy supplies for our state and the nation are fully convinced that among the most important energy decisions to be made in this country is that on the means and timing by which natural gas from the Alaskan Arctic is brought to the lower 48 states. We contend that the Arctic Gas Project, which would transport gas from Alaska's Northern slope by pipeline across Canada to interconnect with pipeline systems serving the West Coast, the Midwest and the Northeast is the approach which would best serve the needs of this entire country. This project has undeniable advantages, including providing some prospect that the adverse consequences of potential curtailment or discontinuations of exports of Canadian natural gas to the United States may be ameliorated.

It is of vital importance that the uncertainties surrounding Alaskan natural gas be ended at the earliest possible time so as to make rational planning possible and to help control the inflation and delay driven escalation of the cost of the system. Every day or month of delay in the completion of a transportation system for Alaskan gas will make that system more expensive. These cost increases will in turn make the gas eventually transported through that system more expensive to consumers.

Enclosed is a statement on Alaskan gas transportation issues which we commend to the attention of your committees. We request that this letter and the statement be made a part of the record in your current hearings. We fully support and urge early passage of S. 2950 and HR. 11273.
line proposed by Arctic Gas.

Very truly yours,
Sincerely.

DANIEL J. DEMLOW,
MELDRIM THOMSON, JR.
Chairman.

MICHIGAN PUBLIC SERVICE COMMISSION—IMPORTANCE OF ARCTIC GAS TO THE NATURAL GAS SUPPLY FUTURE OF MICHIGAN AND THE NATION

Michigan, and the entire nation, is currently in a very tight natural gas supply situation and the probabilities are for a further deterioration of this situation over the next few years. The natural gas shortfall predicted for this past winter proved to be less severe than anticipated. This is not due to overly pessimistic projections as much as to reduced demand resulting from economic factors and warmer-than-normal early winter weather, plus certain self-help efforts within the natural gas industry such as gas exchanges, spot purchases of gas, and direct purchases by industrial customers from producers. In the long run, however, such temporary measures will not suffice given the continuing decline in the productivity of wells in the nation's historical producing areas and the expected economic recovery. The reduction in demand related to the conservation efforts of homes and industries, whether motivated by patriotic or economic reasons, cannot be counted on to significantly offset future growth in demand based on economic or population expansion, or to offset future natural declines in deliverability from existing gas reserves.

No near-term major relief can realistically be expected from accelerated exploration for gas either onshore or offshore in the lower 48 states. Even if Congress finally acts to deregulate gas prices so as to stimulate exploration, years of lead time are required between commencement of exploration programs and delivery of any resulting gas to the burner tips. Further, gas reserves yet to be discovered in the continguous United States are primarily those which are more difficult and expensive to discover and develop. Examples would be those fields to be found on the outer continental shelf, tight formations in the Rocky Mountains, extremely deep reservoirs, and very small reservoirs such as the reef type oil and gas fields being discovered in Michigan.

A large part of future gas supplies will undoubtedly have to be synthetic gas produced from petroleum liquids or coal. It is probable that there will be very limited growth, if any, in the production of SNG from liquids due to the scarcity or unavailability of liquid feedstock. The developing shortages in this country and in Canada of crude oil and petroleum liquids have acted to limit feedstock availability. High Btu gas synthesized from coal which will be compatable with natural gas is a developing technology of great potential. However, the technology is largely at the pilot plant stage at this time and the soonest that any significant quantities of gas from coal can be expected to be available will be in the early 1980's.

Michigan's geographical position and that of many other interior states makes the prospect of liquefied natural gas (LNG) from such overseas sources as Algeria and Siberia remote at best. Even if significant quantities eventually become available via displacement of gas from coast states, the delivery reliability of such gas will be highly questionable.

More than 10% of Michigan's gas supply comes from Canada. This supply faces curtailment sooner or later, depending on Canada's perception of its own deteriorating gas supply situation. Certainly there is no prospect for increased supplies from Canada for many years, if at all. The most optimistic prediction possible with respect to gas from Canada for the next several years is that existing levels of imports might not be reduced radically or eliminated entirely.

Although this is the most uncertain of times for making accurate predictions as to future natural gas supplies lacking a clear and settled national energy policy, the prospect for natural gas over the next few years appears to be one of ever more severe interstate pipeline delivery curtailments. These curtailments will be accompanied by severe reductions in or complete cessation of gas service to lower priority loads, longer interruptions of interruptible industrial and institutional customers, and the addition of fewer and fewer new gas customers, even for the highest priority uses. There is no place in the state of Michigan where large new industrial customers can obtain gas service from utilities, no matter how urgent the need for gaseous fuel. For five years gas utilities in Michigan have been operating under one type or another of load growth managing gas sales restrictions programs imposed by the Michigan Public Service Commission in order to keep gas demand within the bounds of supply. The Michigan Public Service Commission now has in place for one utility a standby curtailment program establishing a reverse priority system for reduction or curtailment of gas deliveries to existing customers if necessitated by a deteriorating supply situation. This program is the pattern for similar standby programs being developed for the other gas utilities in Michigan. Michigan and other states face the spectre of an unbridgeable gap developing between available gas supplies and the requirements of high priority customers.

The only major prospect for some reasonably early alleviation of the very severe gas reliability problems ahead for this country is that of getting the newly discovered Alaskan North Slope gas to the lower 48 states. Two competing proposals for the movement of this gas are being considered. The Alaskan Arctic Gas Pipeline Company (Arctic Gas), a consortium of U.S. and Canadian pipelines and producers, and El Paso Alaska, a subsidiary of El Paso Natural Gas Company are the contenders. Briefly, the two competing proposals are as follows:

ARCTIC GAS PROJECT

The Arctic Gas proposal calls for the transportation of natural gas produced in the Prudhoe Bay Oil Field of Alaska's North Slope and gas fields in Canada's Mackenzie Delta through a large diameter pipeline across Canada into southern Alberta. There the system would branch, one branch interconnecting at the Saskatchewan-Montana border with a pipeline to be constructed by the Northern Border Pipeline Company would extend across Montana and through the Dakotas, Minnesota, Iowa, Illinois, Indiana, Ohio and terminate in Pennsylvania. Along its route it would interconnect with most of the major gas transmission pipelines in the central and eastern part of the U.S., including all of those serving Michigan. The other branch would extend to Washington Oregon and California. Applications for permits to construct the Canadian portion of this project and certain competitive Canadian proposals are before the Canadian National Energy Board. The anticipated cost of the Arctic Gas Project is about $10 billion. The system will involve about 6,000 miles of pipeline and will take five years to construct.

EL PASO ALASKA PROJECT

The proposed El Paso project would involve the transportation of natural gas from the Prudhoe Bay Field by pipeline across Alaska parallel to the trans-Alaska oil pipeline which is now under construction. The gas would then be liquefied at Point Gravina in southern Alaska for shipment by large cryogenic tankers to Point Conception, a California port north of Los Angeles. The liquefied natural gas (LNG) would then be regassified and distributed to various domestic gas systems, largely in California. This proposal is often referred to by El Paso as the "all American Project" because of the lack of involvement of the Canadians, despite the fact that the LNG would be transported on the high seas. The El Paso project is estimated to cost something over $8 billion and could be constructed in approximately the same time frame as the pipeline project but ultimately would probably move less gas and operating expenses would be higher.

The Arctic Gas Project will obviously require cooperation between the U.S. and Canada since Alaskan gas would traverse Canada to get to the lower U.S. It is our understanding that State Department negotiations with the Canadian government for a treaty guaranteeing the integrity of hydrocarbon transportation systems traversing each country are concluded. The treaty would prohibit such things as diversion or interruption of hydrocarbon movement or oppressive or discriminatory taxation. It should be noted that all of the oil which eastern Canada receives from western Canada passes through the United States, as does half of the natural gas transmitted from western Canada to eastern Canada. Further, much of the overseas oil imported into eastern Canada is off-loaded from tankers in Portland, Maine and travels across Maine to the Montreal and Quebec areas by pipeline. It can thus be seen that Canada is far more vulnerable than the U.S. to any interference with international hydrocarbon transportation systems. We are sure that Canada recognizes that non-interference is in its own self-interest. Further, the long history of transportation cooperation between Canada and the U.S. as exemplified by the St. Lawrence Seaway should alleviate any qualms about Canada's involvement in the pipeline project.

It is plain that Michigan's interests lie with Arctic Gas in the competition against El Paso. We contend that the same is true for most other states including the West Coast states. The Arctic Gas proposal is preferable for the following reasons:

(a) The Arctic Gas proposal assures that a fair share of the gas it transports will be distributed to the Midwest and the East. There is no assurance that any of the Alaskan gas will ever arrive in the Midwest or East via the El Paso approach except possibly by some very nebulous displacement schemes which would probably be unacceptable to West Coast states.

(b) The Arctic Gas project will provide a much lower transportation cost for gas to the Midwest and East than the El Paso LNG scheme.

(c) The existence of an on-going, joint U.S.-Canadian project which would bring Canadian frontier gas to Canadian markets should help postpone the time of termination of Canadian exports to the United States.

(d) The pipeline system would be significantly more energy efficient than the LNG tanker system.

(e) The Arctic Gas project will have a larger ultimate delivery capability than the El Paso Alaska project.

(f) The Arctic Gas pipelines could be in operation before the El Paso project.

(g) The Arctic Gas Project will transport both Alaskan and Canadian gas, thus providing some prospect of new Canadian gas for U.S. markets. The El Paso project obviously offers no such possibility.

Nearly as crucial an issue as that of which of the two proposals is to be approved is the probability of several years of delay in getting the gas pipeline project approved and under construction due to ponderous administrative procedures and almost certain court appeals. It appears that the best hope of avoiding such a costly and potentially harmful delay is a legislative rather than an administrative solution. It was such a solution which eventually moved the trans-Alaskan oil pipeline project off dead center. Senator Mondale (D-Minn.) and a number of co-sponsors including Michigan Senators Hart and Griffin have introduced a bill (S-2950) which would direct the Federal Power Commission and the Department of Interior to issue the necessary permits for the Arctic Gas project. A similar bill (HR-11273) has been introduced in the House by Congressman Ruppe (R.Mich.) and Congressman Bergland (D-Minn.). We fully support these two bills and are urging early favorable action.

THE WILDERNESS SOCIETY,
Washington, D.C., March 25, 1976.

Hon. ADLAI E. STEVENSON,
Chairman,
Subcommittee on Oil and Gas Production and Distribution,
U.S. Senate,
Washington, D.C.

DEAR SENATOR STEVENSON: I want to thank you for having given The Wilderness Society the opportunity to appear before the Subcommittee yesterday and to comment on the Alaska Natural Gas Transportation issue.

I would also like to take this opportunity to comment further with regard to your observation during our appearance that a pipeline through the Arctic National Wildlife Range may be inevitable should there be additional reserves discovered by the United States or Canada in the Beaufort Sea region.

Again, I would emphasize that the Canadian reserves in the High Arctic Islands are more likely to be developed first by Canada in that they approach —independently—economic feasibility in terms of size while the MacKenzie Delta reserves do not. Moreover, should additional Canadian reserves be found in the Beaufort Sea or MacKenzie Delta in the near future, this would only strengthen the economic practicality of a Canada only project along the line of the Foothills proposal.

A most interesting element in this regard is the recent story in the Canadian press stating that the U.S. State Department has asked the Canadian government to delay approval of existing lease applications in the Beaufort Sea. If this were to be agreed to by the Canadians then the only short-term manner in which the MacKenzie reserves could be produced economically would be with the Arctic Gas proposal. If such reports are accurate it would appear as if the State Department were furtively supporting the Arctic Gas project, and perhaps exploiting its future potential.

A primary concern of the environmental community with the Arctic Gas project is the effect such a pipeline would have with respect to future decisions regarding future development in the Beaufort Sea and within the Arctic

National Wildlife Range itself. Oil and gas production within the Range would be as equally objectionable, environmentally, as construction of the pipeline in the Range. Additionally, the environmental problems associated with future Beaufort Sea development have not been fully assessed.

Too, the State of Alaska which holds the leases for the Beaufort Sea has not made a final decision regarding development of these reserves. Furthermore, the State has indicated that should they develop these reserves they would want any transport system to go through Alaska.

Should the Arctic Gas proposal become a reality any future decision regarding production from within the Range or from the Beaufort Sea would be a foregone conclusion. Any policy-maker contemplating such a future decision would merely be faced with a fait accompli, irrespective of any additional adverse environmental consequences. Such a "cart before the horse" approach to the present issue is simply not prudent and I certainly question the Department of State's judgment.

Again I want to thank the Subcommittee for its hospitality and express my personal gratitude to the staff for working out a procedure in what was a sticky situation for us, and which allowed us to participate. If The Wilderness Society can be of any further assistance in this or any other matter of mutual concern please let us know.

Sincerely,

BREC A. COOKE
Alaska Conservation Coordinator.

FRIENDS OF THE EARTH,
Washington, D.C., March 26, 1976.

Senator ADLAI STEVENSON
Chairman, Special Subcommittee on Oil and Natural Gas Production and Distribution,
Russell Office Building,
Washington, D.C.

DEAR SENATOR STEVENSON: I wanted to take this opportunity to thank you for your patient interest and willingness to sit through both sessions of the Alaska Natural Gas Transportation hearings on March 24 and 25. We hope the hearings will help you define the most effective position from which to deal with this complex issue.

I also wanted to reiterate one critical point for the record. We believe it is very important to legitimize the Fairbanks-Alcan Highway Corridor as an alternative right now, even though no applicant has yet applied for this route. Each of the other routes reflects the applicant's preference based on his own self-interest. Congress' evaluation however, must be based on the public's interest. If the issue merits Congressional debate, as most people appear to think, then it is incumbent upon Congress to fully scrutinize all the available alternatives. The system ultimately selected must best meet the nation's needs—at lowest environmental and socio-economic costs. As we stated in our testimony, we do think that a procedural bill could best assure Congressional review of the alternatives, and authorization of any necessary studies.

We would be most appreciative if this letter could be submitted to the record as part of Friends of the Earth's additional comments.

Once again, thank you very much, Senator Stevenson, for the opportunity to present our views. We look forward to working with you in the future on this issue. Please call on us if there is any way in which we can be of assistance.

Sincerely,

PAMELA RICH,
Alaska Liaison.

TENNESSEANS FOR BETTER TRANSPORTATION,
Nashville, Tenn., March 26, 1976.

Senator WARREN G. MAGNUSON,
Chairman, Committee on Commerce,
Russell Senate Office Building
Washington, D.C.

DEAR SENATOR MAGNUSON: As a member of Congress, you are aware of the needless delay in the start of construction in the Alaskan Oil Pipeline. Not until Congress acted, were the senseless court delays stopped. We needed the oil all the time the obstruction of building the oil line was permitted. We need the crude even more now.

The same is true about natural gas. This winter there in presently a shortage of current capabilities to provide for the demand. Interruptions are again occuring in the Northeast this year as in the past. That's why we must not permit unnecessary delay in the construction ofthe natural gas pipeline from Alaska in order to help alleviate this problem of a shortage of natural gas.

The Federal Power Commission should act with all deliberate speed in approval of the gas pipeline route in order to allow planning and construction to get underway. Every day of delay compounds the total cost. Delay will not erase our need for the natural gas. I ask you as Chairman of the Commerce Committee of the United States Senate to see to it that the FPC acts promptly and responsibly. If the FPC does not act promptly, action similar to the Alaskan Oil Pipeline should be taken right away by your committee and the members of Congress. We must not allow needless costly delay to occur again.

Pipelines are a valuable and safe form of transportation.

Tennesseans for Better Transportation is a private, non-profit organization interested in the orderly and safe development of a better transportation system in Tennessee and the nation as a whole. This includes pipelines. We would like to request that our views on this matter be made a part of the hearings of your committee.

TBT urges your support of the earliest possible completion of the Alaskan Natural Gas Pipeline.

Sincerely,

BEN R. RECHTER,
President.

WESTCOAST TRANSMISSION CO., LTD.,
Vancouver, British Columbia, March 18, 1976.

Mr. HENRY LIPPEK,
U.S. Senate Committee on Commerce,
Dirksen Senate Office Bldg.,
Washington, D.C.

DEAR MR. LIPPEK: Many thanks for your telephone message that I was being invited to appear as a witness before the joint hearings of the U.S. Senate Committee on Commerce and the Committee on Interior and Insular Affairs. A letter confirming that invitation was received this morning.

Unfortunately, it was my impression that Mr. Blair had been invited alone as President of The Alberta Gas Trunk Line Company Limited and that it would not be necessary for me to appear representing either Foothills Pipe Lines Ltd. or Westcoast Transmission Company Limited. Having made other commitments, I will not be able to appear on this short notice.

While I would have personally enjoyed participating in the joint hearings, my absence is really of little consequence. Mr. Blair is quite competent to give evidence on any subject I might have covered. Indeed, it was the imagination and engineering skill of Bob Blair that generated many years ago what has come to be the great national debate in this country. In my estimation, my colleague possesses, in the aggregate, more intimate knowledge concerning every facet of this most complicated subject than any other person in Canada.

You will find Mr. Blair's prepared testimony most enlightening and I hope the parties exploit his appearance by vigorous cross-examination because it will be in this respect that full benefit of his knowledge will be gained by the hearings.

Sincerely

EDWIN C. PHILLIPS,
President.

CHICAGO ASSOCIATION OF COMMERCE AND INDUSTRY,
Chicago, Ill., March 19, 1976.

Hon. WARREN G. MAGNUSON,
Chairman, Senate Commerce Committee
Russell Senate Building,
Washington, D.C.

DEAR SENATOR MAGNUSON: The Chicago Association of Commerce and Industry, which represents substantially every major business in the greater Chicagoland area, strongly endorses the Arctic Gas Project and respectfully requests that you give the project your active support.

It is the view of the Association that it is in the national interest that a natural gas transportation system be promptly approved and constructed to transport huge supplies of natural gas from northern Alaska to markets across the nation. The Association believes that the all-land pipeline across Alaska, Canada and the contiguous United States proposed by the Arctic Gas Project is the transportation system which will deliver the natural gas most directly to markets.

The Arctic Gas Project in our view will conserve the most natural gas, transport the gas at a materially lower cost to all parts of the United States, operate in the most environmentally protective manner, and is the transportation system which can be put in operation sooner than alternative systems. We believe that the Arctic Gas Project has substantial advantages over alternative methods of transporting northern Alaska gas. It has many advantages over a pipeline, liquefaction-seagoing tanker-regasification-pipeline system which has also been proposed.

The Arctic Gas Project has applications pending before the Federal Power Commission and the Department of Interior for a right of way across federal lands. However, the time normally required for competitive hearings before the Federal Power Commission suggests that consideration be given to the introduction and passage of legislation to expedite the authorization of the construction and operation of the Arctic Gas Project.

The Association believes that the approval of the Arctic Gas Project is vital to all United States consumers, including American labor and commercial and industrial enterprises.

We respectfully urge your support for the early approval of the Arctic Gas Project.

Yours very truly,

PRESTON E. PEDEN,
Director, Governmental Affairs Division.

STATE OF IDAHO,
OFFICE OF THE GOVERNOR,
Boise, Idaho, March 19, 1976.

Senator WARREN G. MAGNUSON,
Senate Commerce Committee Chairman,
Russell Office Building,
Washington, D.C.

DEAR SENATOR MAGNUSON: It is my understanding that your Committee will be holding hearings on March 24, 1976 with reference to transportation of Arctic gas to the lower 48 states. The Western Governors' Conference has taken a position that favors the transportation by ship. I would, however, like to suggest that you give consideration in your deliberations to the question of future inflationary increases.

To transport gas by ship would subject that primary product to the escalating inflationary costs of labor, the cost of operation of ships and the depreciation costs of ships, plus whatever fuel would be a component part of that package. For instance, if there was a continuing inflation rate of 7 percent per year, those costs would double in 10 years.

In assigning the capital costs for an overland pipeline route, the initial costs would be set with the completion and would be depreciated over the normal period, probably 35 years, and those costs would not be subject to inflationary pressure. Only those normal maintenance expenses which incur labor costs would be subject to the inflationary factor.

Thank you, Senator, for making this question a part of your considerations.

Sincerely,

CECIL D. ANDRUS,
Governor.

NEW YORK GAS GROUP,
New York, N.Y., March 19, 1976.

Senator WARREN G. MAGNUSON,
Senator HENRY M. JACKSON,
Washington, D.C.

DEAR SENATORS MAGNUSON AND JACKSON: This letter is written in connection with joint hearings of the Senate Commerce and Interior Committees scheduled for March 24–25. These hearings have been called to discuss the various proposals for bringing Arctic gas to the 48 contiguous states. We ask that this letter be placed in the record of the hearing.

On behalf of the 14 member companies of the New York Gas Group who serve nearly all of the gas consumers of New York State, I wish to express our support of the Arctic Gas system to bring these vast new Alaskan natural gas supplies to this area.

Two competing proposals are now before the Federal Power Commission and have now also become a Congressional, as well as a State issue. They are: (1) the all-overland Arctic Gas pipeline system from Prudhoe Bay, Alaska, through Canada directly to major U.S. markets, and (2) a complex pipeline-liquefaction-tanker-regasification system proposed by El Paso Natural Gas Company, which lands the gas in California and relies upon a tenuous and complicated displacement and excess capacity theory to bring some of the gas to the midwest and east. We understand, too, that a new proposal involving methanol conversion has recently been proposed.

After thorough study, the companies comprising New York Gas Group, in March of 1975 unanimously endorsed the all-land Arctic Gas method as the superior proposal, and the only one capable of bringing substantial quantities of Alaskan gas to New York State consumers. We took this position because studies showed the Arctic Gas system would bring gas here more reliably, at less cost and with substantially less waste in the transportation process. Furthermore, the other method would have the ultimate effect of causing the industrial east and midwest to continue to depend solely upon declining southwest gas fields, instead of achieving a connection to the fresh new supplies of Arctic gas.

Significantly, most of the major gas transmission companies from California to the Atlantic seaboard, except El Paso, support the Arctic Gas project. Those companies, including two which serve New York, also have been working out purchase agreements for virtually all of the gas of the major Prudhoe Bay producers.

Right now, efforts to secure endorsements from public and private groups are being made by the State of Alaska on behalf of the El Paso project. Within recent weeks an Alaskan official has even written a letter to persons having previously expressed interest in State of Alaska Royalty Gas. That letter makes it unmistakably clear that Alaska will sell no gas to those who do not support the other proposal. This circumstance adds to our concern that approval of that other project would be at the expense of New York and other consuming states.

We ask your help in achieving the earliest possible resolution of the issue involved. Without the earliest infusion of new supply from Alaskan reserves the present grave gas supply shortage will escalate to chronic crisis proportions.

Your attention is invited to the Inclosure, which details the reasons for the superiority of the all-pipeline delivery system.

Respectfully,

THOMAS A. GRIFFIN, JR.,
Chairman.

Enclosure

[*Memorandum*]

To: Executive Committee
From: Nyplan Arctic Gas Study Task Group
Through: The Planning Committee
Re: Recommended Plan for Alaskan Gas

At the request of the Executive Committee, and in response to an inquiry of NYPSC Commissioner Roth, June 17, 1974 and reported to PSC Chairman Kahn August 8, 1974, the Planning Committee (NYPLAN) appointed a Task Group to study the development of Arctic gas and recommend the position which New York distributors should take on this subject. The report of the Study Group gives an over-view of the areas where gas has been found and reviews the two more active proposals for bringing this gas south.

On February 20, 1975 NYPLAN adopted the basic recommendation of its Study Group: that the N.Y. Gas Group endorse the Arctic Gas Project to bring Alaskan gas to major U.S. Market areas, including the East, via pipeline. Additionally the Study Group and NYPLAN recommend active support of the project, by intervention at hearings and other appropriate action which may be requested from time to time. We expect a letter from Arctic Gas suggesting helpful action we might wish to take.

The Task Group report points out that, in the event that the El Paso plan wins Government approval (to transport Alaskan gas as LNG to the West Coast) N.Y. Gas must insist that a portion of that LNG be shipped directly to the East Coast and not rely on a vague displacement procedure.

Although not a formal recommendation, NYPLAN felt that consideration could be given to joining the Arctic Gas Project, with N.Y. Gas as a whole buying a share. This membership question is also discussed in the Arctic Group's letter.

Of greater concern to NYPLAN was consideration of acquiring existing and/or future gas reserves. It is true that two suppliers to New York companies are members of Arctic Gas, so that N.Y. Gas members and other gas companies in the State stand to get some of the Alaskan gas, directly or indirectly. And, no one thought N.Y. Gas should take action to secure supplies that would result in these supplies costing more than might otherwise eventuate. Still, we should concern ourselves with reserves. One possible way would be to assist the two suppliers along the lines NYPLAN's Native Gas Ventures Task Group is currently pursuing with prospective partners or co-venturers in other areas.

Looking to the somewhat longer term future, as further gas reserves are developed onshore in the Alaskan Gulf Coast area, offshore in the Gulf of Alaska and from Naval Petroleum Reserve District #4, New York must make certain that it receives its fair share of this gas from the Federal domain. Gas from the first two areas will have to be transported as LNG, wherever it goes. This means that it can be brought to the East Coast at a competitive cost. Gas from District #4 could be brought to the U.S. market areas, including New York, by the Arctic Pipeline system.

New York Gas Group Planning Committee Report—Recommended Plan for Alaskan Gas

(Prepared by Arctic Gas Study Task Force: A. W. Amurgis, Columbia Gas; R. B. Catell, Brooklyn Union; D. W. Lindstedt, St. Lawrence Gas; P. Cantline, Chairman Central Hudson)

Summary

This report recommends endorsement of the Arctic Gas Group Project to bring Alaskan gas to the Eastern United States via pipeline. It also recommends informing the Arctic Pipeline Project of New York Gas Group support and willingness to intervene in their behalf at public hearings.

These recommendations are made for the following reasons:

1. The Arctic Gas pipeline system delivers gas to New York at the lowest overall cost

2. It promises to make more gas available, both from better transportation efficiencies and because it would deliver gas directly to New York.

In the event that the El Paso plan wins Government approval, New York Gas should insist that a portion of the LNG be shipped directly to the east coast.

Assignment

The Executive Committee of the New York Gas Group, at its July 23, 1974 meeting instructed the Planning Committee "to: a) study the various Arctic gas projects; b) prepare an assessment of the advantages and disadvantages of each; c) make recommendations to EXCOM regarding the advisability of adopting a position expressing a preference; d) rank the projects in order of benefit in terms of gas supply to New York State . . .; e) recommend a preferred project; and f) discuss the relative merits of NYGG joining one or more of the Arctic project groups."

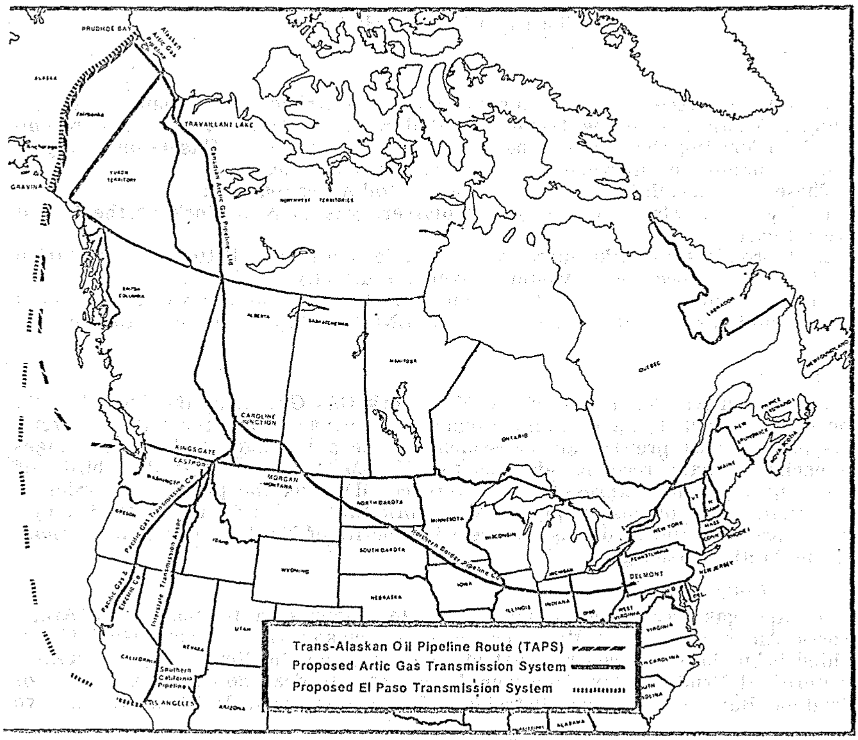
Introduction

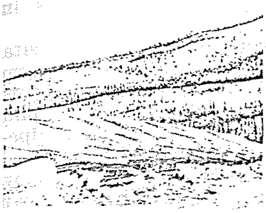
Oil and gas have been found in sizable amounts in four areas of Arctic North America. Two of the areas are in Alaska: the Alaskan Gulf Coast, which is in the south central part of the state, and the North Slope, currently centered at Prudhoe Bay. However, large deposits are known to exist west of Prudhoe Bay in the Naval Petroleum Reserve District. In Canada, the two regions are the Mackenzie Delta and Canada's Arctic Islands northeast of the Mackenzie Delta. The following two maps show, in a general way, the location of the producing areas and possible pipeline routes to the south. The Alaskan Gulf Coast has been producing oil and gas for approximately ten years. It is anticipated that additional production will be found near the coast and on the continental shelf in the Gulf of Alaska. The continental shelf may have reserves as large as those on the North Slope.

The area of Alaska which drains northward to the Arctic Ocean has been known to have oil and gas deposits since the 1920's when the western portion of hte area was set aside as Naval Petroleum Reserve District #4. To the east, in the area around Prudhoe Bay, large reserves of æoil and gas have been found. The oil is the largest pool which has been discovered in the United States since the early 1930's. The gas reserves proven to date are estimated at 26, TCF. As the geology is relatively simple, it is not difficult to estimate reserves. Because the North Slope gas is associated with oil, it will be necessary to have large scale oil production before it will be known how much gas will have to be reinjected into the sand to maintain oil production and the quantity which can be released for pipeline sales.

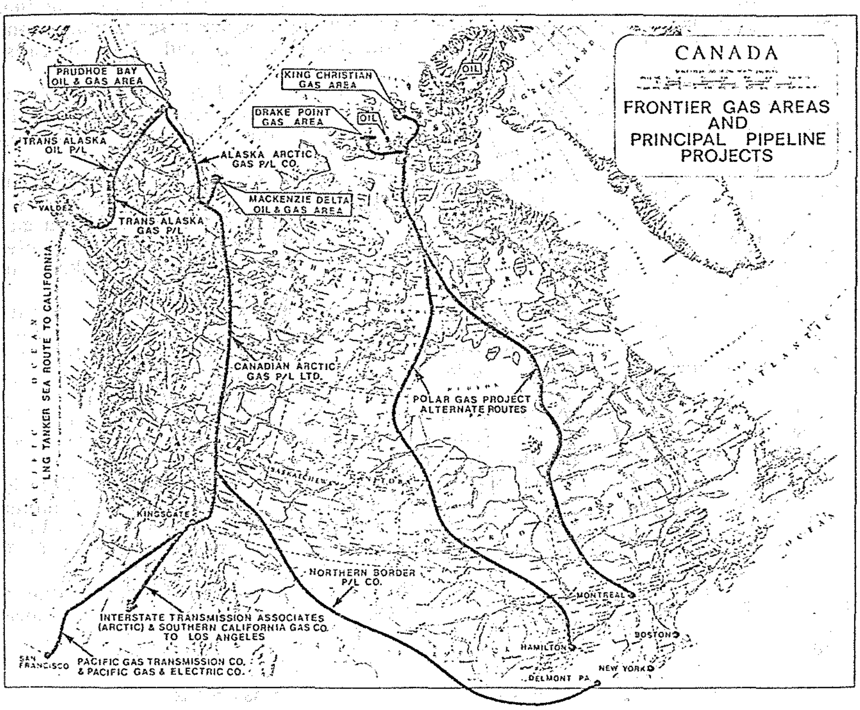
In Canada, 375 miles east of Prudhoe Bay, is the Mackenzie Delta gas field. Independent studies estimate discovered reserves to date at 7 TCF. Operators in the Delta claim 10–15 TCF. It is estimated that 15–20 TCF would be required to justify building a pipeline to transport exclusively Mackenzie gas southward to connect with existing pipelines in Alberta. The geology in the Delta area is complex, making it difficult to estimate reserves and making dry holes more probable than in the Prudhoe Bay area.

Eight to nine hundred miles northeast of the Mackenzie Delta are the Arctic Island discoveries. Gas reserves approximating 12–15 TCF have been discovered to date. It is estimated that 25–30 trillion will be needed to justify a pipeline. Because the islands are situated so much further to the east and the shortest water crossings are on the eastern sides of the islands, a separate pipeline system is required to bring the gas to southern Canada or the United States. Plans to bring this gas south are awaiting further discoveries. An active drilling program is continuing in the region.





Gas Pipeline Projects in Alaska and Canada ... *A Current Size-Up*



A.G.A. MONTHLY/November 1974

Proposed Prudhoe Bay Gas Transportation Systems

Two competing systems have been proposed to bring gas down from Prudhoe Bay. One is the Arctic Gas pipeline project. The other is a proposal by El Paso Natural Gas Company to transport gas by LNG tankers from Alaska to the west coast. For both proposals, the Federal Power Commission and the Department of the Interior Bureau of Land Management will jointly study the environmental impact on public land use.

The Arctic Gas Group proposes construction of pipelines from Prudhoe Bay and the Mackenzie Delta to the west and east coasts of the United States by a new pipeline system. It would connect with existing Canadian pipelines in Alberta for delivery of gas to eastern Canada.

Advantage is taken of a common pipeline for delivery of Mackenzie Delta and Prudhoe Bay gas to southern Canada and the United States. From Canada, two pipeline connections are planned to serve the west coast. A new pipeline is proposed from the border eastward to Pennsylvania where it would connect with major existing pipelines. This is called the Northern Border Pipeline.

The system proposed by the El Paso Natural Gas Company carries gas by pipeline from Prudhoe Bay 800 miles across Alaska to Point Gravina near Valdez on the Alaskan Gulf Coast. The pipeline would be constructed mostly within the "utility corridor" set aside for the Trans-Alaskan Oil Pipeline. At the terminus of the pipeline, the gas would be liquefied in an eight-train liquefaction plant.

The LNG would be transported by eleven tankers of 165,000 cubic meter capacity to receiving and gasification facilities to be located at Point Conception (Los Angeles area), California. Two parallel pipelines 142 miles long would be constructed between Point Conception and a proposed tie to the existing Pacific Gas and Electric facilities at Arvin, California. One line 105 miles long would be constructed from Arvin to Cajon, California to link the Alaska gas system to the existing Southern California Gas Company pipeline. Gas is proposed to be available to markets east of California by displacement of gas committed to the Southern California Gas Company and El Paso transmission systems.

The following tables were prepared to put into perspective the relative cost of each plan excluding well head gas costs. Table I is a summary. Table II gives unit costs for each segment of the plans making it possible to develop delivery costs for selected volumes to the east and west coasts.

Case 1 is the Arctic Gas Group plan for a pipeline system all the way down from Alaska to the east and west coasts of the United States. This analysis retains in Canada all gas originating there and delivers all of the Alaskan gas to the U.S. except that required for transportation energy along the route. This is the least expensive and most efficient of the plans to bring Alaskan gas to the lower 48.

Case 2, El Paso West, is the proposal of the El Paso Natural Gas Company. It includes the cost of idling the capacity in the existing Texas to California system and the cost of transporting displacement gas from Texas through Northern Natural Gas and Panhandle Eastern pipeline systems to eastern markets.

Once the gas is liquefied, we asked the question "Why deliver all of it on the west coast and depend on a tenuous trans-continental displacement procedure to make gas available in eastern markets? Why not bring some of the gas through the Panama Canal to existing east coast LNG terminals?" This is Case 3, El Paso East. The tankers are sized to fit the locks in the Panama Canal. It would take 71 ships to bring all of the gas to the east coast. Obviously, this would not be done; one third to one half would be dropped off on the west coast.

Case 4, El Paso Gulf, brings LNG to the Gulf Coast where it is introduced into existing pipeline systems. Surprisingly, this procedure requires more energy and entails a greater cost than bringing the gas to the east coast as a liquid.

TABLE I.—SUMMARY—NEW YORK ALTERNATIVES FOR ALASKAN GAS

[In cents per thousand Btu]

Case	Name	1973 tariff [1] ex fuel	Efficiency, percent	Fuel cost, percent wellhead	Total mileage
1	Gas Arctic	88	91	10	4,400
2	El Paso West	134	85	18	5,400
3	El Paso East	195	82	21	8,900
4	El Paso Gulf	202	81	24	9,600

[1] This is an illustrative tariff for comparison purposes only.

TABLE II.—NEW YORK STATE ALTERNATIVES FOR ALASKAN GAS

Case	Name	From—To	1973 tariff [1] excluding fuel ¢/MBtu	1973 investment, $G (or unit cost, ¢/MBtu 100 mi)	Efficiency, percent	Fuel cost, percent of Wellhead ¢/MBtu	Distance: Pipeline s. mi.	Distance: Shipping n. mi.	Distance: Shipping s. mi.	Distance: Total s. mi.	Ships: No.	Ships: Size, m³
1	Gas Arctic:											
	CAGPL	Prudhoe—Montana	55	5.7	94.2		2,600					
	Northern Border	Montana—Pennsylvania	30	1.8	96.5		1,600					
	Transmission	Pennsylvania–New York State	3	(1.5)	99.6		200					
			88		90.5	10.4	4,440			4,440		
2	El Paso West:											
	El Paso	Prudhoe—California	100	5.6	87.9		800	1,900	2,200		11	165,000
	Idling	Texas—California	13	(2)			700					
	Displacement	Texas—New York State	21	(1.5)	96.6		1,700					
			134		84.9	17.8	3,200		2,200	5,400		
3	El Paso East:											
	LNG Shipping	Prudhoe—Maryland	190	10.2	82.9		800	6,800	7,800		71	72,000
	Transmission	Maryland—New York State	5	(1.5)	99.4		300					
			195		82.4	21.4	1,100		7,800	8,900		
4	El Paso Gulf:											
	LNG Shipping	Prudhoe—Louisiana	181	9.7	83.3		800	6,400	7,400		66	72,000
	Transmission	Louisiana—New York State	21	(1.5)	97.2		1,400					
			202		81.0	23.5	2,200		7,400	9,600		

[1] This is an illustrative tariff for comparison purposes only.
[2] ½ of 700 mi at 1.5¢/MBtv·100 mi at 40% load factor=½ (7×1.5)/0.40=13.

To obtain total cost of gas per million B.T.U. delivered to New York State, add an assumed well head price to the third column of Table I. This column is headed "1973 Tariff ex Fuel, ¢ ÷ MBtu". To this sum, add the product of the percentage in next to the last column, which is entitled "Fuel Cost, % wellhead ¢ ÷ MBtu", times the assumed well head cost. For example, if the assumed well head price is 10¢ per million B.T.U. for Case 1, the solution is: 88¢ + 10¢ + (10% × 10¢) = 99¢ per million B.T.U. transported to New York State. For Case 2, using the same well head price, gas delivered to New York would cost $1.458 per million B.T.U. In Case 2, it was assumed that some expense would be allocated to the idled pipeline capacity between Texas and California. This is shown on the second line of Case 2 in Table II.

It should be noted when comparing Case 1 with Case 2, that as the well head price of gas goes up, the cost of delivering gas goes up in a disproportionate amount for Case 2 as its transportation efficiency is lower.

Since the tables were prepared, the Arctic Gas Group has filed exhibits with the Federal Power Commission which indicate higher delivered gas costs than shown in our tables. However, the difference in cost between plans remains about the same. Our example shows a difference in cost of 47¢ between the plans, and the Arctic Gas representative stated that his "Company's prices would be 30 cents to 50 cents cheaper than those offered by the El Paso project".

The cost of bringing gas to the east coast by Case 3, using the 10¢ per MCF well head price, is $2.07. As this is double the cost of Case 1, it should not be considered unless the El Paso project is approved. In the event the El Paso project is approved, this plan represents the best way of assuring deliveries to New York. In addition, it gives an illustration of the cost of bringing Alaskan Gulf gas to the east.

POLITICAL CONSIDERATIONS

El Paso calls its plan the "All American". It is favored by the people in Alaska, and by the Alaskan government. The tax base of an 800 mile pipeline, and the income from a large liquefaction plant would provide a long term source of income in the state. El Paso hopes to use the oil pipeline right of way for its pipeline. El Paso would also use much of the environmental impact information developed for the oil pipeline. Another plus from the Alaskan point of view if that this route would make gas available to the City of Fairbanks. The United States has settled the Alaskan native claims at a cost of nearly one billion dollars. All told, El Paso does not anticipate much in the way of legal delays in building a pipeline across the state and a liquefaction plant on an unsettled site on the Alaskan Gulf Coast. El Paso may have difficulty siting an LNG receival terminal on the coast of California near Los Angeles.

The Arctic Gas Group's overland project will not do much for Alaska. The Alaskan portion of the Gas Group pipeline goes through a wildlife preserve requiring a permit that will be much more difficult to obtain. Canada has yet to settle her native claims. Based upon the size of the Alaskan settlement, the natives will push for a substantial settlement. A permit for a right of way through the Northwest Territories will be required from the Department of Indian and Northern Affairs. The procedures for obtaining the necessary permits in the Province of Alberta and in the lower 48 states will be time consuming and arduous. However, procedures and precedents have been established for pipeline construction and arbitrary delays are not anticipated. The fact that a Mackenzie Delta pipeline coming down through Canada alone has doubtful economics gives impetus to Canadian approval of a joint pipeline project.

Other than fear of adding to inflation by the tremendous amount of money which would be spent in Canada and to some extent creating a boom-bust-situation in the Mackenzie valley, the Canadians, and especially those in the northwest, will favor this project, as they will see the long range benefits it can bring to the region. One of the benefits would be an all weather road all the way to the Delta. This road would make accessible mineral deposits which currently cannot be worked for lack of transportation.

The Arctic Gas Group will not own the gas in its pipeline. They will act as a contract carrier at fixed rates plus the gas needed for transmission purposes. El Paso likewise will act as a contract carrier.

In general terms, it appears that the construction time for both of these projects will be about the same to completion which will be some time after 1980. In the meantime, Canada, although prudently withholding her reserves for use in Canada, might well be willing to exchange Prudhoe Bay reserves to be delivered at a later date for Mackenzie Delta or even gas from the Province of Alberta, which could precede the completion of the pipeline to the Mackenzie Delta. Currently, there is talk of such an exchange in crude oil. As Canada has had to refuse additional sales of gas and oil, she probably would be agreeable to an exchange arrangement in the hope that it would improve her deteriorated relationship with the United States.

ARCTIC GAS PROJECT MEMBERSHIP

Of the nine United States pipeline and utility companies that are in the Arctic Gas Project, two serve areas in New York State both directly and indirectly. They are Columbia Gas Transmission and Texas Eastern Transmission. Texas Eastern, in addition to serving New York distributors directly, also supplies Columbia Gas Transmission and 25% of Consolidated Gas Supply Corporation's annual sales.

RECOMMENDATION AND SUMMARY

We recommend that the New York Gas Group support the Arctic Gas Project primarily because this plan is the most efficient way to bring Alaskan gas to the east coast. Using a well head gas cost of 10¢ per million B.T.U., this plan delivers gas at two thirds of the cost of the El Paso plan. Any increase in the well head price increases the differential. Likewise, as the Arctic Gas Plan is more efficient, it will deliver 7% more gas. It appears that either plan could be brought into complete operation in about the same time span.

As pointed out, it may be possible to reduce the initial delivery time for the Arctic Gas Plan by exchanging Canadian gas now for Alaskan gas later. In addition, the Arctic Gas Plan delivers gas directly to the east rather than by displacement through a roundabout procedure.

It is recommended that NYGG contact the Arctic Gas Project Group to inform them of our support of their project, and ask them how they would like our support to manifest itself. For example, do they want us to intervene at any hearings? Although we are not necessarily committing any money at this time, are they looking for anybody to join the project? From this liaison, which should be on going, NYGG would become more knowledgeable about reserves which may become available in the future.

If the El Paso Project is approved, arrangements should be made to bring LNG directly to the east coast. Because of the popularity of the El Paso Project in Alaska, it could well win approval in Washington. This makes it that much more important that the New York companies express a preference for the Arctic Gas Project, and actively intervene in its behalf. New York must make a strong stand for its fair share of gas from the Public Domain in Alaska including that found in the Gulf of Alaska. The gas from here would have to come east as LNG.

ATTACHMENTS

Attached is a copy of an article giving further information which appeared in the November 1974 issue of The American Gas Association Monthly by Charles R. Hetherington, CEO of Pan-Arctic Oil, Ltd. entitled "Gas Pipeline Projects in Alaska and Canada".

Editor's Note: A coordinated presentation of the various frontier gas projects proposed and underway in Canada and Alaska and how they may affect the availability of gas in New England is given in this article. It is based on remarks by Charles R. Hetherington, president and CEO of Panarctic Oils Ltd., presented at the Gas Utility Managers' Conference of the New England Gas Association in Kennebunkport, Maine, in September 1974.

The principal frontier areas of gas are: (1) the Canadian East Coast offshore, (2) the MacKenzie River Delta, including adjacent offshore Beaufort Sea, (3) the Canadian Arctic Islands, including offshore channels, and (4) Alaska and offshore areas.

Offshore the eastern coast of Canada, the oil and gas industry has expended over $300 million on exploration with limited success. Discoveries of some oil and gas have been made on and near Sable Island some 175 miles offshore Halifax, Nova Scotia.

No plans are in progress to pipe gas from this area to the mainland even though many still think that Canada's East Coast offshore has great potential, particularly in very deep water.

When discoveries are made, they will lie closer to the eastern coast of Canada and the United States than any other frontier supplies. They should be readily marketable.

In Alaska, gas from the Cook Inlet area is already being produced and liquefied for shipment to Japan. But as we all know, the real interest lies on the North Slope of Alaska where huge oil and gas reserves have been discovered at Prudhoe Bay.

Natural gas and some oil have been discovered in the adjacent Mackenzie Delta area of Canada as well as in the Canadian Arctic Islands which lie a thousand miles to the northeast.

POTENTIAL RESERVES

The potential for gas reserves that may be discovered in these areas has been estimated by a number of authorities.

Potential gas reserves in the Arctic Islands have been estimated at 90 to 260 Tcf, Alaska/North Slope at 100 to 366 Tcf and the Mackenzie Delta from 65 to 95 Tcf.

The Arctic Islands constitute by far the largest potential, having the largest areal extent and volume of geologically prospective sediments.

These potential reserves, however, have yet to be discovered, and much money and exploration must be involved before these potentials can be realized. Good discoveries have been made in all three of these areas, and there is reasonable expectation that large reserves will eventually develop.

These frontier areas may be expected to produce 300 to 500 trillion cubic feet (Tcf) which exceeds remaining United States gas reserves of 250 Tcf and amounts to one-third to one-half of the estimated United States potential gas supply of 1,100 Tcf.

NORTH SLOPE OF ALASKA

The North Slope of Alaska has the largest presently proved reserve of over 26 Tcf. This gas is contained principally in the Prudhoe Bay oil field as gas cap and solution gas in the oil. A few smaller discoveries are productive of non-associated gas.

Finally, after many years of delays, the trans-Alaska oil pipeline (Alyeska Pipeline Service Company) is getting under way with preliminary work and with pipe laying to commence this winter for first operation in 1977.

When the oil pipeline is completed and oil is marketed, the solution gas in the oil will also be produced and separated from the oil in the Prudhoe Bay field.

It is unlikely that conservation authorities will allow this gas to be flared, so it must either be compressed and reinjected into the formation or sent to market through a gas pipeline. At least initially, the gas will be reinjected until questions of oil conservation are decided and decisions are reached on competitive pipeline marketing projects.

Alaska gas is sour—that is, it contains up to 10% carbon dioxide and hydrogen sulfide which must be removed if the gas is to be marketed. This will involve huge processing facilities.

All in all, a great many things must be done, and favorable decisions must be obtained before North Slope Alaska gas can be brought to market.

MACKENZIE DELTA

Exploration in the Mackenzie Delta area of Canada adjacent to the Alaskan North Slope has been very active, and nine gas and six oil discoveries have been made.

One of these discoveries lies offshore in the Beaufort Sea in shallow water and was drilled from a man-made island dredged up from the ocean floor.

The presently proved gas reserves of the Mackenzie Delta have not been made known publicly, but various estimates made in the absence of complete information place the figure at only a small fraction of the Alaska reserves.

It is generally considered that the minimum threshold reserve required to support the economic viability of a pipeline project out of Alaska and the Mackenzie Delta is 25 to 30 Tcf. It is believed that there is this volume of gas presently proved in these two areas. So, the reserve requirement for a pipeline out of these areas would seem to be satisfied.

It would also appear that the reserve in Alaska is adequate to support a pipeline out of Alaska alone. However, there is not sufficient gas at present in the Mackenzie Delta to support a major pipeline out of this area based on Canadian gas alone.

The exploration programs in the Mackenzie Delta are continuing at an active pace, and substantial new discoveries can be expected to be made. Six more artificial islands are being built in the shallow water of the Beaufort Sea where seismograph data indicate prospects for oil and gas.

ARCTIC ISLANDS

Exploration has also been very active in the Canadian Arctic Islands. Over $300 million has been spent on exploration to date. Six major gas fields have been found, and oil has been encountered at several locations with one very encouraging oil discovery.

Here again, information on presently proved reserves has not been made public. Here the threshold reserve required to support a pipeline outlet is 20 to 30 Tcf, depending upon what size project is finally decided upon. It has been indicated that the presently known six fields could produce up to one-half of this threshold reserve.

In the Arctic Islands, a technique has been developed for drilling offshore wells using conventional drilling rigs supported on artificially thickened pads of ocean ice. This spring, one successful gas well was drilled in 425 feet of water 8 miles from shore using this method.

With exploration expenditures in the Arctic Islands ranging from $70 to $90 million annually and with this ability to drill low cost offshore exploration wells from the ice, it is to be expected that threshold gas reserves will be obtained at an early date.

PIPELINE PROJECTS

There are three principal projects for delivering gas from the frontier areas of Alaska, the Mackenzie Delta and the Arctic Islands to markets in Canada and the United States.

The Arctic Gas Pipeline System contemplates deliverying both Alaskan and Mackenzie Delta gas to markets in Canada and to both the western and eastern United States.

The trans-Alaska pipeline project of El Paso Natural Gas Company contemplates delivering Alaska gas to the ice-free port of Valdez where the gas would be liquefied and transported to markets in the Pacific Northwest and California by LNG tankers.

The Polar Gas Project contemplates transporting gas from the Canadian Arctic Islands to eastern Canada and the United States.

ARCTIC GAS PIPELINE SYSTEM

The Arctic Gas Pipeline System is by far the most all-encompassing and costly project presently being planned. It is also the largest gas pipeline project ever considered in the world and consists of five segments of the Arctic Gas Pipeline System: (1) pipeline in Alaska, (2) pipeline through Canada, (3) pipeline to the eastern United States and (4) the new trunk pipelines to northern and (5) southern California.

Major looping would be required in the Pacific Gas & Electric Company system in northern California and in the Southern California Gas Company system. The overall project is estimated to cost almost $8 billion in terms of today's dollars.

In Canada, two principal authorizations must be obtained—a permit dealing with environmental matters and land use from the Department of Indian and

Northern Affairs and permits from the Government of Canada based on recommendations to be made by the National Energy Board.

Hearings in the first application are presently in progress and will involve sittings in native communities throughout the North. There is a question of aboriginal rights of the Indian in northern Canada which is becoming entangled in the pipeline hearings.

The Arctic Gas Pipeline System contemplates delivering both Alaskan and producers who are devoting much effort and energy to see this project to fruition. It is the most advanced of the three major projects.

The prospects however for the Arctic Gas Pipeline System are clouded by uncertainties as to gas supply. If the production of Alaskan gas is delayed or if El Paso's trans-Alaska gas pipeline project is successful, the Alaskan gas would not be available for the Arctic Gas Pipeline System through Canada, and at least at this time, there is not sufficient gas in the Mackenzie Delta to support this major project on Canadian gas alone.

SUGGESTED PROJECTS

In view of this gas supply situation, other smaller pipeline projects are being suggested out of the Mackenzie Delta area. One project is designated as the Maple Leaf Pipeline. It is a smaller pipeline from the Mackenzie Delta and connects existing pipeline facilities in northern Alberta about 1,000 miles in to the south.

Another possibility of Mountain Pacific Pipe Line Company involves a smaller diameter pipeline from the Mackenzie Delta through British Columbia or possibly connecting into the pipeline facilities of Westcoast Transmission Company near the British Columbia-Yukon border some 800 miles to the south.

This certainly indicates that gas will eventually be available from the Mackenzie Delta via one means or another, probably in the 1980s.

EL PASO TRANS-ALASKA GAS PIPELINE

El Paso Natural Gas Company states that studies completed in 1972 established that Alaskan North Slope gas could be delivered to United States markets through facilities located entirely within the United States at about the same cost as a pipeline system bringing this gas through Canada.

There is no question that this gas is needed to supplement declining energy supplies in the United States, and El Paso maintains that keeping the gas in the U.S. would favor the U.S. balance of payments and would eliminate uncertainties in foreign energy sources. It could be implemented far sooner than any other plan.

El Paso maintains that the transportation of natural gas through Alaska will stimulate the development of Alaska's rich mineral deposits along the pipeline route and adjacent areas with increased employment and tax base within Alaska.

Public announcements would seem to indicate that the State of Alaska supports keeping its gas within the state. Whichever way one views the El Paso Alaska project, it must be considered a serious competitor to the Canadian-Arctic Gas Pipeline System.

Authorizations must be obtained from the Federal Power Commission, the Department of the Interior, the Environmental Protection Agency and various Alaskan authorities. Massive plants and ships must be constructed so that at best one would expect that this project would follow the planned 1977 completion of the trans-Alaska oil pipeline by a year or so, giving the possiblity of first deliveries in the early 1980s.

An previously noted, Prudhoe Bay gas will initially be reinjected into the reservoir. A second oil line paralleling the trans-Alaska oil pipeline presently in progress may even be constructed before a gas line is built out of the North Slope of Alaska, so that gas from this area may not come until the mid-1980s.

POLAR GAS PROJECT

The Polar Gas Project was formed with the aim of investigating a pipeline and order modes of transportation to deliver substantial quantities of natural gas from known reserves in the high Arctic to markets in Canada and the United States.

Principals participating in the project are TransCanada PipeLines Limited, Canadian Pacific Investments Limited, Panarctic Oils Ltd., Tenneco Oil & Minerals, Ltd., Texas Eastern Transmission Corporation and Pacific Lighting Gas Development Company, each with a major interest in purposeful and orderly development of the natural gas resources of the Canadian Arctic Islands.

The challenge facing Polar Gas is to devise a means of economically moving trillions of cubic feet of Arctic Islands natural gas reserves over 3,000 miles southward and across up to 150 miles of Arctic Ocean channels without seriously damaging terrestrial, aquatic or human environments.

At present, two main alternative routes are under consideration—one to the east of Hudson Bay through the Province of Quebec and the other down the west side through Manitoba and Ontario.

As part of its overall research program, Polar Gas is also investigating complementary modes of transportation which have been proposed to transport energy from the Arctic Islands.

However, the major thrust will be toward a large diameter pipeline system offering the most economical and efficient means of transporting large volumes of gas over the distances involved.

The Polar Gas Project is not really competitive as such with the projects from Alaska and the Mackenzie Delta. The Polar Gas Project depends upon separate gas reserves and there is adequate market for the gas from both areas.

Only if the projects from both of these areas matured at about the same time would there be problems in obtaining financing, construction equipment and materials; priorities would then have to be determined to see which project proceeded first.

The Polar Gas Project is gearing its research studies to the progress made in discovering gas reserves in the Arctic Islands with view to applications to regulatory authorities in 1976 and first deliveries in 1980.

EFFECT ON U.S. MARKETS

The El Paso Project to take Alaskan LNG to the West Coast contemplates that these additional supplies could be made available throughout the United States by substitution through making more western United States gas available for the main pipeline transmission companies supplying the midwestern and eastern United States.

The Canadian Arctic Gas Project contemplates a United States extension to near Pittsburgh, which would cross essentially all of the main pipelines supplying the midwestern and eastern United States, including the pipelines of Texas Eastern Transmission Corporation and Tennessee Gas Transmission Company which supply New England.

The Polar Gas Project probably offers the best prospects for additional gas supplies for New England—Vermont Natural Gas Company already buys some small quantity of gas from TransCanada Pipelines.

Arctic Islands gas will provide increased supplies for TransCanada, so that Vermont may benefit from this source. TransCanada PipeLines also delivers gas to Tennessee Gas Transmission Company at Niagara where Tennessee Gas Transmission provides the transportation from Buffalo to Boston.

Tennessee Gas Transmission also has a loop connection from Mercer, Pennsylvania, via New York City to Connecticut, connecting onto its Buffalo line at Boston. Any gas made available to Tennessee Gas Transmission Company offers the possibility of increased supplies to New England through this loop system.

Any additional supplies of gas provided to Texas Eastern Transmission Corporation offer possibilities of increased supplies to New England through the Algonquin Pipeline System.

NATIONAL WILDLIFE FEDERATION,
Washington, D.C., April 5, 1976.

Hon. WARREN G. MAGNUSON,
Chairman,
Senate Committee on Commerce,
Russell Senate Office Building,
Washington, D.C.

DEAR SENATOR MAGNUSON: The National Wildlife Federation appreciates the invitation to comment upon S.2950, S.3167, and S.2778, bills relating to methods of transporting natural gas from the Prudhoe Bay Field in Alaska to the contiguous 48 States, and asks that this letter be made a part of the record of the current joint hearings being held by your Committee. This letter is also being sent to Senator Jackson, Chairman of the Senate Committee on Interior and Insular Affairs. Attached is a resolution which this organization adopted on the subject in 1975. This resolution makes it clear that the National Wildlife Federation does not oppose the use of Alaskan natural gas; rather, our prime concern is for minimizing environmental damage and threats to human safety.

S.2778 would require an all-American, or trans-Alaskan route. S.2950 authorizes and directs the appropriate Federal agencies to issue the necessary permits for construction of the Alaskan natural gas pipeline across Federal lands in Alaska and Canada. S.3167 authorizes the President, with Congressional review, to select the gas pipeline route.

After reviewing S.2950 and S.3167, we find that both are objectionable in that they negate the essential processes required by provisions of the National Environmental Policy Act. The process established by NEPA is designed to bring out into public scrutiny all of the factors relating to a particular project, with alternatives, before a decision to proceed is made. NEPA also provides for judicial review, a process which would be suspended by Section 3 of S.2950 and Sections 9 and 11 of S.3167. To us, it is highly important that this process be carried out in this major Federal action, both for the information it will reveal and because of the precedent to be continued. Significant amounts of money and effort already are invested in assessing these factors. They must be given due consideration and attention.

We believe it would be premature for the Congress to make a decision until the Federal Power Commission completes its review and offers its conclusions in a final environmental impact statement. We also think it would be premature to reach a decision because what could be the cheapest and environmentally least damaging route, that generally following the Alcan highway, has not been studied in detail. Even though none of the bills under consideration by the Committee would authorize the so-called Alcan route, and no gas company has applied for approval of it, this alternative has been given favorable treatment by both the Federation Power Commission in its draft EIS, released in November, 1975, and by the Department of the Interior in a study released in December 1975. Testimony has indicated that the estimated costs of the Arctic proposal through Canada and the Trans-Alaska proposal of El Paso are about the same, as is the time of construction. However, comparable information is not available on the so-called Fairbanks route, even though it would appear to be even less costly.

We also believe the Committee, in considering these bills, should investigate the international questions which are involved. What obstacles must be overcome to gain Canadian approval for any gas transmission system involving that Nation?

Only when all of the information is available will the National Wildlife Federation reach a conclusion on which of the various routes would be preferable from the environmental point of view.

Sincerely,

THOMAS L. KIMBALL,
Executive Vice President.

Enclosure.

[Resolution No. 17]

NATURAL GAS TRANSMISSION IN ALASKA

Whereas, an estimated 26 trillion cubic feet of natural gas reserves have been discovered associated with oil resources now being developed at Prudhoe Bay, Alaska; and

Whereas, utilization of these resources by the Nation is of a high order of priority and inevitability; and

Whereas, the National Wildlife Federation has a deep concern for the potential environmental impact of the several alternative proposals now before the U.S. Department of the Interior and the Federal Power Commission and is examining available information related thereto; and

Whereas, available information relating to the full range of alternatives is lacking, but is available for both the Alaskan and conterminous state routes as proposed by Arctic Gas Company, the latter of which parallels existing lines primarily after entering the Lower 48 States, thus providing a basis for judgment as to environmental impacts following several years of operation of the existing lines; and

Whereas, utilization of the natural gas component of the Prudhoe Bay fields is indicated as an energy conservation measure by virtue of ongoing crude oil exploration; now, therefore, be it *Resolved*, That the National Wildlife Federation, in annual convention assembled March 14–16, 1975, in Pittsburgh, Pennsylvania, hereby urges prompt, specific and definitive assessments of environmental impacts of all alternatives; and be it further:

Resolved, That, until such information is available, the National Wildlife Federation will consider, without endorsement, only that route which presents: 1. adequate pre-project environmental assessments which provide a basis for judgment from the standpoint of environmental impact; 2. provides the most efficient and hazard-free method of transportation; 3. assures maximum conservation of energy; and 4. meets the broadest national interest consistent with environmental safeguards.

MARITIME TRADES DEPARTMENT,
AMERICAN FEDERATION OF LABOR AND
CONGRESS OF INDUSTRIAL ORGANIZATIONS,
Washington, D.C., April 9, 1976.

Hon. WARREN G. MAGNUSON,
Chairman,
Senate Commerce Committee,
Dirksen Senate Office Building,
Washington, D.C.

DEAR MR. CHAIRMAN: The AFL-CIO Maritime Trades Department (MTD) favors the all-United States, trans-Alaska route to bring Alaskan natural gas to the "lower forty-eight" states because it will provide more employment for American workers, more tax dollars for the U.S., and greater U.S. control over resources than would the trans-Canadian route.

Representing forty-three national and international unions with a combined membership of 8 million workers, the MTD is concerned with protecting both the American worker and American resources.

It is estimated that the trans-Alaska project would provide 345,000 man-years more employment than the trans-Canadian route—a margin of 85 percent. The Alaska route would maximize American employment and further stimulate the U.S. economy, since its sponsors are committed to procuring all possible goods and services within the U.S., whereas the Canadian project would allow billions of dollars worth of equipment to be purchased in Europe and Japan.

American approval alone is necessary to begin building the trans-Alaska project; the trans-Canadian route requires both Canadian and American approval, opening the way for snags and delays. Whereas Alaskan native claims are already settled, Canadian native claims have not yet been negotiated and Canadian environmental litigation threatens as well. The longer the project is postponed, the more it will cost, and Americans will be deprived of both jobs and energy.

It is estimated that the trans-Alaska project would provide $9.3 billion more in taxes to the U.S. than the Canadian alternative. If the Canadian route were used, the American consumer would pay more than $7 billion (based on present schedules) in Canadian taxes; no Canadian taxes would be paid by Americans if the Alaska route is approved. On the Alaskan pipeline-plus-wate route, additional tax revenue would be realized from the employment of U.S.-flag tankers and the resulting shipboard and shipyard jobs. (Once the natural gas is liquefied, tankers would carry it from Alaska to ports in the lower 48 states.) When the tax advantage of the Alaska route is considered, there is no significant transportation cost advantage for either project.

It must also be noted that the U.S. Coast Guard has reported that LNG (liquefied natural gas) shipment is among the safest of seagoing operations. There has not been a single spill in the more than twelve years that LNG has been shipped; no spills in over 14,000 deliveries.

Since the trans-Alaska project will utilize the existing utility corridor of the Alaska pipeline with its established haul roads, work pads, camps, and equipment, it involves less interference with the environment than the alternative Canadian route. It will also utilize the idle capacity in existing interstate pipeline systems. The trans-Canada route would require 5,500 miles of pipe, much of it in new corridors.

To avoid costly delays, Canadian politics and regulation, to assure U.S. employment and resource control, the Maritime Trades Department urges approval of the all-United States trans-Alaska route.

Sincerely,

PAUL HALL,
President.

NATIONAL AUDUBON SOCIETY,
Washington, D.C., April 16, 1976.

WARREN G. MAGNUSON,
Chairman,
Senate Commerce Committee,
Senate Office Building,
Washington, D.C.

DEAR MR. CHAIRMAN: I would like to submit for the record the following comments on the administration's bill regarding Alaskan natural gas pipelines, S. 3167. At the time I testified before the Joint Committees, the bill had just been introduced and I had not yet had time to study it in detail.

As I indicated in my testimony, we believe that the procedural approach taken by the bill is preferable to the approach taken by S. 2950 which mandates a specific route and almost immediate construction.

We believe that the Fairbanks-Alcan corridor deserves consideration as an alternative, and now that Northwest Pipeline Corporation has announced an interest in building a pipeline along this route, this would seem to make this alternative even more viable.

Another alternate means of transporting North slope gas to markets in the lower 48 states surfaced during the hearings. In testimony presented by Westinghouse Electric Corporation the methanol approach was discussed as a viable system.

Although we realize that this approach represents a new and different form of gas transportation and there may not be time to consider it for the gas supply now being considered, we still believe this possible alternative should be investigated so that it could be utilized in the future.

We hope that the Committee will set forth the various alternatives in its bill, including the Fairbanks corridor and methanol, and direct the Interior Department or the Federal Power Commission to contract for independent studies to gather the necessary additional information to evaluate all the alternatives.

We recommend that Section 9(b) be struck from the bill. We are opposed in principle to the waiver of Sec. 102(2)(c) of NEPA. Further, as worded this section could be interpreted as requiring that a separate impact statement on an alternative, such as the Fairbanks corridor, would have to be prepared. We believe that there is sufficient flexibility in CEQ's procedure to accommodate alternatives, such as the Fairbanks route, through a supplemental statement to those already prepared rather than an entirely new statement. We are sure that the Council on Environmental Quality would be glad to work with the Committees to assure the efficient implementation of NEPA in the most rapid manner consistent with the law.

We also strongly urge that Sec. 8, Congressional Review, be rewritten to spell out more clearly the role of Congress. Although it is obviously the intent of the bill to allow Congress to disapprove the President's decision, the nature of the "congressional action" which would take place is not clear. For instance, would both Houses have to reject the recommendation, or would rejection by the House or the Senate be sufficient to send the decision back to the President? We believe that either body, by a simple majority vote, should be able to reject the decision.

Section 10(b) provides that the Secretary and other federal officers "may waive any procedural requirements of law or regulations which they deem desirable to waive in order to accomplish the purposes of this Act." We are opposed to this sweeping usurpation of the whole body of federal law which has been enacted to protect the environment. For example, this language would permit the Secretary to waive the Endangered Species Act, the Migratory Bird Treaty Act and countless other important statutes. While we appreciate the desire to provide for prompt action, nothing justifies this sweeping language.

Finally, we are opposed to the waiver of judicial review in Section 11 and urge that this section be struck.

Thank you for considering our views.

Sincerely,

CYNTHIA E. WILSON,
Washington Representative.

ALASKAN ARCTIC GAS PIPELINE CO.,
Washington, D.C., April 7, 1976.

Hon. WARREN G. MAGNUSON,
U.S. Senate,
Russell Senate Office Building,
Washington, D.C.

DEAR SENATOR MAGNUSON: Recently you received a letter from Senator Mondale on behalf of S.2950, which he has introduced. This bill would require prompt permission to construct the Arctic Gas Project: a natural gas pipeline from Prudhoe Bay in Northern Alaska, across the Arctic coastal plain, across West-Central Canada, and to markets in Western, Midwestern and Eastern states.

The importance of this legislation is obvious. As you well know, we need to develop new energy sources in order to ensure a continued supply, to lessen our dependence on foreign energy (mainly OPEC oil), to protect against unconscionable price increases, and to reduce foreign exchange outflow.

There are about 24 trillion cubic feet of proven gas at Prudhoe Bay (over 10 percent of the nation's proven gas reserves), and there is a potential in Northern Alaska of from 100 to 175 trillion cubic feet of gas. Those who have sponsored S.2950 have done so, I believe, because they believe the Arctic Gas pipeline is the most secure, economical, environmentally sound, energy conserving and realiable method of transporting this essential fuel to energy hungry markets in the "lower 48". Another good reason for this bill is that the Arctic Gas pipeline would carry gas from the Canadian Arctic areas to southern Canadian pipelines, which supply over a trillion cubic feet of gas a year to the United States.

Enclosed is a chapter from a Rand Corporation Report, commissioned by the California State Assembly and published in December, 1975. In the report, Rand compares the proposed Arctic Gas Project system with a system proposed by El Paso Gas, which would deliver Alaskan natural gas to California by means of LNG tankers.

Since, under the El Paso system, *all* Alaskan gas would be delivered initially to California, California is the point of comparison that would show the El Paso proposal in the most favorable light. Despite this, the Rand study, basing its conclusions on five criteria—cost, reliability, timeliness, safety and environmental effect—states that the Arctic Gas Project's all-pipeline transportation system would be of greater benefit to California than the El Paso system. It goes on to state that the Arctic Gas system would provide greater benefits to the country as a whole—with particular emphasis on cost and supply benefits—than would the El Paso system.

The issue is, of course, a complex one. We are eager for you to have the full benefit of all available information so please contact me if you have any questions.

Sincerely yours,

WILLIAM W. BRACKETT,
Vice Chairman.

Enclosures.

1914

Arctic Gas

R A N D S T U D Y

COMMISSIONED BY

THE CALIFORNIA STATE ASSEMBLY

A SUMMARY

Major discoveries of natural gas at Prudhoe Bay on the North Slope of Alaska exceed 10 percent of this country's existing reserves - 24 trillion cubic feet - and additional major findings are expected in northern Alaska.

Two methods of transporting this gas to the "lower 48" are currently under consideration: The Arctic Gas pipeline (with a design capacity of 4.5 billion cubic feet per day) to carry natural gas through Canada directly to residential, commercial and industrial markets throughout the contiguous 48 states (in addition to carrying Canadian gas to Canadian pipelines which export gas to the United States); and, the El Paso Natural Gas system which would transport only Alaskan gas, by a smaller pipeline to the South Coast of Alaska, where it would be liquified for loading onto tankers, then shipped to California and re-gasified for transmission to markets.

Both Arctic and El Paso have applications for authorization before the Federal Power Commission. Both are the subject of legislation currently being considered by Congress. The question: which alternative proves superior when such facts as costs to consumers, timeliness, reliability, energy savings and effect on the environment are taken into consideration.

Alaskan Arctic Gas Pipeline Company / 1730 Pennsylvania Avenue, N.W., Suite 230, Washington, D.C. 20006 / (202) 331-0933

A WORD ABOUT THE MATERIALS TO FOLLOW

In 1973, the Energy Policy Subcommittee of the Committee on Planning and Land Use of the California State Assembly commissioned the Rand Corporation to identify and analyze the energy issues facing California.

One issue studied by Rand: given the fact that the Northern Slope of Alaska is expected to become one of the primary sources of natural gas for U.S. consumers, which of the two proposed alternative transportation systems for delivering the gas to the lower 48 would best serve the interests of the people of California.

For its answer, Rand compared the all pipeline Arctic Gas system proposed by the Alaskan Arctic Gas Study Project and the Trans-Alaskan pipeline liquefaction LNG tanker regasification pipeline system proposed by the El Paso Gas Company.

California is the point of most favorable comparison for the liquefaction-tanker system, since all the Alaskan gas would be initially delivered to California. Nevertheless, Rand, after extensive study, concluded that the Arctic Gas proposal is superior for California. It is clear that the advantages to other states in the lower 48 would be even more significant.

The following materials include a summary of the pertinent chapter of the Rand report, and a copy of the chapter itself. After the quotations in the summary, you will find references to pages in the attached copy of the chapter.

AN OUTLINE SUMMARY OF CHAPTER SEVEN

OF THE RAND REPORT ENTITLED:

"ENERGY ALTERNATIVES FOR CALIFORNIA"

Chapter seven from the Rand Study compares the proposed Arctic Project system and the proposed El Paso Trans-Alaska system. It utilizes five criteria for determining which fuel delivery system would most benefit the people of California (page 87) which may be paraphrased as follows:

COST - Which system will provide an adequate supply of gas at the lower price?

RELIABILITY - Which will be more reliable; less subject to major disruption?

TIMELINESS - Which of the two systems will be ready to go into operation first?

SAFETY - Which is the safer system?

ENVIRONMENTAL EFFECT - Which will be most compatible with the environment?

COST

"The Arctic Gas system appears to have both lower direct and indirect costs than the Trans-Alaska Gas system." (page 91)

Rand states:

> *"Direct costs are the transporation costs associated with each system. Indirect costs are the costs to California consumers if higher cost sources of gas displace lower cost supplies because of exchanges among companies or national allocations of gas supplies."* (page 87)

In addition to the lower initial costs of the Arctic Gas Project, Rand also finds, with regard to the reduction of unit transportation cost as a result of expansion of the system, that

> *"this reduction is likely to be less with the Trans-Alaska (i.e. liquefaction-tanker) Gas system. ... Initial expansion of the Arctic Gas system requires only the addition of some companion stations and pipeline segments."* (page 88)

As to a central feature of the tanker system, Rand concludes:

> *"The Arctic Gas system avoids the major cost and regulatory problems associated with the large-scale displacements created by the Trans-Alaska Gas system."* (page 91)

Rand also concludes:

> *"Over the long run, these states (Midwestern and Eastern) would receive less gas and have to pay a higher price for it with the Trans-Alaska gas system."* (page 90)

RELIABILITY

"In summary, the Trans-Alaska Gas system is vulnerable to more kinds of disruptions than the Arctic Gas system." (page 92)

In the analysis of the reliability of the proposed El Paso Trans-Alaska system, the report finds:

> *"Because it traverses the active earthquake zone across Southern Alaska and because of its LNG link, the Trans-Alaska Gas system would be vulnerable to a substantially greater variety of disruptions. A major earthquake in Southern Alaska could put the pipeline, liquefaction plant or loading facilities temporarily out of commission. (page 92)*

Rand examines the claim sometimes made against Arctic Gas that transportation across Canada will be disrupted and finds it "unlikely":

> *"The Arctic Gas system appears to be subject to only one other vulnerability. Conceivably, the Canadian Government could disrupt the flow of gas into the United States. Such a possibility appears to be unlikely. An agreement between the two governments permitting oil and gas to travel in bond across either country is likely to be formally announced soon. Moreover, most of the oil currently consumed in the provinces of Ontario and Quebec is transported to these provinces across U. S. territory. If Canada halted or diverted the shipment of Alaskan gas to the United States, it would be highly vulnerable to both a retaliatory disruption of these oil supplies by the United States and other appropriate countermeasures." (page 92)*

Recognizing there are unknown risks in either proposal, Rand discusses various known risks of interruption and concludes:

> *"Preliminary evidence does, however, suggest that the Arctic Gas system would be more reliable and that coping with the possible disruptions associated with it would be easier for California consumers, distributing companies and regulatory agencies." (page 93)*

TIMELINESS

"All factors considered the Arctic Gas system appears to be advantageous here." (page 94)

In coming to this conclusion, the report considers the following factors: the more extensive studies prepared by the Arctic Gas Project; the possibility of delays in constructing the liquefaction facility and the LNG tankers; the more likely financing delays with the El Paso Trans-Alaska project and the need for Canadian approvals of the Arctic Gas Project. Rand states:

> *"In sum, there may be differences in the time when each system could initiate deliveries to California. These differences, if they do exist, should not exceed 18 months. All factors considered, the Arctic Gas system appears to be advantageous here. ... There may be some differences between the time each system could expand beyond its present design capacities, the Arctic Gas system having a clear advantage." (page 94)*

SAFETY

"Safety is primarily a consideration with the LNG shipments associated with the Trans-Alaska system." (page 94)

Rand observes that the history of transporting natural gas through pipelines has a *"good record of safe operations"* while:

> *"...spills of LNG which can result from several causes pose serious safety problems particularly if the spill is or becomes a large one ... if the probability of a major LNG accident is related to the frequency of arrivals (as is normally assumed) the Trans-Alaska Gas system would substantially increase it." (page 94)*

ENVIRONMENTAL EFFECT

"The adverse environmental effects associated with each system in California are local, typically minor and often temporary." (page 95)

Rand finds no significant damage to the California environment when they study the comparative effects of the construction and maintainance of each system.

PARTICIPANTS IN ARCTIC GAS PROJECT

Arctic Gas

UNITED STATES COMPANIES AND AREAS THEY SERVE:

Columbia Gas Transmission Corporation
serves customers in the District of Columbia, Kentucky, Maryland, New York, Ohio, Pennsylvania, Virginia and West Virginia

Michigan Wisconsin Pipe Line Company
has market areas in Illinois, Iowa, Kansas, Michigan, Missouri, Ohio, Tennessee, and Wisconsin

Natural Gas Pipe Line Company of America
(a subsidiary of Peoples Gas Company)
serves customers in Illinois, Indiana, Iowa, Kansas, Missouri, Nebraska, Oklahoma, Texas, and Wisconsin

Northern Natural Gas Company
markets gas in Colorado, Illinois, Iowa, Kansas, Michigan, Minnesota, Nebraska, and South Dakota

Pacific Gas and Electric Company
is the San Francisco and northern California supplier which participates through a Canadian affiliate

Pacific Lighting Gas Development Company*
through affiliates, serves customers in central and southern California

Panhandle Eastern Pipe Line Company
serves customers in Illinois, Indiana, Michigan, Missouri, and Ohio

Texas Eastern Transmission Corporation
delivers gas in Alabama, Arkansas, Illinois, Indiana, Kentucky, Louisiana, Mississippi, Missouri, New Jersey, New York, Ohio, Pennsylvania, Tennessee, and Texas.

CANADIAN COMPANIES:

Gulf Oil Canada Limited
Imperial Oil Limited
Shell Canada Limited
TransCanada PipeLines Limited
Union Gas Limited

Alberta Natural Gas Company Limited
Canada Development Corporation
Northern and Central Gas Corporation Limited
The Consumers' Gas Company

*Northwest Energy Company, which will receive gas and also assist in delivering gas to Pacific Lighting, serves customers in Arizona, Colorado, Idaho, Oregon, Utah, Washington and Wyoming.

Alaskan Arctic Gas Pipeline Company / 1730 Pennsylvania Avenue, N.W., Suite 230, Washington, D.C. 20006 / (202) 331-0933

ENERGY ALTERNATIVES FOR CALIFORNIA: PATHS TO THE FUTURE

PREPARED FOR THE CALIFORNIA STATE ASSEMBLY
WITH SUPPORT FROM THE ROCKEFELLER FOUNDATION

WILLIAM AHERN, RONALD DOCTOR, WILLIAM HARRIS,
ALBERT LIPSON, DEANE MORRIS, RICHARD NEHRING,
JAMES DEHAVEN, MORLIE GRAUBARD, DAVID JAQUETTE,
ALLEN LEE, WILLIAM MOOZ, RICHARD SALTER, KATHLEEN WOLF

R-1793-CSA/RF
DECEMBER 1975

Rand
SANTA MONICA, CA. 90406

PREFACE

This report presents the results of a Rand study aimed at identifying and analyzing energy policy issues facing the State of California. The major results are presented in a companion Executive Summary, *Energy Alternatives for California: Paths to the Future*, R-1793/1-CSA/RF. The work was begun in September 1973 at the request of what was then the Energy Policy Subcommittee (chaired by Assemblyman Charles Warren) of the Committee on Planning and Land Use of the California State Assembly. Additional funds to support the project have been provided by the Rockefeller Foundation and Rand itself.

The primary purposes of the study were to identify the major energy issues affecting California, to assemble relevant factual information bearing on these issues, to define the key alternatives that the state could pursue, and to discuss the implications of these alternatives for state energy policy. Because of the interrelationships among key issues, considerable emphasis was placed on developing a coordinated state policy response.

We emphasize California's particular interests in our analyses of the issues, but within the context of broader national interests. Where the two may conflict, we have sought to develop alternatives that reconcile state and regional interests with national ones.

The report is divided into four parts. The first provides an overview of the California energy system. This part focuses primarily on a description of past and future sources and uses of energy in California to the year 2000 (Chap. 2). Past and future sources of oil and natural gas are treated in more detail in a forthcoming supplementary report, *Oil and Gas Supplies for California: Past and Future*, R-1850-CSA/RF.

The second part of the report addresses nine energy supply issues: West-East oil movement (Chap. 3), offshore oil and gas development (Chap. 4), a northern California deepwater port (Chap. 5), liquefied natural gas (Chap. 6), gas transportation from the North Slope of Alaska (Chap. 7), natural gas regulation (Chap. 8), natural gas allocation policies (Chap. 9), electricity generation (Chap. 10), and the development of alternative energy sources (Chap. 11).

The third part analyzes issues of energy use and conservation. Conservation measures are examined in the transportation sector (Chap. 12), the residential sector (Chap. 13), the commercial sector (Chap. 14), and the industrial sector (Chap. 15).

In the final part, the implications of three different scenarios of California's energy future, each of which incorporates a different set of policy actions, are described and discussed (Chap. 16). Various institutional alternatives for formulating and implementing state energy policy are examined in Chap. 17. The conclusions and recommendations of the study are presented in Chap. 18. Supporting material for some of the individual chapters is presented in the appendixes.

The conclusions and recommendations presented are those of the authors of this report. Ronald Doctor was the project leader of this study until his departure from Rand to join the California Energy Resources Conservation and Development Commission in February 1975; William R. Ahern was also a principal in the study until his appointment to the staff of the California Assembly Committee on Resources, Land Use, and Energy in March 1975.

Chapter 7

GAS TRANSPORTATION FROM THE NORTH SLOPE OF ALASKA

CONTEXT

The North Slope of Alaska is expected to become one of the primary sources of natural gas for U.S. consumers after 1980. All assessments of potential national natural gas resources consider it to be an extremely promising area for future discoveries. In the Prudhoe Bay field alone, 26.0 trillion ft^3 of natural gas reserves have already been confirmed, an amount constituting more than 10 percent of current U.S. gas reserves. Additional major discoveries in the next five to ten years are considered to be highly probable. Despite the anticipated importance of North Slope gas, no means of transporting it to U.S. markets currently exists or is under construction. Two applications to construct gas transportation systems from the North Slope were filed with the Federal Power Commission (FPC) in 1974. A map showing the two proposed systems is given in Fig. 7.1.

The Arctic Gas system application is the proposal of a twenty-member consortium of U.S. and Canadian petroleum producing, gas transmission, gas distribution, and financial corporations. Both of the two major gas distribution companies serving California are members of this consortium through their subsidiaries or affiliates. The Arctic Gas consortium proposes a pipeline system with two initiating branches, a 490-mile-long one from the North Slope and a 145-mile-long one from the Mackenzie Delta in the Northwest Territories. (Other corridors from the North Slope to the Mackenzie Valley than the one proposed could be used.) The two would join south of the Mackenzie Delta and would move 1300 miles up the Mackenzie River valley into Alberta with a 48-inch-diameter pipeline having a design capacity of 4.5 billion ft^3/d. In southern Alberta, the Arctic Gas system would split into branches serving three basic destinations. The first would move gas into the existing Trans-Canada pipeline system, serving Canadian consumers in Ontario and Quebec. The second would move gas into the proposed Northern Border pipeline, serving U.S. consumers in the Midwest and East. The third would supply gas to an expanded Pacific Gas Transmission pipeline system serving northern California and to the proposed Interstate Transmission Associates (Arctic) pipeline serving consumers in southern California and the Pacific Northwest. Because initial deliveries to California may not exceed 800 million ft^3/d, the original proposal for initial capacity to California is being scaled down. The natural gas shipped through the Arctic Gas system would be produced in both Alaska and Canada. All gas originating in Alaska would be consumed in the United States. Natural gas produced in Canada in excess of long-term Canadian requirements could also be exported to the United States through the Arctic Gas system.

The second application, the Trans-Alaska Gas project of the El Paso Natural Gas Company, proposes a combined pipeline-liquefied natural gas (LNG) tanker transportation system. (Nearly 50 percent of California's gas supply in recent years was shipped to the state via the present El Paso system in Arizona, New Mexico, and

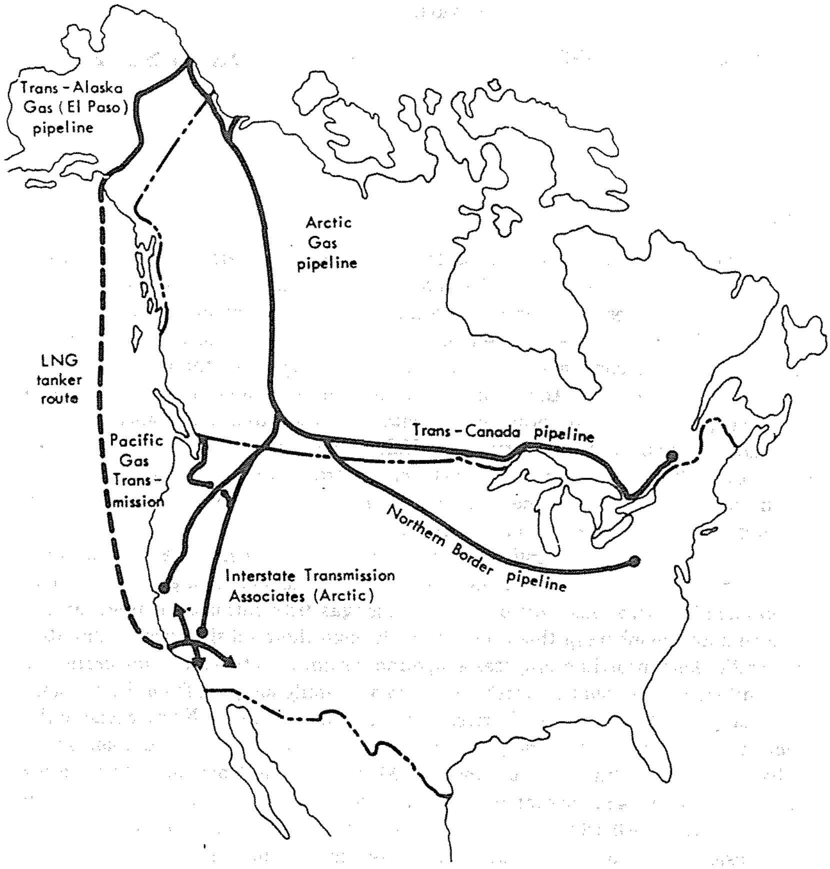


Fig. 7.1—Proposed North Slope natural gas transportation systems

Texas.) The gas would move by an 809-mile pipeline from the North Slope, along a route generally paralleling the Trans-Alaska oil pipeline, to a liquefaction facility at Gravina Point on Prince William Sound. This pipeline would be 42 inches in diameter with a design capacity of 3.5 billion ft^3/d. After liquefaction, the liquefied gas will be loaded into LNG tankers for shipment to California. At design capacity, eleven 165,000 cubic-meter-capacity tankers would be required. The LNG would be received at an unloading, storage, and regasification facility at Point Conception. After regasification, the gas would be pipelined from Point Conception to Arvin in the San Joaquin Valley, whence it could flow north to serve northern California and Pacific Northwest consumers, south to southern California consumers, or east to consumers in southern Nevada, Arizona, or elsewhere. Natural gas that would otherwise have been shipped to California from west Texas and New Mexico through the present El Paso system would be displaced from the California market by North Slope gas and be shipped instead to midwestern and eastern markets.

The issue posed by these two competing applications is whether the State of California should favor one or the other in order to influence the choice between them by the FPC and the Department of the Interior. This choice is likely to be made in 1976. It promises to be the most significant determinant of California's gas supply from 1980 into the 21st century. Because of the importance of this choice for the availability, composition, cost, reliability, and safety of California's future gas supplies, thorough consideration of the relative merits of the two proposals is essential.

EVALUATING THE TWO SYSTEMS

To provide a basis for a thorough evaluation of the two proposals, we have identified five criteria:

1. To maintain the lowest delivered cost of gas to California consumers consistent with maintaining adequate supplies of natural gas over the long run at prices that are competitive with other energy sources.
2. To maintain reliability of delivery of natural gas supplies, avoiding major disruptions.
3. To obtain new natural gas supplies in a timely manner to replace declining supplies from current sources.
4. To have a natural gas delivery system that is as safe as possible.
5. To avoid or minimize adverse environmental effects that may be associated with natural gas transportation.

In the following discussion, we consider the implications for California of the two proposals in the light of these five criteria. The relative importance of the criteria is also assessed. The discussion provides only a preliminary comparison of the two proposals. The complete details of each proposal are only now being released. No detailed independent studies comparing the two proposals have been completed. Numerous studies should be available in the latter part of 1975, providing the legislature, the governor, the Energy Commission, the Public Utilities Commission, and the California congressional delegation with information they should have before taking a position.

Gas Supply and Costs

Both direct and/indirect costs of each system need to be considered. Direct costs are the transportation costs associated with each system. Indirect costs are the costs to California consumers if higher cost sources of gas displace lower cost supplies because of exchanges among companies or national allocations of gas supplies. These indirect costs are closely related to the amount of gas supplied to California by each system. At relatively low quantities, natural gas from the North Slope would only *replace* declining supplies from other sources. At larger quantities, it would begin to *displace* other, less expensive sources of supply as well. In the long run, large quantities of North Slope gas coming into California could also foreclose opportunities for obtaining less expensive sources of supply. Large quantities coming through a single system would also reduce competition in the California gas market.

Arctic Gas estimates an average transportation cost over 20 years of $0.90 to $1.05 (in 1974 dollars) per million Btu from the North Slope to California. Assuming a combined wellhead price and Alaskan severance tax of at least $0.50 to $0.60/Mft^3, the delivered cost of North Slope gas via the Arctic Gas system would be at least $1.40 to $1.65/Mft^3. To date, El Paso has not released any detailed estimates of average transportation costs for its system or for the Arctic Gas system. Earlier, the company made the general claim that deliveries through its system would cost no more than deliveries through the Arctic Gas system. Arctic Gas, however, estimates that deliveries of the same volumes through the Trans-Alaska Gas system to the two major California markets would cost $0.20 to $0.30 more per million Btu than similar deliveries through the Arctic Gas system. The estimated costs of either system are likely to increase as more is learned about the construction costs of the Arctic pipeline, the liquefaction plant, and LNG tankers. Recently, the FPC requested that both applicants file revised cost estimates in terms of 1975 costs. When available, these new estimates should provide a basis for additional comparisons of the two systems.

Expansion of either system in the 1980s beyond design capacities could reduce unit transport costs. Because liquefaction facilities and LNG tankers increase proportionately with throughput, this reduction is likely to be less with the Trans-Alaska Gas system. Initial expansion of the Arctic Gas system requires only the addition of some compressor stations and pipeline segments. An independent, comprehensive cost analysis comparing the two systems at both planned and expanded capacities up to 5.0 billion ft^3/d has not yet been performed, thus precluding more definitive conclusions.

The amount of gas that would be supplied annually by each system to California, both initially and eventually, is unknown. This will depend primarily on how much additional natural gas will be discovered on the North Slope during the next 15 years, on how much of present and future gas reserves the Pacific Gas and Electric Company (PG&E) and Pacific Lighting will ultimately contract for, and on the rate of gas production from the Prudhoe Bay field. The Arctic Gas consortium proposes to begin operations with an initial flow of 2.25 billion ft^3/d from the North Slope to the United States. Canada may also export somewhat smaller amounts to the United States during the initial years of operation. From existing contract options, it appears likely that California will initially receive about 25 to 35 percent of the total, or about 0.50 to 0.80 billion ft^3/d. As further discoveries are made on the North Slope, the amount coming to California would probably increase. California's proportion of the total would decline, given the other sources of natural gas that are likely to be available to California and the comparative lack of new sources that would be available to the Midwest and East. All of the North Slope gas delivered through the Trans-Alaska Gas system would initially be physically delivered to California. The flow in the first few years of operation will probably be at least 1.5 to 2.0 billion ft^3/d. As deliveries through this system increase beyond 2.0 to 2.5 billion ft^3/d, natural gas would likely flow through California into other states.

Because most of the gas that would be delivered through the Arctic Gas system to the lower 48 states would be delivered to states other than California, the proportion of California natural gas supplies provided through each of the two systems would differ substantially. In the mid-1980s, about 10 to 20 percent of California's gas supply would be provided through the Arctic Gas system and about 25 to 40 percent through the Trans-Alaska Gas system. Because the amounts supplied to California through the Arctic Gas system would be relatively small, they would probably only replace declining supplies of natural gas from Canada, New Mexico, and Texas. If supplies through the Arctic Gas system to California increase in the late 1980s, it is possible that their availability would foreclose obtaining additional supplies from the Southwest, particularly the more costly synthetic natural gas from coal. Because the amounts supplied through the Trans-Alaska Gas system would be substantial in the mid-1980s, they would displace all natural gas supplies currently coming into California through the present El Paso pipeline system from the Southwest. If gas is available to increase the throughput of the Trans-Alaska Gas system beyond 2.0 billion ft^3/d and if national gas supplies remain relatively tight, gas from the Transwestern pipeline system could also be displaced. If North Slope gas comes to California via the Trans-Alaska Gas system, it is likely to preclude the California gas distribution companies from obtaining any new gas delivery contracts in the Southwest after 1980.

The large displacements of southwestern gas that would occur with the Trans-Alaska Gas system are a central feature of the El Paso proposal. Because the North Slope gas would be shipped to California, gas produced in the Southwest and contracted for use in California would be shipped to midwestern and eastern markets in place of the North Slope gas contracted to these markets but used in California.[1] Such displacement is likely to create substantial problems because of the unprecedented magnitude of the displacements that would occur, the complex negotiations that would be necessary to reach specific displacement agreements, and the conflicting interests among the potential participants in such agreements.

Although the southwestern gas contracted to California may be sufficient for full displacement in the first few years of operation, such a situation would not persist even through the first decade of operation of the Trans-Alaska Gas system. In 1974, California received slightly more than 3.3 billion ft^3/d of gas from the Southwest. The *1975 California Gas Report* projects a decline to 1.5 billion ft^3/d by 1982, assuming no new contracts. Even with new contracts and wellhead price deregulation, a decline to no more than 2.0 billion ft^3/d by 1982 is highly probable with the anticipated decline in production in the Permian and San Juan basins in Texas and New Mexico. If the initial shipments through the Trans-Alaska Gas system were no more than 2.0 billion ft^3/d, gas that would otherwise have come to California through the present El Paso system would be displaced. (Assuming that roughly 30 percent of the gas from the North Slope will be contracted to PG&E and the Southern California Gas Company, displaced gas would have to cover the other 70 percent contracted to midwestern and eastern companies.) With initial shipments at a level of 2.0 to 2.5 billion ft^3/d, gas that would otherwise have come to California through both the El Paso and Transwestern systems would have to be displaced to the Midwest and East. With early shipments greater than 2.5 billion ft^3/d, gas that would otherwise have come to California from the Southwest would be insufficient

[1] Displacement would occur because it would be less expensive than maintaining shipments of southwestern gas to California and having to build and use new pipelines from California to Texas to transport North Slope gas eastward.

to provide full displacement. Most probably, North Slope gas would be shipped eastward into Arizona, and gas from the Southwest that would otherwise have come to Arizona would be displaced to the Midwest. Beyond 3.0 billion ft^3/d, even this would be insufficient. Some North Slope gas would then have to be shipped eastward 1500 to 2500 miles to the companies that have contracts

Between 1982 and 1992, the amount of gas contracted to California from the Southwest would continue to decline, reducing the amount available for displacement. Simultaneously, production capacity for natural gas is apt to continue to increase on the North Slope. If California distribution companies do not contract for all the additions to reserves, the amount of North Slope gas arriving in California that cannot be covered by displacement will be steadily increasing. Under these conditions, California would become a growing transshipment point for North Slope gas as well as for North Slope oil (see Chap. 3).

The displacement of large amounts of southwestern gas is likely to result in higher prices for California gas consumers. Assuming that prices on existing gas contracts will not be changed, even with deregulation, the average city-gate price in California of gas from the Southwest will be less than the price of North Slope gas delivered through the Trans-Alaska Gas system. With full displacement, arrangements could be made to offset this difference. California consumers could pay the delivered price for the North Slope gas for all North Slope gas contracted to California. For North Slope gas contracted to the Midwest and East but delivered to California, they could pay the delivered price for southwestern gas. Midwestern and eastern consumers could pay the delivered price of North Slope gas in California, plus transmission charges from the Southwest for the gas they receive from the Southwest to replace the North Slope gas for which they have contracts.

Such an arrangement would clearly be in California's best interests. However, it would not be in the best interests of the midwestern and eastern states. If they were actually receiving southwestern gas, they would obviously prefer to pay the lower price of southwestern gas, leaving California to bear the full brunt of the higher priced North Slope gas. Moreover, if the Trans-Alaska Gas system were to be approved, they would have considerable motivation to seek such an arrangement. Over the long run, these states would both receive less gas and have to pay a higher price for it with the Trans-Alaska Gas system. Given these circumstances, it would not be surprising if they would seek some form of legislative recompense as embodied in the pricing provisions of any displacement agreement.

The implications of displacement when full displacement is possible are complicated enough. They become even more complicated and uncertain when there is insufficient gas in the Southwest for full displacement. The midwestern and eastern companies will have to determine how to share among themselves the remaining displaced gas and the North Slope gas shipped eastward from California. Both displacement and the inability to displace fully will affect the participation of California and other distribution companies in the bidding for new gas contracts from both the Southwest and the North Slope. With the amount of gas from the Southwest available for displacement declining annually, displacement agreements may have to be renegotiated regularly, particularly if new participants (such as companies in Arizona, Nevada, and New Mexico) have to be included. Displacement and reversal of existing pipelines from the Southwest to California would probably impose additional contingency costs on California. To reduce the consequences of potential interruptions in deliveries, California gas companies (and thus gas consumers) would have to provide additional storage or maintain a quick-response reversibility in the existing pipeline system.

Conceptually, displacement appears to be a simple idea. Working out the specific details of displacement agreements covering up to two decades of displacements under changing circumstances is likely to be immensely complicated and potentially rancorous. Moreover, federal intervention will probably be necessary to resolve the inter-regional conflicts. Because of this complexity and apparent conflict, any predictions about whether such agreements could be reached and what they might contain must be considered highly tenuous. Moreover, no public proposals or official rulings have been made by any of the participants as to what the specific arrangements might be.

There are, however, some conclusions that are clear. The Trans-Alaska Gas system would require displacements of unprecedented magnitude. Negotiating the details of these displacements will be a major regulatory problem. Displacements, regardless of how they are resolved, will impose indirect costs, and at least some of these will be borne by California. By comparison, the Arctic Gas system will avoid problems associated with major displacements.

The choice between the two proposals is likely to affect competition among suppliers to the California gas market. Currently, El Paso transmits nearly half of the natural gas consumed in California. Approval of its proposed system from the North Slope would permit it to retain and expand this dominant position into the next century. Approval of the Arctic Gas proposal would introduce new suppliers into the California market, at the same time that supplies through the El Paso system from the Southwest would be declining, creating a situation where no supplier would be dominant. Transmission charges will probably be marginally lower in these circumstances than they would be if one supplier were dominant.

The Arctic Gas system appears to have both lower direct and lower indirect costs than the Trans-Alaska Gas system. Transmission charges are likely to be less, either permitting a lower delivered price or providing an additional incentive to exploration and development on the North Slope. The Arctic Gas system avoids the major cost and regulatory problems associated with the large-scale displacements created by the Trans-Alaska Gas system. The Arctic Gas system also keeps open all current gas supply possibilities for California, giving the California distribution companies flexibility during rapidly changing circumstances, a flexibility they would lack with the Trans-Alaska Gas system. Greater flexibility to choose among suppliers would also promote competition.

Reliability

Neither system appears to promise natural gas deliveries free from the threat of disruption. The disruptions in deliveries that could occur differ considerably between the two systems. Since each would transport gas produced with North Slope oil, each is likely to suffer a large reduction in gas deliveries if oil production had to be temporarily halted as a result of a shutdown in the Trans-Alaska oil pipeline. Each could undergo a temporary disruption of deliveries if a leak or break in the Arctic segments of either system occurred which could not be repaired immediately because of weather conditions precluding transport of the repair crews. Accidental disruptions of pipelines are more probable in the more populated temperate regions traversed by both systems (primarily Arctic Gas). Because such disruptions can be readily repaired, any lengthy disruption from this cause is quite unlikely. Each pipeline is also moderately vulnerable to sabotage. Disruptions or shortages in energy supplies in other parts of the United States could produce a reduction in the flow of natural gas to California through either system as a result of governmental reallocations. Such reductions may be more feasible in practical terms with the Arctic Gas system than with the Trans-Alaska Gas system.

The Arctic Gas system appears to be subject to only one other vulnerability. Conceivably, the Canadian Government could disrupt the flow of gas into the United States.[2] Such a possibility appears to be unlikely. An agreement between the two governments permitting oil and gas to travel in bond across either country is likely to be formally announced soon. Moreover, most of the oil currently consumed in the provinces of Ontario and Quebec is transported to these provinces across U.S. territory. If Canada halted or diverted the shipment of Alaskan gas to the United States, it would be highly vulnerable to both a retaliatory disruption of these oil supplies by the United States and other appropriate countermeasures.

Because it traverses the active earthquake zone across southern Alaska and because of its LNG link, the Trans-Alaska Gas system would be vulnerable to a substantially greater variety of disruptions. A major earthquake in southern Alaska could put the pipeline, liquefaction plant, or loading facilities temporarily out of commission. To some unknown extent, however, the disruptive effects of an earthquake would be limited by the proposed design standards for these facilities. Operating accidents, design and engineering errors, sabotage, labor disputes, structural failure, or mechanical failure associated with the liquefaction plant, loading and unloading facilities, and LNG tankers could produce a full or partial disruption of deliveries through the LNG element of the system. The probability that such disruptive events would occur can be reduced by using the best available design standards and by maintaining high operating standards. The unprecedented scale of the Trans-Alaska Gas proposal does, however, make the success of such measures uncertain. Unusually adverse weather in the Northeast Pacific could delay LNG tanker shipments.

Disruptions in the Trans-Alaska Gas system would have more serious consequences for California than disruptions in the Arctic Gas system. Disruptions in the former would affect a larger proportion of California's gas supply and would probably last longer. The effects of a disruption could be reduced by various ameliorative measures, such as emergency storage or emergency displacements through reversible trunk pipelines. With the Trans-Alaska Gas system, these measures would have to be more extensive, hence, more expensive, and implementing some, such as emergency displacements, would pose substantial regulatory and political problems.

In summary, the Trans-Alaska Gas system is vulnerable to more kinds of disruptions than the Arctic Gas system. However, the probabilities of each disruption to which either system is subject are unknown because of the lack of any operating history for very large-scale LNG systems and for large-volume transport of gas in

[2] The El Paso Natural Gas Company has asserted that the possibility of Canadian disruptions constitutes the primary reason for accepting its application and rejecting the Arctic Gas application. In other cases, El Paso has not objected to foreign control over gas supplies for the United States. El Paso is currently involved in projects that could result in the importation of LNG to the United States from Algeria, Iran, and the Soviet Union.

Arctic regions. Thus, in comparing the two systems, no precise conclusions can be made regarding the overall difference in the probability of disruption. Preliminary evidence does, however, suggest that the Arctic Gas system would be more reliable and that coping with the possible disruptions associated with it would be easier for California consumers, distributing companies, and regulatory agencies.

Timeliness

The proponents of each system have promised timely delivery of North Slope natural gas to U.S. markets. The original Arctic Gas proposal envisaged deliveries of North Slope gas beginning in 1979. Later, this group foresaw completion by mid-1980 if approval was granted by the end of 1975. Because approval may not be forthcoming until late 1976, 1981 is a more realistic date. The El Paso proposal envisages initial deliveries beginning 70 months after firm initiation. Assuming approval in 1976, this suggests a 1982 starting date. The Arctic Gas system must be approved by both U.S. and Canadian authorities, while the Trans-Alaska Gas system need only be approved by U.S. authorities. Approval of the Arctic Gas system could be delayed by the Canadian Government, particularly over the question of choosing between it and a competing all-Canadian proposal, the Maple Leaf pipeline, for the transport of natural gas from the Mackenzie Delta only. The Canadian Government could conceivably deny a permit to the Arctic Gas system.

The Arctic Gas consortium and its predecessors have been studying gas pipelines from the Arctic for over five years. During this period, they have performed extensive preliminary studies. The El Paso effort is less than three years old, and the basic research, planning, and design are not as advanced, a factor that accounts for the longer period required from approval to initial deliveries. The Trans-Alaska Gas system requires substantially less pipeline construction than the Arctic Gas system (800 miles compared with 2600 miles, excluding branches to destinations). Construction of its pipeline segment will take less time. However, delays in constructing the liquefaction facility and the LNG tankers are a real possibility in the El Paso system.

Both systems will be extremely expensive. As initially proposed, the Arctic Gas system, including the Northern Border pipeline, the Interstate Transmission pipeline, and the Pacific Gas Transmission expansion, is estimated to cost $8 to $10 billion (1974 dollars). The proposed Trans-Alaska Gas system, including the LNG tankers and the receiving facilities in California, is estimated to cost over $7 billion (1974 dollars). Because of the high capital cost of each, both may encounter difficulties in financing, creating some delays. These difficulties appear to be more likely to arise with the El Paso proposal. The estimated cost of its proposal is roughly four times the net value of the El Paso Natural Gas Company's current property, plant, and equipment. If the El Paso proposal were to be accepted, other firms would undoubtedly join it, providing the necessary financing for the project. However, negotiating the scope of participation of each new partner is likely to be time-consuming, assuming that separate agreements will have to be negotiated for the pipeline, the liquefaction and terminal facilities, and the LNG tankers. The estimated cost of the Arctic Gas proposal is only about 60 percent of the net value of the property, plant, and equipment of just the U.S. natural gas transmission and distribution companies participating in the Arctic Gas consortium. The resources that the participating Canadian corporations and the major oil firms could bring to the project could be even greater.

If there are substantial discoveries of natural gas on the North Slope between 1975 and 1990, increasing present reserves to 40 to 60 trillion ft^3 or more, expansion of transport capacity would be desirable. If the Arctic Gas system were chosen initially, its capacity could be easily expanded. If the Trans-Alaska Gas system were constructed initially, a second pipeline similar to the present Arctic Gas proposal would be desirable if there were substantial additions to North Slope reserves. Given the limited market for natural gas on the West Coast and the additional costs of shipping the gas eastward 1500 miles to the first significant market, expanding the delivered capacity of the proposed Trans-Alaska Gas system beyond 3.5 billion ft^3/d would make little sense. However, present reserves would have to increase by at least 25 trillion ft^3 to justify a wholly new system. Lesser additions would either have to be shut in or be transported through an expanded Trans-Alaska Gas system and a reversed El Paso system in the Southwest to midwestern and eastern markets. Expanding the Arctic Gas system would not only require less time than constructing a new system from scratch but could also be done in paced additions paralleling the discovery of new gas reserves.

In sum, there may be differences in the time when each system could *initiate* deliveries to California. These differences, if they do exist, should not exceed 18 months. All factors considered, the Arctic Gas system appears to be advantageous here. Considering that the choice of systems will have a substantial effect on California gas supplies for more than 30 years after deliveries begin, any likely differences should not be highly emphasized in the choice between systems. There may be some differences between the time each system could expand beyond its present design capacities, the Arctic Gas system having a clear advantage.

Safety

Safety is primarily a consideration with the LNG shipments associated with the Trans-Alaska Gas system. Over the past several decades, natural gas has been shipped through modern high-pressure pipelines with a good record of safe operations. There is no reason to assume that this record would be altered by shipments of North Slope gas by pipeline into California.

Spills of LNG, which can result from several causes, pose serious safety problems, particularly if the spill is or becomes a large one. Employing the best available safety measures would reduce these risks, but the extent to which the risk can be reduced is uncertain. The hazards of LNG are discussed in greater detail in Chap. 6. The Trans-Alaska Gas system, with planned deliveries of 2.8 billion ft^3/d in California, would increase the frequency of arrival of LNG tankers in California ports from 96 to 122 arrivals per year (the current proposals from Indonesia and the Cook Inlet) to 404 to 430 arrivals per year. If the probability of a major LNG accident is related to the frequency of arrivals (as is normally assumed), the Trans-Alaska Gas system would substantially increase it.

Assuming that gas transported through the Trans-Alaska Gas system would be delivered as planned to a terminal at Point Conception, it would not pose a substantial risk to public safety. Only if LNG shipments were delivered to other terminals is there apt to be any public safety hazard. The use of other terminals on a regular basis would be likely to occur if shipments began to average more than 3.0 to 3.5 billion ft^3/d.

Environment

The adverse environmental effects associated with each system in California are local, typically minor, and often temporary. Construction of the pipelines bringing North Slope gas into California would temporarily disrupt the surface in the pipeline corridor. Because the pipeline will be buried, the surface can be revegetated and reclaimed within a few years after construction. Only the compressor stations associated with each line preempt other surface uses during the life of the pipelines, using 4 to 6 acres per station. Their operation will also create moderate noise in the immediate vicinity of the station.

The unloading, storage, regasification facilities, and adjacent buffer zones associated with the Trans-Alaska Gas system would use 200 to 250 acres in the coastal zone and adjacent tidelands. Construction of port facilities may require dredging, temporarily disturbing marine life in the area. Because these facilities may be built to handle other LNG projects in any event, they may cause little incremental construction effect. If seawater is used as a heat source for regasification (as is proposed for the Point Conception facility), pumping the cooled water back into the ocean could have adverse effects on local marine life. LNG spills and their consequences would also have temporary adverse environmental effects (see Chap. 6).

EXISTING PROCESS AND ALTERNATIVES

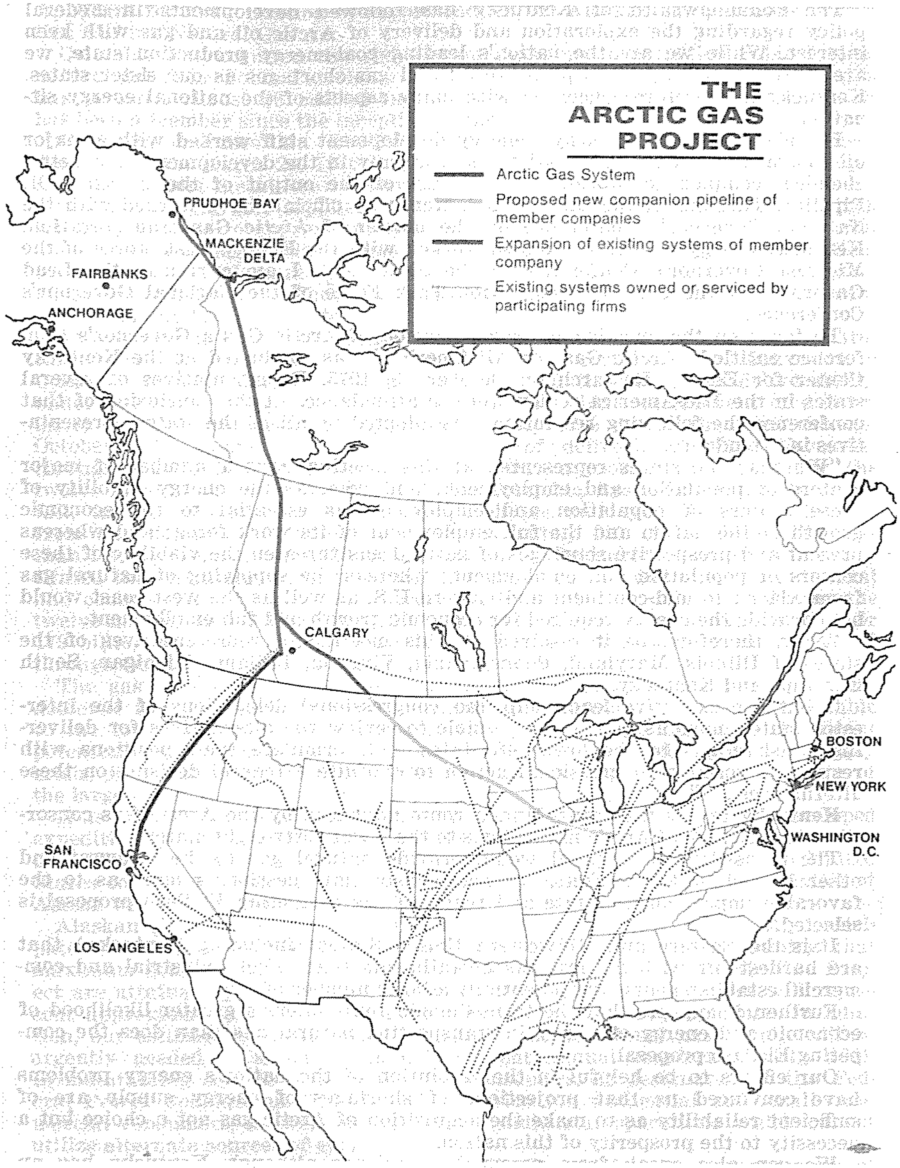
The State of California has relatively few direct levers on the decision between the two proposals. Most of the authority rests with the FPC. Each applicant has had to file with the FPC a request for a certificate of public convenience and necessity to construct and operate its planned facilities. The Arctic Gas group has also had to request from the FPC a Presidential permit to construct, operate, maintain, and connect facilities crossing an international border. Both have also had to apply to the Department of the Interior for rights-of-way on federal lands. The Arctic Gas group has also had to request a certificate of public convenience and necessity from the National Energy Board of Canada and has had to apply to the Canadian Minister of Indian Affairs and Northern Development to acquire the interests in lands and receive the approvals necessary to own and operate facilities in the Yukon Territory and the Northwest Territories. International aspects of the Arctic Gas proposal are currently under negotiation between the State Department and the Canadian Department of External Affairs. PG&E and the Southern California Gas Company must apply to the California Public Utilities Commission to construct pipelines receiving the gas at the California border and to pass their expenditures in the Arctic Gas project on to ratepayers. State and local agencies can also participate in the LNG terminal siting process (see Chap. 6).

Basically, the decision is a federal one. Given the interests involved and the high stakes, the final decision is likely to be made at the highest levels of the U.S. and Canadian governments. If the State of California wants to influence the process, it could do so as an intervenor before the FPC. Because this decision, like the Alaskan oil pipeline decision, may end up in Congress, the California congressional delegation could also exercise some influence over the final decision.

The alternatives for the state on the choice of gas transport routes from the Alaskan North Slope are to do nothing, leaving the final decision wholly up to the other participants, or to advocate a specific choice before the appropriate federal bodies. Because the choice will have major consequences for the cost, reliability, and safety of California's gas supply after 1980, doing nothing is not a desirable alternative.

CONCLUSION

The choice for California between the two routes is not wholly straightforward at this time because decisions could be made during the next year affecting the comparisons. However, under current circumstances, the Arctic Gas proposal does *not* appear to be inferior to the El Paso proposal on any of the five criteria examined earlier (gas supply and costs, reliability, timeliness, safety, and environmental effects). On most, it appears to be superior. Moreover, it appears that only negative actions of the Canadian Government could significantly alter this comparison.


THE ARCTIC GAS PROJECT
Arctic Gas System
Proposed new companion pipeline of member companies
Expansion of existing systems of member company
Existing systems owned or serviced by participating firms
PRUDHOE BAY
MACKENZIE DELTA
FAIRBANKS
ANCHORAGE
CALGARY
BOSTON
NEW YORK
WASHINGTON D.C.
SAN FRANCISCO
LOS ANGELES

STATEMENT OF HON. JULIAN M. CARROLL, GOVERNOR OF KENTUCKY

The Commonwealth of Kentucky has followed developments in Federal policy regarding the exploration and delivery of Arctic oil and gas with keen interest. While we are the nation's leading coal-energy production state, we are, unfortunately, just as prone to oil and gas shortages as our sister states. Kentucky is therefore concerned with many aspects of the national energy situation.

For about a year Kentucky's energy development staff worked with a major oil company in an effort to assist that company in the development of a petrochemical complex to process a large part of the output of the Alaskan Oil Pipeline. Throughout the same period, Kentucky officials have worked with the National Governor's Conference on the matter of Arctic Gas transportation. Kentucky energy officials have also worked with the Energy Task Force of the Midwest Governor's Conference in the same field. I am currently the Lead Governor for the Coal Transportation Task Force of the National Governor's Conference.

To focus on the question of transportation of Arctic Gas a Governor's Conference entitled "Arctic Gas for All-America" was conducted at the Kentucky Center for Energy Research on October 29, 1975. Representatives of several states in the Mid-America region were in attendance. At the conclusion of that conference the following resolution was adopted by all of the state representatives in attendance.

"Whereas the states represented at this meeting have a number of major centers of population and employment; and whereas the energy viability of these centers of population and employment is essential to the economic growth of the nation and the full employment of its work force; and whereas present and prospective shortages of natural gas threaten the viability of these centers of population and employment; whereas the supplying of natural gas from Alaska to mid-continent and eastern U.S. as well as the west coast would help provide the energy required for economic growth and full employment.

"Now, therefore, be it resolved by this meeting of representatives of the states of Illinois, Maryland, Pennsylvania, Virginia, Indiana, Michigan, South Carolina, and Kentucky.

"That the executive leadership and congressional delegations of the interested states move as quickly as possible to review the alternatives for delivering Alaskan gas to the lower 48 states and formulate their positions with respect to possible congressional action to expedite a federal decision on these alternatives . . ."

Kentucky favors the trans-Canada route advanced by the Arctic Gas consortium for delivery of Arctic natural gas to the lower forty-eight states.

The trans-Canada proposal would provide natural gas to the Midwest and other United States markets, whereas substantial questions remain as to the favorable impact on our state and region if the competing El Paso proposal is selected.

It is the Eastern and Midwestern United States (including Kentucky) that are hardest hit with natural gas curtailments that affect industrial and commercial establishments, and potentially a large number of jobs.

Further, it appears that the trans-Canada route offers a greater likelihood of economic and energy efficiency in transporting natural gas than does the competing El Paso proposal.

Our efforts to be helpful in the resolution of the nation's energy problems have convinced us that projections of shortages of energy supply are of sufficient reliability as to make the acquisition of Arctic gas not a choice but a necessity to the prosperity of this nation.

We can also speak from personal experience although Kentucky has an abundance of energy in the form of coal, we are experiencing a shortage of natural gas that threatens our industrial base. We share a common realization with our sister states that a shortage of natural gas in the industrial heartland of America is a situation that cannot long be tolerated by those who have the interests of this country at heart.

Kentucky supports Senate Bill 2950 which assures the Eastern and Midwestern United States a share of Alaskan natural gas.

STATEMENT OF SEYMOUR ORLOFSKY, ON BEHALF OF COLUMBIA GAS TRANSMISSION CORP.

Columbia Gas Transmission Corporation (Columbia) is a wholly-owned subsidiary of The Columbia Gas System, Inc. Columbia is an affiliate of Columbia

Alaskan Gas Transmission Corporation, which is a partner in the Northern Border Pipeline Company, a part of the Arctic Gas Group. Columbia is also an Applicant for authorization to export and import Alaskan gas pursuant to Section 3 of the Natural Gas Act.

Columbia has acquired the right to purchase up to 6 trillion cubic feet of natural gas from Sohio Petroleum Company in Prudhoe Bay, Alaska. Columbia has invested almost $6 million in the Gas Arctic Study Groups, of which it has been a member since the inception of the project.

Columbia endorses Mr. Brackett's prepared testimony presented to these Committees on March 24, 1976 that the Arctic Gas Project is the best alternative to transport the Alaskan reserves to the lower 48 states.

Columbia is the sole supplier of its 7 affiliated distribution companies, which sell gas at retail to approximately 1,850,000 residential, commercial, industrial and other customers in the states of Ohio, Pennsylvania, West Virginia, Kentucky, New York, Virginia and Maryland. The 68 non-affiliated companies supplied by Columbia throughout its seven-state area and Washington, D.C. serve approximately 2,200,000 customers.

At the present time, Columbia obtains approximately 86 percent of its natural gas supplies from the Southwest. Increasing curtailment of deliveries to Columbia by non-affiliated pipeline suppliers and the decline in deliverability under contracts with producers necessitated Columbia's curtailment of deliveries to its wholesale customers by approximately 27% during the April through October 1975 summer period. Curtailment of deliveries for the November through March 1975–1976 heating season was approximately 23%. For the twelve months ended March 31, 1976, the Columbia System's net supply shortfall, taking into account emergency purchases and synthetic gas deliveries from an affiliate of Columbia, was approximately 281 billion cubic feet less than its requirements of 1,436 billion cubic feet. Columbia's curtailments necessitated that its affiliated distribution companies curtail deliveries to industrial and commercial consumers by approximately 105 billion cubic feet during the twelve months ended March 31, 1976. Columbia presently anticipates a 30%, or 179 billion cubic feet, supply shortfall from traditional sources for the April through October 1976 summer period.

The gas supply situation will continue to worsen until the huge potential domestic reserves, such as those in Alaska, are developed and made available to the lower 48 states. The Alaskan reserves constitute the most significant potential domestic natural gas resource available to alleviate the gas supply crisis. Exploration of the North Slope of Alaska has only begun, in spite of the large reserves already found.

It is critical to America's welfare that Alaska's gas reserves be developed expeditiously and transported to the lower 48 states in the most economical and efficient manner which will provide direct delivery of this gas to United States consumers from the Pacific to the Atlantic Coasts. The vast potential of Alaska will not be explored until an adequate delivery system exists.

Alaskan gas represents the most significant new gas supply presently anticipated to be made available to Columbia and its customers. Assuming that maximum contractual deliveries of gas to Columbia from the Arctic Gas Project are attained by the end of 1983, we estimate that such volumes will represent approximately 15% of Columbia's current annual requirements. In addition, our estimates indicate that this significant additional gas supply will be urgently needed to assist Columbia's current annual requirements. In addiin maintaining service to high priority consumers, as designated by the Federal Power Commission. This includes service for residential and small commercial consumers, as well as for certain industrial operations which cannot utilize alternate sources of energy.

Columbia strongly supports the Gas Arctic System for the transportation of the Alaskan reserves. Based on Columbia's independent evaluation of the Gas Arctic System, it is our opinion that it is the most environmentally sound, efficient, reliable, secure and economical alternative to bring the much-needed Alaskan gas to the lower 48 states.

While Columbia recognizes the viability of an LNG transportation system such as that proposed by El Paso, we fully agree with Mr. Brackett's testimony that, while an LNG transportation system may be the best means of delivering natural gas when an ocean separates the markets from the sources of natural gas, such a system is only second best when compared to a conventional buried pipeline system contemplated by the Gas Arctic Project.

As indicated by the testimony of Mr. Brackett, it is anticipated that Canada will complete its deliberations on the Arctic Gas Project near the end of 1976, or early 1977. In order to ensure a final decision on the U.S. portion of the Arctic Gas Project that will be contemporaneous with the expected Canadian decision, it is essential that expeditious regulatory procedures be enacted. If there is concern as to the relative timing of the U.S. and Canadian decisions concerning the Arctic Gas Project, any U.S. approval can obviously be made conditioned upon the issuance of appropriate Canadian authorization.

Columbia urges the Congress to keep in mind that the Gas Arctic System will be the largest and most costly construction project ever undertaken by private industry. Therefore, it requires new regulatory approaches so that the project will be able to be financed. The orderly and prompt recovery of this unprecedented expenditure of funds required for this project is essential if the financial burdens of the project are to be borne by the applicants. Columbia, and the other shippers, more than any other parties, will be required to provide financial assurances of unprecedented scope and magnitude.

S. 2778, among other things, would mandate an allocation of all the Alaskan Gas throughout the U.S. Columbia strongly objects to any such mandatory allocation of the Alaskan reserves. In view of the staggering and unprecedented amounts of private capital that will be necessary to effectuate the Arctic Gas Project, any form of mandatory allocation on the Alaskan gas would completely frustrate the participation by private companies such as Columbia in an Alaskan transportation system. Columbia would not and could not make any investments in an Alaskan transportation system without the full prior assurance that the Alaskan gas contractually available to Columbia will be made available to Columbia and its customers from the Arctic Gas Project.

In conclusion, it is Columbia's position that the Gas Arctic System must be expeditiously authorized; and that the members, including shippers, should receive the regulatory treatment as requested in the Federal Power Commission proceedings. Action by this Congress which would expedite such authorization at the earliest practical time would clearly be in the national interest. Approval of the Gas Arctic System will provide a necessary step in solving our long-term energy problem and will help to reduce our reliance on OPEC energy sources. It will also provide an economic stimulus and have a positive effect on our balance of payments, as well as offering the possibility of transporting to the United States, Canadian gas which is found to be surplus to Canada's needs.

Statement of Kurt H. Wulff, Member, National Association of Petroleum Investment Analysts

More than 300 members of the National Association of Petroleum Ivestment Analysts (NAPIA) are involved with nearly all the major sources of capital in the U.S. for oil and gas investment. Thus the views of NAPIA members will have an important bearing on whether an Alaskan natural gas transportation system can be financed. However, the views expressed in this submission are my own and thus should not be construed as any official statement by NAPIA.

I am a vice president-energy analyst with Donaldson, Lufkin & Jenrette Securities Corporation with whom I have been associated since 1971. Prior to DLJ, I worked four years as a management consultant in the energy field with Arthur D. Little, Inc. Prior to ADL, I worked three years as a design engineer with Standard Oil Company of California. My educational background includes a degree in chemical engineering from the University of Wisconsin and a graduate degree in business from Harvard.

In my view, investor willingness to commit new funds to Alaskan natural gas will be heavily influenced by results achieved on the funds already invested in the gas utility industry. A possible cost of $15 billion for developing and transporting natural gas from the North Slope of Alaska to markets in the lower 48 states compares with approximately $45 billion invested by the gas utility industry at the end of 1974. Meanwhile, without new legislation, the interstate portion of the natural gas industry is under the complete domination of the Federal Power Commission which determines wellhead prices and allowable charges for transportation. The two critical investment variables in transportation charges are the rate of return on equity and depreciation life. The quality of regulation is good for return on equity, improving for depreciation life, but lagging seriously for wellhead price.

Regarding the effectiveness of continued government regulation of the natural gas industry, I believe that the trend will be constructive but confess that my views are more optimistic than those of most investment analysts. Only time will tell whether the changes I envision will be accomplished. In the remaining paragraphs, I quote from some of the more than 240 separate items of oil and gas research published by DLJ during 1975. The initial comments deal specifically with gas from Alaska, next utility regulation, and then wellhead price controls. Lastly, I consider the question of producer participation in pipeline financing in the context of the natural gas industry and the broader uncertainties facing all new energy investment.

RESEARCH COMMENTS ON ALASKAN GAS PIPELINE

"The overland pipeline to bring North Slope gas to market could cost $15 billion to eventually transport 30 trillion cubic feet of reserves. This investment of $.50 per thousand cubic feet would require something like $1.50 per thousand cubic feet in transportation charges to recover the pipeline investment and earn a return as well as pay for operating costs. Added to a wellhead price of, let's say $.50 per MCF, this results in a delivered price of gas to the midwest of some $2.00 per MCF which is competitive with imported oil today. . . . pipeline investment spread over a five-year period from, say, 1978 to 1983 . . . is about equal to total capital expenditures for the last five years."

"Potential investment cost of $.50 per MCF for the pipeline contrasts with undepreciated investment of $.12 per MCF of undepreciated plant spread over dedicated reserves. This conventional investment is currently being recovered at a rate less than $.12 per MCF which has given rise to alarmist concerns that natural gas pipelines will not recover their historic investment. We point out that depreciation rates have already moved up sharply in the last few years and we envision further significant increases. In fact, *if conventional investment is not recovered at a more rapid rate, North Slope investment will not be made.* (emphasis added) Continuing the trend of the past few years, we believe that the Federal Power Commission will very readily allow higher rates of investment recovery and will be supported by distribution company customers of pipelines. The economic leeway to do this is enormous. While still remaining competitive, rates could be increased by at least $1 per MCF at the present rate of sales and would recover total undepreciated historical investment in a single year. Of course, rates will not be increased this much immediately, but the potential to do so gives us confidence that interstate pipelines are among the most economically viable of regulated industries."

"We envision that a natural gas pipeline to the North Slope would be readily financed . . . with the increased internal generation of funds from higher depreciation rates on present facilities."

"The next problem is how would we finance that big a pipeline? Some . . . have worried about the financial outlook, and I do believe some changes are in order. Now I'm clearly looking beyond the immediate horizon of a Federal Power Commissioner. I think that the existing pipelines have the ability to generate funds for an Alaskan pipeline project. This ties in with a point . . . about gas pipelines having shown a good return on equity, but not a very good return on investment. The return on investment is going up, that is, the depreciation rates are increasing. We are beginning to get capital back faster. I visualize that the Federal Power Commission would significantly increase depreciation rates, perhaps to the extent of amortizing existing pipelines over current reserves. If this were done, pipelines could generate much, much more annual cash flow which in turn could finance an Alaskan pipeline. Thus one identifiable new source of supply is gas from Alaska transported in a very expensive pipeline, but still delivered at an economic price. Such a pipeline would not be financed unless cash flow increased for present pipelines."

FINANCIAL OUTLOOK FOR GAS UTILITY INDUSTRY

"A strong strategic position gives us confidence that regulatory authorities can and will continue to permit pipeline rate increases to maintain utility earnings even without higher wellhead prices and increased supply. During 1974 the gas utility industry margin was about $.65 per MCF above the price of $.30 per MCF paid to domestic producers. The resulting delivered cost of $.95 per MCF compares to the delivered cost of imported heating oil which would approach the equivalent of $3.00 per MCF for small users. Suppose that federal policies allowed no further price increases in natural gas and that, as a result, volume declined to 50% of current levels after 1980. To maintain earning power on half volume would require that the utility margin be doubled from \$.65 per MCF to \$1.30 per MCF. With little change in wellhead prices delivered gas cost would still be less than half the equivalent value of imported heating oil."

"Our projections allow more than ample growth in utility margin. In these projections (see Table 3), utility revenues expand by \$25 billion of which cost of gas accounts for \$16 billion leaving \$9 billion for the increase in utility margin. The projections allow for a \$3 billion increase in operating expense. A well managed company should readily be able to hold operating expense below this allowed 10% per year rate of increase. The projections allow for a \$3 billion increase in amortization including depreciation. This would be three times the absolute amount estimated to be applicable last year and further represents a shrinking of the depreciable life of gross plant from 30 years in 1974 to 15 years in 1980. The projections allow for the remaining \$3 billion increase in utility margin to be spread evenly among interest, income taxes, and net income. Interest is sufficient to support higher average interest rates while net income expands in excess of 6% per year. A dividend payout of 50% is maintained and return on equity continues above 12%. New debt is added at a declining rate with the expansion of retained earnings and amortization. In other words, the regulatory outlook illustrated leads to enhanced ability to generate capital internally. Funds are applied to capital investment at a growth of 10% per year."

TABLE 3.—GAS UTILITY INDUSTRY ILLUSTRATIVE FINANCIAL MODEL

	1974	1975	1976	1977	1978	1979	1980
Sales (TCF)	16.0	15.1	14.2	13.5	13.1	12.9	13.0
Purchases (TCF)	17.0	16.0	15.1	14.3	13.9	13.7	13.8
Sales price (\$/MCF)	\$.95	\$1.15	\$1.45	\$1.85	\$2.20	\$2.70	\$3.00
Purchase price (\$/MCF)	.30	.40	.55	.75	1.00	1.30	1.50
Utility margin (\$/MCF)	.65	.75	.90	1.10	1.20	1.40	1.50
Income statement (in billions of dollars):							
Revenue	\$15.0	\$17.7	\$21.1	\$24.9	\$29.6	\$35.0	\$39.6
Cost of gas	5.0	6.4	8.3	10.7	13.9	17.8	20.7
Operating expense	4.1	4.5	5.0	5.5	6.0	6.6	7.3
Amortization	1.5	2.0	2.5	3.0	3.5	4.0	4.5
Earnings before interest and tax	4.4	4.8	5.3	5.7	6.2	6.6	7.1
Interest	1.4	1.6	1.8	2.0	2.2	2.4	2.6
Earnings before tax	3.0	3.2	3.5	3.7	4.0	4.2	4.5
Income tax	1.2	1.3	1.4	1.5	1.6	1.7	1.8
Net income	1.80	1.92	2.06	2.20	2.36	2.52	2.70
Dividends	.90	.96	1.03	1.10	1.18	1.26	1.35
Retained earnings	.90	.96	1.03	1.10	1.18	1.26	1.35
Balance sheets (in billions of dollars):							
Assets:							
Current	15	16	17	18	20	22	24
Gross plant	45	49	52	57	62	68	74
Reserve	15	17	19	22	25	29	33
Total assets	45	47	40	53	57	61	65
Liabilities and net worth:							
Current	10	10	11	11	12	13	14
Debt	20	21	22	24	25	27	29
Equity	15	16	17	18	19	21	22
Total liabilities and net worth	45	47	50	53	57	61	65
Funds statement (in billions of dollars):							
Sources:							
Retained earnings		1.0	1.0	1.1	1.2	1.3	1.4
Amortization		2.0	2.5	3.0	3.5	4.0	4.5
New debt		1.2	1.3	1.4	1.5	1.6	1.7
Total sources		4.2	4.8	5.5	6.2	6.9	7.6
Uses:							
Plant		3.6	4.1	4.7	5.3	5.9	6.5
Working capital		.6	.7	.8	.9	1.0	1.1
Total uses		4.2	4.8	5.5	6.2	6.9	7.6

WELLHEAD PRICE INCREASES BOLSTER CONVENTIONAL FINANCIAL OUTLOOK

It is economically inconsistent to consider financing a project that would deliver Alaskan gas for $2.00 per MCF while controlling wellhead prices of nearer supplies at only $.30 per MCF. Investors will have to see considerable further progress in the relaxation of wellhead price controls in order to prudently consider participation in financing a project dependent upon government regulation for its financial viability.

"If pipelines could buy gas for $2.00 per MCF producers would be willing to invest some $.60 per MCF to find and develop new supplies. To replace the 22 trillion cubic feet to be consumed this year would then justify spending of some $13 billion for exploration and development. The fact is that, excluding lease bonuses, the industry spends far less than this on oil and gas together, the amount spent last year on natural gas was less than $3 billion. In other words, industry has been spending only a fraction of what it ought to be."

"Our projections allow a five-year period during which exploration and development spending would build up to an economically and politically justifiable level (see Table 1). After some lag time for the increased expenditures to effect, additions to reserves increases to match annual withdrawals."

TABLE 1.—U.S. NATURAL GAS EXPLORATION AND PRODUCTION TRENDS

	Production (trillion cubic feet)	Capital expenditures (billion dollars)	Additions to reserves (trillion cubic feet)	Year-end reserves (trillion cubic feet)	Reserve life index (years)
Natural gas:					
1974	21.7	$2.8	8.8	211	9.7
1975	20.5	3.5	8.0	199	9.7
1976	19.3	5.5	7.0	187	9.7
1977	18.3	7.5	9.0	178	9.7
1978	17.8	9.5	12.0	172	9.7
1979	17.5	11.5	15.0	170	9.7
1980	17.6	14.0	18.0	170	9.7

Source: DLJ estimates.

"Few people in industry, government, or the investment community share our optimistic projections of reserve additions. A common belief holds that there is not enough nautral gas to be found to justify the level of expenditures we project. We concede that only the less attractive reserves remain to be added in conventional areas. We maintain however that the inventory of propects that are still economic at prices up to ten times the average of just a few years ago is sufficient to support rapid growth in exploration for a five to ten-year period; after this coal gasification, liquefied natural gas, and other substitutes would become more meaningful. We know for example that there are abundant reserves in the Rocky Mountain states where the producibility is low by historic standards. Even today new contract prices for gas in the Rocky Mountains have not reached the significant levels of the major industrialized producing states as there is little unregulated demand and regulated prices remain low. Finally, we point out that explorations have experienced new natural gas prices approaching oil prices for little more than a year in the unregulated Texas intrastate market and already a surplus has developed."

"As economically desirable as higher spending on natural gas exploration and development may be, it won't happen unless companies are assured that investment in high cost reserves can be recovered through higher prices. Theoretically the capital markets could provide anticipatory funds for such spending if higher future prices were assured. Practically speaking, however, the strongest assurance of realistic and reasonable pricing in the future is for revenues on new and existing production to expand as rapidly as does the ability to apply increased funds effectively in new capital projects. We postulate a fivefold increase in average natural gas price to $1.50 per MCF in 1980 (see Chart 2). Prices for post-1972 contracts under FPC regulation and for new contracts in the unregulated intrastate market would be $2.00 per MCF in 1980 and, in our projections, prices under older contracts would reach $1.00 per MCF and would account for half of 1980 volume (see Table 2)."

CHART 2

NATURAL GAS WELLHEAD PRICE TRENDS

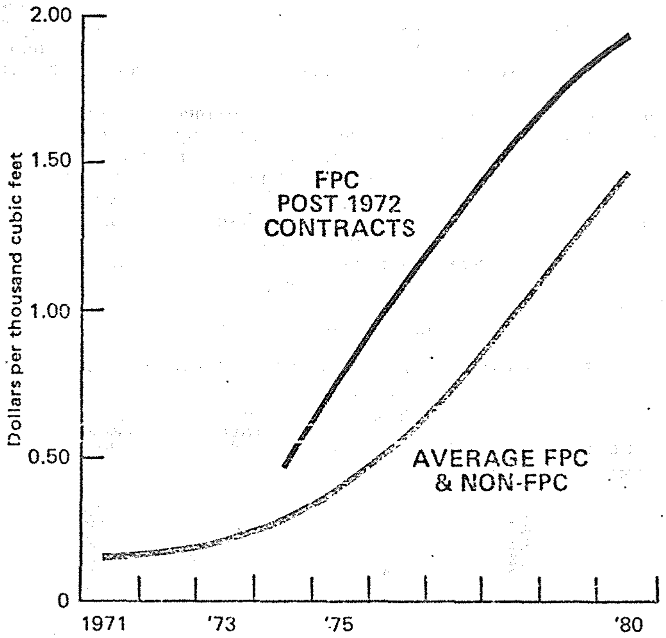


TABLE 2.—NATURAL GAS WELLHEAD PRICE STRUCTURE

	Volume (trillion cubic feet)	Price	Revenue: Billions of dollars	Revenue: Percent
1974:				
Interstate:				
Pre-1973 (mostly onshore)	11.9	$0.25	$3.0	46
Post-1972 (mostly offshore)	1.0	.45	.5	8
Intrastate	8.7	.34	3.0	46
Total	21.6	.30	6.5	100
1980:				
Interstate:				
Pre-1973	4.8	1.00	4.8	18
Post-1972	4.8	2.00	9.6	37
Intrastate	8.0	1.50	12.0	45
Total	17.6	1.50	26.4	100

"Between now and the end of the year we expect the FPC to announce a price for the 1975–76 biennium for post-1972 wells and contracts. The FPC Bureau of Natural Gas recommended a price of approximately $1.30 per MCF. Meanwhile the Senate has said indirectly that at least $1.30 per MCF would be appropriate. We have hedged our expectations by looking for a "political decision" which establishes $.90 as an interim price; we would be disappointed if the price for 1975–76 were less than $.75 (compared to a price in 1974 of $.50 per MCF). A major advantage of the FPC's biennial approach is that a new price level applies for only two years after which the matter is again open for reconsideration both for subsequent contracts and for gas committed during the previous two-year period. Accordingly we expect the price to be established for the 1977–78 biennium would be $1.20 to $1.50 and for the 1979–80 biennium $2.00 per MCF."

"Either through a liberal definition of new contracts or through direct price increaases on old contracts, we expect the price from flowing gas production (pre-1973) to move up sharply as well. Just about every gas field offers some potential for further incremental investment to develop incremental reserves. Such investment simply cannot be justified except in the context of a reasonable pricing structure. While some differentiation between "new" gas and "old" gas can be achieved, too rigid a distinction would be economically inefficient. Today's new gas producer is tomorrow's old gas producer. To the extent that a producer has to give undue consideration to future regulatory treatment, he will be willing to take less risk. For example, during the early sixties, the FPC actually rolled back natural gas prices from contract levels mutually agreed upon and/or approved by the FPC itself. In our judgment price increases on old gas are justified from the point of view of encouraging development of new supply in existing fields as well as their usefulness in creating an atmosphere of productive cooperation between consumers and producers rather than counter-productive hostility."

"Consumers have little to lose through gradual increases in average wellhead prices in line with an efficient rate of reinvestment. If at any time during the next several years it appears that the proceeds from higher gas prices are not being reinvested further price increases can be postponed."

"Our price projections can be achieved in the context of continued regulation of the interstate market by the Federal Power Commission and an unregulated intrastate market. Legislative developments could accelerate the price trend. There appears to be a consensus . . . in favor of long-term legislation which would decontrol new gas prices onshore while providing a phaseout of price controls offshore. This approach implies more rapid price appreciation in the onshore market than our projections imply and appreciation in the offshore area in line with what we contemplate."

PRODUCER PARTICIPATION IN ALASKAN FINANCING

Under normal circumstances I would not expect major oil and gas companies to participate in the financing of Alaskan gas beyond the wellhead. While the producers have financed the Alaskan oil pipeline, the latter is inherently less risky as the investment cost in the oil pipeline is less than $1.00 per barrel compared to an imported oil equivalent delivered price twelve times greater, or near $12.00 per barrel and an average regulated oil price of some $7.66 per barrel. In contrast, an investment cost in a gas pipeline of $.50 per MCF compares with an imported oil equivalent delivered price four times greater, or near $2.00 per MCF. The investment cost of a gas pipeline actually exceeds the current average regulated wellhead price of natural gas in the U.S. Producers may be willing to invest in a gas pipeline if a portion of the delivered natural gas price were tied to market considerations as was the case in the development of Dutch gas. Under normal circumstances in this country however, producers would be unwilling to finance a regulated natural gas transportation project because they perceive the historic record of the Federal Power Commission entirely negatively. Natural gas pipeline companies, on the other hand, are accustomed to working within a fully regulated framework and are the logical financial and operating participants in this proposed project.

Despite the inherently more favorable economic characteristics of an Alaskan oil pipeline compared to a gas pipeline, there can be no doubt that the backing of strong participating companies facilitated the oil financing that has taken place. The commitment of an Exxon, for example, plays an important role in assuring investors of the viability of investment in Alyeska. This willingness of large companies to commit to vital new energy development projects is presently threatened by the prospects that new legislation may require breaking up these entities. Such prospects only compound the continued uncertain outlook for federal and state tax policies, oil price controls, environmental constraints, leasing policy and other factors. While most of the discussion in this submission has dealt with the natural gas industry, the point that government regulation of existing operations has great bearing on investor willingness to participate in new ventures applies to the oil industry as well.

CONCLUSION

An Alaskan gas pipeline could be financed by conventional means in the context of a constructive regulatory environment. The conditions of that environment cannot be known before the fact. Hence it becomes important that the signals and trends by which investors judge the future environment be positive. Specifically this means a regulated return on equity for pipeline operations that keeps stock prices at or above book value for most companies in normal markets, a depreciation rate on pipeline investment that more closely matches the life of reserves, and rising wellhead prices that assure efficient allocation of capital to the lowest cost incremental sources of gas supply.

STATEMENT OF J. C. TURNER, PRESIDENT, INTERNATIONAL UNION OF OPERATING ENGINEERS

My name is J. C. Turner. I reside in Washington, D.C., and I am President of the International Union of Operating Engineers.

The Operating Engineers are an affiliate of the American Federation of Labor—Congress of Industrial Organizations. The International Union of Operating Engineers has 425,000 members, in the United States and Canada. It is a member of the Building Trades Department of the AFL-CIO. Members of the Operating Engineers are engaged in construction and other work vital to this nation in all parts of the United States and Canada.

I am very pleased to be able to submit this statement for this joint hearing of the Senate Committee on Commerce and on the Interior, to give the views of the International Union of Operating Engineers with regard to the transportation of Northern Alaskan natural gas to the lower 48 states of the United States. I am sure that I do not need to stress to these Committees the great need for energy in this nation. We are all well aware of the substantial dependence we now have upon imported fuels, and particularly upon imported oil from the OPEC nations. Both the supply and the price of that imported energy are in the hands of the OPEC nations. It seems obvious to us that multiple steps to reduce the dependence upon the governments of the OPEC nations are needed.

We have all been made aware of the development of a large amount of natural gas on the north coastal area of Alaska, along with the large amount of oil discovered there. It seems self-evident that this large supply of natural gas should be transported to the market areas which require it, for use in the homes of the people of the United States, and by the industries and commercial activities which are necessary for the employment of our people. Securing that gas is a necesary supplement to the development of additional sources of energy, and to efforts to conserve energy. At a time when unemployment and under-employment is such a serious problem in our nation, we should take no chances that an insufficient supply of energy may worsen that situation.

The union which I represent has been made aware of the two alternative applications for government permission to construct transportation systems to carry the North Slope natural gas to the lower 48 states: the all pipeline proposal and the liquefaction proposal. We have reviewed the various aspects of those proposed projects and have concluded that the best interests of the United States will be best served if the transportation method which is constructed and put into operation is an all pipeline system from Alaska to the United States. Such a pipeline system would, of course, cross Canada, and would therefore be able to transport the substantial amount of natural gas which we are informed has been discovered in the Canadian Arctic. We are aware of the large amount of natural gas now exported from Canada to the United States and we believe that a pipeline which will allow Canada to transport its own Arctic reserves to its markets will be helpful in allowing the United States to continue to import at least the quantities now imported, which are very significant to our nation's natural gas supply.

In addition, we believe that an all-land pipeline is the most economical way to transport the natural gas to all parts of the nation: the West and Northwest, as well as the Midwest and East. We are also aware of the efficiency and reliability of a natural gas pipeline, since the members of the union which I represent have long experience in the construction of natural gas pipelines. We are one of the essential trades which made the construction of pipeline systems possible.

We are very much aware, in supporting the construction of the pipeline across Alaska and Canada to the United States, that a project of this size will not only provide natural gas to the areas which need it, but will also cause an increase in the general economic activity of the United States. The purchase of substantial materials in the United States, and the utilization of United States contractors and United States working men and women during the construction period, will be a very useful addition to the economic activity of the nation. At a time when the construction activities in this nation are at such a low level, we need to encourage projects of this type, which will serve a useful public function when completed. We need to have them move ahead as promptly as possible.

In that regard, we are aware of legislation pending before the United States Senate with regard to transportation systems for Alaskan natural gas. We are aware that the administration has recently proposed legislation which would call for the various regulatory agencies and administrative departments to make recommendations to the President by about February 1, 1977, and for the President to issue a decision by August 1, 1977, subject to Congressional disapproval.

S. 2950 offers the opportunity for approval of the pipeline across Alaska and Canada to the United States in 1976.

The International Union of Operating Engineers supports this more prompt and certain approval of that pipeline, and we therefore urge the members of the Senate Commerce and Interior Committees to favorably report S. 2950. We hope that the Senate will act favorably on that legislation as promptly as possible.

We shall also urge similar action on a similar bill in the House of Representatives, in the hope that the project can be approved in this session of Congress, before the autumn recess, so that this important energy project can move forward to construction as promptly as possible.

On behalf of the International Union of Operating Engineers, let me again express my appreciation for the opportunity of submitting our views to this Committee.

Statement of the Indian Brotherhood of the Northwest Territories and Metis Association of the Northwest Territories

INTRODUCTION

Since the discovery of hydrocarbons at Prudhoe Bay, Alaska, in 1968 there has been much speculation as to how the oil and natural gas might be moved to markets in the United States. Different interests have for some time expressed a keen interest in moving natural gas from Alaska to the "Lower 48" by pipeline via the Mackenzie River Valley route in the Northwest Territories, Canada. A consortium of companies called Canadian Arctic Gas Pipelines, Ltd. has applied to the Government of Canada for the right of way to build such a pipeline.

At present hearings are being conducted by Mr. Justice Thomas Berger, Commissioner of the Mackenzie Valley Pipeline Inquiry, in connection with the application for a right of way, and by the National Energy Board in Ottawa in connection with the application for a Certificate of Public Convenience. Simultaneously, hearings are being conducted by the Federal Power Commission in Washington in connection with the applications of the U.S. Sister Company to Canadian Arctic Gas Pipeline, and the rival El Paso proposal.

In Canada, Foothills Pipelines Ltd. has applied to build the so-called "Maple Leaf" or "All-Canadian" line from gas fields in the Mackenzie Delta to Southern Canada via the Mackenzie River Valley. This application is also before Mr. Justice Berger and the National Energy Board.

Competing legislation is also now before the U.S. Congress as to the manner of transporting Alaskan gas to market and possible transportation routes.

The Senate, in considering the question of whether Alaskan gas should be moved to markets in the United States, via the Mackenzie River Valley, should be cognizant of all matters bearing on that question. A major issue which must be given due consideration is the matter of the land rights of the Dene people of the Northwest Territories.

BACKGROUND

The Dene are the Native people—Indian and Metis (Half-Breeds) of the Mackenzie Valley of the Northwest Territories. The Dene have occupied their lands in the Northwest Territories south of the tree-line since time immemorial. Until recently they have remained relatively undisturbed by the encroachment of the dominant society on the use and occupation of their lands. The most recent and significant disturbance to their lifestyle has occurred with the transfer of thousands of Civil Servants to the Northwest Territories in 1967–68, and with the increasing exploration activities which accompany Government and industry's burgeoning interest in the area's non renewable resources.

The Northwest Territories are unique in Canada in that it is the only area where the indigenous population still constitutes a majority. Of the approximately 42,000 people living in the Northwest Territories, some 18,000 are Dene, while another 15,000 are Inuit (Eskimo).

In 1899 and 1921, treaties 8 and 11 were signed with the Dene. These treaties purport to extinguish their aboriginal title to their traditional lands. The Treaties have been the subject of recent litigation.

In 1973, the Chiefs of the 16 Indian Bands in the Mackenzie Valley presented to the Registrar of Land Titles in Yellowknife, Northwest Territories, a caveat claiming ownership by virtue of aboriginal title, of the 450,000 square miles of land south of the tree-line in the Mackenzie River Valley.

The contention of the 16 chiefs was that Treaties 8 and 11 were treaties of peace and friendship only—not land cession agreements—and that the Dene were still the legal owners of the lands in question.

The Land Titles Registrar referred the caveat to Mr. Justice William Morrow of the Supreme Court of the Northwest Territories. In the hearings that followed, evidence was heared from the Chiefs, eye-witnesses to the signing of the Treaties including signatories and one interpreter, anthropologists and other experts. Mr. Justice Morrow ruled in October, 1973, that he was satisfied that the Dene had the right to claim the lands in question by filing of a caveat.

The case was appealed by the Federal Government, and the Northwest Territories Court of Appeals overruled Mr. Justice Morrow's decision on the technical issue of whether or not a caveat could be filed against lands for which no Certificate of Title was registered in the Land Titles Office. Leave to appeal this decision to the Supreme Court of Canada was granted in February, 1976, and will be heard and ruled upon in due course. The lands in the Mackenzie River Valley are therefore subject to litigation and the claim of ownership of the Dene.

In the early 1970's, two organizations were formed to officially represent the Dene in their fight for recognition of their ownership of the land—the Indian Brotherhood of the Northwest Territories and the Metis Association of the Northwest Territories. (Two separate organizations were necessary because of the Federal Government's distinction between "Status" Indians, "Non-Status" and "Metis"—not because of any division among the Dene themselves.) The official position of the Dene through their representative organizations since 1971 has been "No pipeline before a Land Settlement."

Extensive land use and occupancy research carried out by the Indian Brotherhood of the Northwest Territories proves conclusively that the traditional lifestyle of hunting, trapping, and fishing is still viable and widespread: and that the entire land area of the 450,000 square miles under question is continuously used to sustain this lifestyle.

In hearings before Mr. Justice Berger in the Dene communities throughout the Mackenzie Valley, the Dene have expressed unanimous and unqualified opposition to the construction of a pipeline prior to a land settlement. The pipeline companies and the Federal Government of Canada are aware, and have been aware since 1971, that on no terms is a pipeline prior to a land settlement acceptable to the Dene.

PROGRESS ON LAND CLAIMS

The reactions of the Government of Canada and the pipeline companies to the Dene claim have always been disappointing, but due to the persistence and patience of the Dene they have at last come to appreciate the significance of the issues.

Recent progress on the land claims includes:

(1) The admission of Mr. Robert Blair, President of Foothills Pipelines, at the hearings of Mr. Justice Berger at Fort Good Hope, that his company would not risk building a pipeline before a just land settlement has been negotiated with the Dene. (Toronto Star, August 7/75, Globe and Mail, August 7/75, Calgary Alberta, August 8/75, The Edmonton Journal, August 8/75, etc., although Mr. Blair later alleged he had been misquoted.)

(2) The recent appointment of Mr. Digby Hunt as Special Government Negotiator in Areas of Comprehensive Claims—i.e. areas where land rights have not previously been extinguished by Treaty or otherwise. The Federal Government has instructed Mr. Hunt to begin discussions with the Dene on the basis that the Dene have a right to a settlement on broad and comprehensive terms, i.e. have unextinguished aboriginal rights.

(3) The agreement of the Federal Government of Canada to negotiate with the Dene following submission of a claim and a settlement proposal on or about November 1, 1976 (Speech of the Minister of Indian Affairs and Northern Development, February 13, 1976).

The claim of the Dene is one for recognition and preservation of their rights, which are seen as both property rights over their traditional lands, and political rights, the rights to self-determination and survival as a cultural and national entity. The pursuit of the claim involves as a significant factor the education and sensitization of government, industry, and the general public. Ignorance is pervasive but not insurmountable as witnessed by the progress being made.

CONCLUSION

The U.S. Senate is advised that the primary consideration in the Mackenzie Valley with regard to the possible future construction of pipelines is the issue of the land rights of the Native people. No decision regarding a Mackenzie Valley pipeline will be tolerated by the Dene prior to the negotiation of a satisfactory land settlement.

Pipeline companies are misleading the Senate if the impression created by them is that the issue of the land rights of the Native people is a minor consideration. No pipeline can be built until a fair and just settlement has been reached with the Native people. The obstacles to construction of a pipeline before land settlement include—beyond the solidarity of the Dene in their position—powerful legal and moral considerations that cannot be overlooked.

STATEMENT OF BREC COOKE, FOR THE WILDERNESS SOCIETY

Mr. Chairman, Members of the Committee, The Wilderness Society, a national conservation organization dedicated to the preservation of the wild lands and waters of our nation, appreciates the opportunity to comment with respect to the issue of transportation of Prudhoe Bay, Alaska natural gas to markets in the "lower 48" states.

Let me state at the outset, that the Society is unalterably opposed to the construction of a pipeline—any pipeline—through any porion of the Arctic National Wildlife Range or through any portion of the additions to the Range proposed by conservation groups. As oil and gas development proceeds across nearly all other areas of Alaska's North Slope, the Range remains today the only protected region on the North Slope which encompasses a complete Arctic ecosystem stretching from the coastal plains into the rugged Brooks Range with its snow clad mountains and broad valleys. The area is remote from major human influence and typifies Alaskan Wilderness.

There are those who glibly speak of the "mitigation" of wildlife losses and other environmental damage that would result from constructing a pipeline through this wilderness—as if there were a viable means of doing so. "Mitigation" is a word which contains an inherent assumption—that there will be adverse consequences of a given action. The word argues only for the ability to limit such consequences, and when applied to the harsh but fragile Arctic environment is but a farce.

The justification set forth in 1960 for establishing the Range, remains valid today.

The wildlife, vegetation, water, geological, archeological, scientific recreation, aesthetic, and other environmental values which comprise this unique ecosystem—

patiently developed by natural processes over thousands of years—remain directly dependent upon the wilderness character of the region. What exists in this magnificent Range today, is a result of the unmodified, natural condition that prevails there. The Department of Interior Draft Environmental Impact Statement, in its evaluation of the environmental values of the Range that would be affected by the pipeline construction points out, "The one quality certain to be lost is that of wilderness . . ." (Vol. I, page 484).

A pipeline through this Range and the associated construction, operation and maintenance would destroy forever this wilderness quality—and thus irreparably damage the environmental values now present.

The construction of a pipeline through the Range would be a short-sighted, short term use of the environment with permanent, irreversible consequences. The rationale would be what economists have referred to as "sub-optimization," finding out the best way to do something which should not be done at all.

In no way is this issue merely a question of "mitigation". It is rather a land use decision—determining the "highest and best use" of this land. That use in this area should be as wilderness—as it always has been.

Moreover, there exists alternatives to constructing a pipeline across the Arctic National Wildlife Range. It is important to understand that any proposal will have adverse environmental consequences. The all-Alaska LNG Tanker proposal raises serious questions regarding LNG tanker safety, increased LNG tanker activity and LNG facilities siting on the coasts of South Alaska and California.

The ultimate goal is to find the route that will provide the cheapest, most reliable supply of natural gas after having examined the political, environmental, economic, time and supply factors of all alternatives. One route which we feel merits a more complete investigation is the Fairbanks-Alcan highway corridor which would follow the Alyeska corridor from Prudhoe Bay to Fairbanks and then head eastward following the Alcan highway corridor into Canada and then turning south, and ultimately connecting with the existing distribution system in the "lower 48" states. This route was endorsed by the Federal Power Commission's environmental staff in their draft EIS (November 1975) and received favorable economic analysis by the Department of the Interior in their P.L. 93–153 Title III Study (December 1975).

We believe that this route has excellent potential in environmental and economic terms and deserves a more complete review in any process that would arrive at a final decision. The Fairbanks-Alcan corridor avoids crossing the Arctic National Wildlife Range, would utilize existing transportation corridors, and still deliver the gas to the appropriate U.S. markets. Such a proposal also avoids the serious uncertainties regarding the Canadian Native Claims Settlement issue which confronts the Arctic Gas consortium proposal. With these advantages the Fairbanks-Alcan corridor alternative appears to be a most favorable route. It has not, however, been analyzed in the detail that the Arctic Gas and all-Alaska-LNG proposals have been analyzed. For this reason we do not endorse this route, but do feel that any final decision that is reached which does not fully examine this alternative would be premature.

The Wilderness Society would support any legislation which would provide for the completion of the ongoing administrative proceedings and which would provide for a complete review of the available alternatives. We, however, firmly believe that judicial review under NEPA must be upheld and that public participation in any route selection be provided.

Another factor of concern to all of us is time. This is the concern of much of the public, but must be placed in proper perspective. We have been told that due to ever-increasing construction costs, "time is money"—that a decision on which route must be made soon. However, when Mr. Guy Martin, Commissioner of Natural Resources for the State of Alaska, testified before this Joint Committee last month he clearly pointed out the supply risks associated with the reserves with which we are concerned—gas production, linked with the developvent of Prudhoe Bay oil.

We thus find ourselves discussing enormously expensive but established proposals to deliver natural gas to the "lower 48" states from Alaska, and still do not know for certain the levels of producibility that can be achieved from the production reservoir. Mr. Martin's testimony, pointed out that, based on models, the State of Alaska could decide on production levels by the end of the year, but that the "optimal" decision could be made only after field operation information is gathered which could take two years. In other words, until Alyeska oil flows, no precise determination can be made with regard to levels of gas producibility.

There is no reason why this nation cannot make an "optimal" decision in this instance. We all realize that with the development of Prudhoe Bay oil, the associated gas will also be produced. It should be. Natural gas is a most preferable fuel. The Wilderness Society does not oppose the delivery of Prudhoe Bay natural gas to the "lower 48" states. There will be no "battles" fought by environmentalists over whether to produce these reserves or not. The issue here is not whether, but how and where transport will occur.

We have only to look at the Alyeska oil pipeline and discover what premature decisions can bring. Recent Federal Energy Administration actions before the FPC indicate that now unless a transportation system is developed to move Alaska oil from California, where it will be needed, to the Midwest and East, that the oil may not be produced, or if it is, then sold to foreign countries.

Project Independence has come to mean—suck us dry first—whether it be Alaska oil and gas, or oil, gas and strippable coal from the rest of the country.

Policy makers have learned, all too painfully in recent years, the importance of basing energy resource allocation decisions on thorough analysis and reasoned thinking as opposed to being stampeded into an emotional, premature decision. This decision requires no less.

Questions remain unanswered regarding the environmental costs, the economic risks associated with tremendous capital outlays, and ultimately producibility risks. Alternatives exist which have not been fully explored.

These questions must be answered and alternatives fully examined before this nation makes an irretrievable committment of our not inexhaustible resources—economic and human as well as environmental. It ill-behooves us to do otherwise.

STATEMENT OF ANGELO FOSCO, GENERAL PRESIDENT, LABORERS' INTERNATIONAL UNION OF NORTH AMERICA, AFL-CIO, CLC

Mr. Chairman and Members of the Committee, my name is Angelo Fosco. I am President of the Laborers' International Union of North America and a Vice President of the AFL-CIO and the Building & Construction Trades Department. At this hearing I will speak in my capacity as General President of the nearly three-quarters of a million member Laborers' International Union of North America.

On behalf of those members I wish to thank the Chairman and Committee members for the opportunity to appear here to speak to the issues involved in S-2950, the Alaskan Natural Gas Pipeline Act of 1976. Our International Union is no stranger to pipeline construction. From the early days of the "Big Inch" during the Second World War to the present, we have been one of the major unions participating in the construction of underground pipelines. At present, we are the largest, numerically, of the four unions having national agreements in both the United States and Canada with national mainline pipeline contractors associations. Depending upon the state of the industry, from 5 to 10 thousand members of our International Union are employed annually in the construction of mainline pipelines. As for myself, my interest in this work extends over the period of my service with the International Union. In my former capacity as Vice President and Regional Manager of our International Union's Chicago Regional Office, I was directly responsible to my predecessor for the administration of our national pipeline agreement.

Thus, I think that I can appear before you today with a fair basis of experience in the pipeline and construction and transmission industries.

I speak also from a basis of deeper concern with respect to this bill, however. In recent years I have joined those who are convinced that the energy crisis faced by this country, if not met squarely, can have serious long-term effects on the quality of our national life. Just to hold our own, economically, will require that we meet growing demands upon our energy sources. Continued economic growth for our nation requires an ever-expanding base of energy resources. At the same time, I join with others in a desire to make this country as nearly independent of foreign sources of energy as our resource base and technological ingenuity permit.

To my mind it is vital that we develop as rapidly as possible all known domestic energy sources. Among these sources, Alaskan oil and natural gas are of supreme importance. In the case of natural gas the Prudhoe Bay Reserves, alone, are estimated to add 11.7 trillion cubic feet to our domestic supply of natural gas, with other North Slope reservoirs expected to add an additional 8.4 trillion cubic feet. The development of this field is expected to add to our proven reserves over 20 trillion cubic feet of natural gas by 1985, sufficient for a daily consumption of gas from this slope of 2.5 billion cubic feet for the next 20 years.

To assess the merits of the competing proposals for transporting this vast reserve of new energy to the continental United States, I have directed close attention to the 1975 report of the U.S. Department of Interior entitled "Alaskan Natural Gas Transportation Systems." In my opinion, this report clearly demonstrates the superiority of the Alaska-Canada Pipeline proposal over the Liquefied Gas proposal for transporting the North Slope natural gas to the continental United States. Not only does the Alaska-Canada Pipeline promise to deliver gas at a lower cost and greater safety to our country, it has additional benefits for our good neighbor to the North. Benefits which will be shared and enjoyed by the many thousands of members of our International Union who are Canadian citizens.

The experience of the United States with pipeline transportation of oil and natural gas, has, in my opinion, demonstrated that this technology provides the safest, cleanest, least wasteful and most environmentally protective method of moving these resources from the wellhead to the point of use that we are capable of developing. The pipeline safety record—both in construction and operation—is superior to most domestic industries. This is not to say that there have not been tragic occurrences in connection with pipelines, they have, however, proven to be controllable and each one has resulted in additional safeguards to the public. In its operation, a buried pipeline disturbs very little of the environment and interferes least with the flow of other goods and services on the surface of the ground. Finally, pipelines use less energy to move cargo than any other known form of transportation making their net benefit in terms of the delivery of natural gas higher than that which could be achieved by any other method. In passing, let me say that these benefits are not restricted to pipeline transmission of oil and natural gas, and put in a small plug for passage of the Coal Slurry Act presently under consideration in this Congress.

The benefits described above are certainly clear in the case of the Alaska-Canada Pipeline proposal. Again, according to estimates prepared by the Department of Interior at a delivery rate of 2.5 billion cubic feet per day, liquefied natural gas delivery cost is $1.60 per million BTU, assuming that no fuel is lost in transit or in processing. Fuel losses, however, would increase that cost by five cents (5¢) to $1.71 per million BTU. By contrast, at the same delivery rate the pipeline would bring natural gas to Chicago at a rate of $1.58 per million BTU with only a four-cent (4¢) per million fuel loss. This benefit continues once the gas is delivered in the United States. The cost of constructing distribution systems within the United States is estimated $2 billion less for delivery by the Alaska-Canada System rather than by the Alaskan LNG System.

I have previously indicated that our Union has a deep and abiding interest in the Dominion of Canada, both by virtue of our common heritage and the fact that our Union represents over 50,000 construction and other workers in the several provinces in Canada. We are aware that these members are suffering as deeply from unemployment as our construction workers in the United States and that the construction of a cooperative pipeline in Canada would do much to heal their unemployment problems. Going deeper than that, however, the benefits to the Dominion arising from this joint venture, are significant for consideration by this Body. Canada is a major supplier of natural gas to the Northwest and western states. However, Canada has been depleting their own reserves of natural gas in making these deliveries. The Alaska-Canada Gas Pipeline proposal will open the way for Canada to enjoy proven reserves of natural gas in the MacKenzie fields of the Yukon territories. Thus, the Dominion's enhanced energy supply will be along with that of the United States. The reserves which Canada has in the MacKenzie area will be a significant addition to Canada's energy sources. They are not, unfortunately, sufficiently significant for Canada to pursue an independent course in bringing those reserves to the southern provinces. Of course, our point of view is not entirely altruistic, since a failure on the part of the Dominion of Canada to develop the MacKenzie reserves will have consequences on the United States. Canada, as has been noted, is depleting its own natural gas reserves and is seriously concerned about that depletion. In point of fact, the National Energy Board curtailed long-term delivery contracts for natural gas in 1950 and although they have promised that there will be no sudden curtailment of Canadian natural gas exports to the United States, that very promise implies that phased curtailment is an active possibility. By assuring or helping to insure a stable Canadian supply of natural gas, we contribute to our ability to continue, over the near term, purchases of Canadian natural gas for domestic use. On balance, surely, a consideration which should move us even further along the road of approval of the Alaska-Canada Natural Gas Pipeline.

It is seldom in this life that I have been given a hand consisting of all Aces, but I feel that this is one of those occasions. It pleases me greatly to reiterate our International Union's support for the Alaska-Canada Natural Gas Pipeline Act of 1976, and urge on environmental, economic, foreign policy and plain humanitarian grounds that Congress effect a prompt passage of this legislation.

ENVIRONMENTAL IMPACTS—PIPELINE CONSTRUCTION—ARCTIC NATIONAL WILDLIFE RANGE

(By John Hakala)

Arctic Alaska remains a vast unknown land. Very little is known about its ecology—what is known is that it is made up of unusually fragile ecosystems. Like all natural ecosystems, the Arctic Ocean, the tundra and the adjoining arctic mountains are open, dynamic systems, each composed of many organisms that have evolved adaptations and interdependencies with climate, geology and each other.

Of the factors affecting Arctic life, low temperature is of prime importance. The extreme cold that persists most of the year has determined the life styles of plants and animals, resulting in the formation of relatively simple communities. One consequence is perennially frozen ground (permafrost) which underlies most of the Arctic and has limiting effects on plants. The permafrost prevents downward movement of water through the soil, producing wet, boggy land surfaces and abundant ponds and lakes where the land is not well drained.

Of critical importance to plant life, and therefore to animals, is the seasonal summer thawing of the "active layer" of the tundra surface. Soil thawing on the Arctic Slope varies from a few inches to a few feet, due to the insulating effect of the tundra mat. In addition, the amount of precipitation is low, averaging between four and seven inches annually but due to low evaporation rates and perennially frozen ground, the tundra and foothill regions are usually quite moist during the short summer. For the remainder of the year, most moisture is frozen and static.

But the Arctic is not always cold. During the short summer, temperatures average 40 degrees F. on the interior plains and within a few inches of the ground where vegetation, small animals and insects inhabit the tundra microclimates, temperatures rise to over 100 degrees F. From June to August the long daylight hours of a low-angle sun cause a burst of plant productivity already initiated in May beneath the insulating layer of snow prior to the melt. By early August most plants have completed their seasonal life cycles. While seeds are maturing, new leaf and flower buds develop near the surface of the soil and food is stored in underground rhizomes or root systems in preparation for next year's growth.

Tundra vegetation supports large numbers of small herbivorous mammals as well as birds, insects and large mammals. The growth of fur, hair, fat and feathers helps many animals to survive the extremes of cold, particularly large animals. The small mammals adapt by hibernation or feeding under the snow cover which protects them from cold and most predators.

The tendency in ecosystems toward fewer numbers of species under severe limiting conditions is illustrated by the low number of animal and plant species of the tundra. Nevertheless, large numbers of birds migrate to northern Alaska during the brief flush of high summer productivity. The surge of vegetative growth, stimulated by high insolation, provides good forage. One hundred thirty-nine bird species have been identified and millions of waterfowl and shorebirds migrate through or nest there. Of these birds the ptarmigan is the most completely adapted to the year-round rigors of tundra life.

The most common large herbivorous land mammal of the Arctic is the caribou. Their habit of migrating great distances between winter, calving and summer ranges was instrumental in initiating the first biological studies of the area in 1922. Migration over large land areas assures food while preventing overgrazing and habitat destruction to any particular region. Aside from the wolf and numerous parasites, the caribou has few natural enemies except man.

The finest remaining wilderness under the U.S. flag is the Arctic National Wildlife Range. It is now the only wilderness preserve of any kind in the Arictic, the result of dedicated persistence of such individuals as Dr. Olaus Murie and his brother Adolph who first visited the eastern Brooks Range in 1922–23 and publicized its biotic and geographical wonders; Robert Marshall, who made six trips to the Brooks Range and who in 1936, after visiting the area, publicized the need to establish in Alaska ". . . a really sizeable area free from all roads and industry, where frontier conditions will be preserved" and proposed a single great wilderness area embracing all of northern Alaska; George Collins and Lowell Sumner, who in 1952 travelled in some of the areas now within the Arctic Range and recommended that the area be preserved; and again in 1956, Olaus Murie visited that part of the Brooks Range within the Wildlife Range and publicized its scenic and wildlife values, followed by an illustrated lecture tour during the summer of 1957, which was presented throughout Alaska. During the next three years amid growing support nationwide, Secretary of the Interior Fred A. Seaton, after a bill (S.1899) introduced into the Congress to establish the Arctic National Wildlife Range became bogged down in committee, established the Range by Public Land Order (2214) on December 6, 1960. The PLO provided for the preservation of its unique wildlife, wilderness and recreational value.

A Wilderness Study Report completed on the Arctic National Wildlife Range in April 1973 is awaiting the U.S. Department of Interior and Presidential action. During the interim, the total area (8,900,000 acres), with the following exceptions: (1) a 456 acre tract at Camden Bay—a former DEW Line Site, (2) a 420 acre tract near Beaufort Lagoon—another former DEW Line Site, (3) all those lands selected by the villagers of Kaktovik (3 townships) as designated by the Alaska Native Land Claims Settlement and (4) all of the 4,500 acre Barter Island withdrawn by the Air Force under PLO 715 and the 141 acre townsite of Kaktovik under PLO 3849 is being managed as wilderness under Department of Interior general wilderness management guidelines published in the Federal Register, Vol. 36, 20:252, December 31, 1971. These guidelines for management and administration of a refuge wilderness area are consistent with the directives of the Wilderness Act of September 3, 1964 (Public Law 88–577).

Wilderness has had too quiet a voice speaking in its behalf. If wilderness is left to serve its highest purpose—being there for itself and its indigenous life forms, being there for its wholeness, its beauty, its truth, its spiritual release —then those that understand must speak again as lucidly and as persuasively as did Aldo Leopold, Olaus Murie, Robert Marshall and Howard Zahniser. Nancy Newhall has put it beautifully: "Wilderness holds answers to questions man has not yet learned to ask." J. H. Rush, a physicist mindful of natural laws, made the point just as tellingly: "When man obliterates wilderness . . . man is on his own" with no answers to questions he would one day be wise enough to pose.

The Arctic Wildlife Range is one of the few places left under the jurisdiction of the U.S. Government remote, wild and large enough where a visitor can still have a true wilderness experience of solitude and physical dependence upon self that was once such an every day part of the early pioneer's life. This is well expressed by Olav Hjeljord who has skiied from Barter Island to Arctic Village and hiked alone from Barter Island east to the Canning River, then south up the Canning to Arctic Village. Hjeljord states: "The feature which makes the Wildlife Range worth preserving is its vast expanse of land free from human influences and tracks. The feeling this gives the hiker of being the first man ever to roam its valleys and to climb its mountains while so doing, if he wishes, to live off the land with fish tackle and gun in hand. On our increasingly crowded earth, this is a quality which, if preserved, may make the Arctic Wildlife Range unique on the globe." John Milton stated: "On this 300 mile walk my own purpose was to blend into the soul of these Arctic mountains and plains, to sense the moods and manifestations of the land. Our journey was a lesson in solitude, a vanishing experience in an age when most of mankind is crowded, yet lonely."

The most important issue at stake today in arctic oil and gas development is an intangible—the integrity of one of North America's largest, and one of its most beautiful wildernesses. Oil and gas activities and their associated appurtenances will degrade the wholeness of that last whole place. The issue is the destruction of wide, unbroken spaces, of that quality—more fragile even than the tundra—its wildness.

The Arctic National Wildlife Range preserves and protects a substantial portion of our nation's arctic not seriously degraded by the activities of man. Permitting intrusion of a pipeline through, into or around the Range is equivalent to administering its coup de grace for once violated, other demands will follow. Construction of a line will result in dire consequences to its wildlife, fish, vegetative, ecological, scenic, wilderness, anthropological, research and aesthetic values—many of which will be lost irretrievably for all time.

The proposed and two alternate routes for a natural gas pipeline traverse the Arctic Coastal Plain, the foothill provinces and the Brooks Range, habitats which are of prime importance to its biota. The management philosophy and policy of the Range is one in which each species carries out its life cycle in a natural state, undisturbed and unassisted by man. Man is free to visit but not remain. Planned invasion of this pristine environment by the oil and gas cartel requires careful study and evaluation of all its values prior to commitment to prevent irreversible damage to the Range. Environmental impacts resulting apply equally to the three routes. The selection then becomes a choice between three impossible alternatives.

The proposed Arctic Coast route follows the five hundred foot contour with variations in elevation from fifty feet to approximately eight hundred feet. This belt of land is heavily used by wildlife. Many species (including muskoxen, Arctic fox, moose and wolf) inhabiting the Arctic slope use the area year-round; and others such as caribou, barren ground grizzly, swans, shorebirds, waterfowl, snow buntings, etc. for brief periods during the short summer to produce and raise their young. Some, such as snow geese, arrive in the fall to feed and rest on their southern migrations, while one—polar bear—locates den sites in early winter to bear and raise its young.

Caribou (estimated population 140 to 160 thousand) are the most numerous of the large mammals. They are seen everywhere on high mountain passes and slopes, along rivers, in the foothills and on the Arctic plain during various times of the year. Many Arctic Range caribou, known locally as the Porcupine Herd, winter in Canada on the Old Crow Flats. Though always unpredictable in migration paths used, this truly international herd moves in May to the Arctic Slope of the Range where some forty to sixty thousand females separate from the herd and make use of their historical calving grounds along the eastern foothills and the Arctic plain between the Kongakut and Katakturuk Rivers. The balance of the herd continues feeding in the foothills and mountains as far west as the Canning River, returning in July to rejoin the females and then once again moves south and east into the mountains by mid-July. Many small groups (bulls and yearlings) remain through summer and fall, some staying on windswept slopes to feed throughout the winter.

In 1969 fifty-one muskoxen were reintroduced on the north slope of the Arctic Wildlife Range after having been exterminated in this part of the Arctic by whaling ship crews foraging for food. They use the coastal area, river drainages, foothills and lower north-facing slopes of the mountains as feeding range, following the snowline as it descends or recedes. During August to October many of the animals are seen feeding in the general area of the proposed pipeline route in the foothills. By 1974, twelve muskoxen were known to be dead and four others had wandered into Canada. Calves have been reported during the past two years so apparently the introduction is a success. Present numbers are estimated at fifty-five animals.

Grizzly bear, wolf, wolverine, coyote, fox, raptors (bald eagle, golden eagles, gyrfalcon, goshawk, peregrine and rough-legged hawk) jaegers and owls use the foothills as their hunting grounds, searching out marmots, ground squirrels, lemmings and other microtines which find ideal habitat there. Dall sheep range in the mountains to the south of the coastal plain pipeline route. Ptarmigan have excellent feed as flocks numbering in the thousands were observed flying, and after the first snows, countless tracks marked every drainage containing willow brush. Various species of ducks, loons, plovers, shore birds, gulls and passerines with large groups of snow buntings and hoary redpoll use the waters and shorelines of upland and lowland lakes and streams, tundra, muskegs and sedge meadows throughout the route. Trumpeter swan, once on the endangered list, use upland lakes within one-half mile of the proposed route as well as lowland ponds and lakes in company with whistling swan. Size of adults and cygnets, location and size of nest mounds identified these birds.

Snow geese by the hundreds of thousands and gray white-fronted geese find suitable historic feeding and resting grounds during their southern migration. The foothills serve as a staging area where the geese concentrate after winter storms force them out of their breeding and nesting territories in northwest Canada. Here, birds of the year and adults can feed and rest prior to continuation of their next thousand mile flight southward. During 1973 the geese were in the area from September 8 through September 27th, when snow finally forced them out, a total of twenty days. The geese occupied the area between the Jago and Kongakut Rivers with depth varying from twenty-four miles in the west to sixteen miles on the east. During the period of maximum concentration which occurred the second week, virtually a pin cushion of necks and heads could be seen, (using binoculars from an aircraft flying the south edge of the concentration) lining the foothills and lowlands as far north as visibility permitted the full length of the flight line. An estimated four hundred thousand (400,000) geese were in the area at this time, a figure which could be off fifty per cent. Reports indicate the birds occupied this same area in 1974.

Polar bear use denning sites along drainages of the foothill province where sows give birth to and raise their young to cub stage. Two polar bears were seen during October, 1973 approximately twelve and seventeen miles inland south of the Arctic Coast on the Carter and Itkilyarik River drainages. During the spring of 1974, refuge personnel reported finding three polar bear dens in this area, two of which were thoroughly investigated. During a prior spring they had reported tracking a polar bear and cub from a mountain drainage on the east end of the proposed line to the Arctic Coast. Apparently the polar bear sows travel long distances inland looking for suitable sites to "hole" up. Dens as commonly known are not used. They apparently find a suitable embankment where they lay up, permitting the constantly moving windblown drifting snow to form a cornice over them. The snow eventually envelopes them completely, deepening with each accumulation of drift. Body heat melts the interior, forming an ice wall, which the bears apparently scratch through to keep a supply of fresh air circulating. Polar bear were previously known to den along the north coast of the Arctic Wildlife Range. Now it is a known fact that they do den, but also further inland than reports have ever indicated.

The two interior alternatives for the gas pipeline route are named (1) Canning River and (2) Marsh Fork options and pass through wildlife habitat of prime importance to caribou, Dall sheep, moose, grizzly bear, wolf, coyote, fox, muskox, wolverine, marten, golden and bald eagles, peregrine falcon (an endangered species), goshawk and rough-legged hawk, owls, willow and rock ptarmigan, gulls, jaegers, plovers, various ducks, loons, shorebirds and passerines on which a pipeline and its associated disturbances would have a calamitous effect. Though routed outside the present boundaries of the Range (by following (1) the west bank of Canning River to its South Fork, then crossing the divide to Cane Creek, across Chandalar River to the headwaters of Old Woman Creek, then south along its west bank and the west and south bank of Monument Creek to its intersection with Sheenjek River and (2) the west bank of Canning River to Marsh Fork of Canning, then south thirty miles and east ten miles to its intersection with the South Fork from where it follows the Canning River option to Sheenjek River) construction, operation and maintenance of a pipeline with its associated appurtenances would result in environmental impacts which would directly affect the Range.

A description of the pipelines and their included appurtenances is needed to gain a perspective of the serious impacts of the problem. The proposed route (Arctic Coastal) follows the approximate five hundred foot contour in a continuous strip, crossing perpendicularly to numerous rivers, streams and drainages—twenty-five of major consequence, one hundred and thirty-three miles from the west bank of Canning River (Milepost 62) to the Alaska-Canada border (Milepost 195). Buried in this strip will be a forty-eight inch chilled-dry gas (29 degrees F.) pipe installed in a trench on a gravel pad, backfilled and over-laid with a gravel berm. Three compressor stations will be constructed at Mileposts 83, 129 and 175. Each station will consist of a twelve thousand horsepower dry-gas turbine powered pressure boosting pump, a four to six thousand H.P. dry-gas turbine powered refrigeration unit, a twenty-four hundred foot airstrip, housing for maintenance crews, material stockpile storage area, barrow pits and communication towers one hundred forty feet to two hundred eighty feet high. (Though plans initially called for the horsepower ratings reported, Alberta Trunk Pipeline operation and maintenance personnel state triple the ratings will have to be used to obtain the full flow capacity of the line.) Barrow pits will be constructed at mileposts 63 (Canning River), 101 (Marsh Creek), 112 (Sadlerochit River), 151 (Aichilik River) and 172 (Kongakut River). Block valves and heliopads will be installed at mileposts 69, 98, 144, 160 and 191. Temporary winter haul roads beginning at mileposts 101 and 189 to Camden Bay (14 miles) and Demarcation Point (6 miles) where wharves, twenty-four hundred foot airstrips, material stockpiles, housing for personnel and borrow pits will be located. In addition, communications towers and heliopads will be installed south of mileposts 69 (4 miles winter trail), 101 (5 miles winter access trail) and 147 (½ mile winter access trail). Since the proposed pipelines are scheduled for winter construction, it is presumed a snow or ice road the total length of the line will be constructed adjacent to the trench and ice or snow bridges installed across all drainage systems to haul the tremendous amount of gravel needed, pipe required and serve as a working platform for pipeline crews.

The Canning River and Marsh Fork alternatives, though located outside the Range, will create considerable irreversible impacts on all its values. Beginning at Milepost 75 for both lines, the following will be constructed: Milepost 75, compressor station and eighty foot tower on top of ridge four and one-half miles west of boundary, Milepost 89, block valve and heliopad, Milepost 93, borrow pit one and one-half miles west of Canning River, Milepost 95, six thousand foot airstrip, one mile road and borrow pit in Canning River, Milepost 144, block valve and heliopad, Milepost 107, barrow pit, confluence of Canning River and Marsh Fork branch, and 100 foot communications tower four miles east on top of a mountain within the ANWR.

The routes split at this point with the Canning River alternate continuing up Canning River to its South Fork approximately seventeen miles, then up South Fork to its intersection with the Marsh Fork alternate. This stretch is a high risk construction zone necessitating either building a bench along very steep scree and talus slopes, dumping excess material into Canning River which is within the ANWR to widen the bench or burying the pipe in the bed of Canning River in these areas. At Milepost 118 a compressor station, housing for personnel, sixty foot communication tower, heliopad, material stockpile and a borrow pit would be installed. At Milepost 131 a block valve, heliopad and borrow pit would be constructed. Along the Marsh Fork alternate at Milepost 119 a compressor station, housing for personnel, a sixty foot tower, heliopad, material stockpile and a borrow pit in the river would be constructed. At Milepost 131 a borrow pit in the river is planned.

The two routes converge at the South Fork of Canning River where they follow the same course to the Canadian boundary. Mileposts used will be those reported for the Canning though the same installations are planned for approximately the same locations for both alternatives: Milepost 142, compressor station, housing for personnel, two hundred foot tower heliopad and borrow pit. Milepost 163, six thousand foot airstrip, material stockpile, housing for personnel and borrow pit on the north-west side of Chandalar River. Milepost 175, block valve and heliopad. Milepost 192, compressor station, housing for personnel, two hundred foot tower, twenty-four hundred foot airstrip, material stockpile and borrow pit. Milepost 200, one hundred foot tower two miles west of line, block valve and heliopad one-half mile west of boundary. Milepost 229, block valve and heliopad. Milepost 232, material stockpile and borrow pit Sheenjek River. Milepost 257, six thousand foot airstrip, compressor station, housing for personnel, sixty foot tower, borrow pit and five and one-half miles of winter trail north to sixty foot tower and heliopad.

Environmental impacts imposed by construction and operation of a chilled dry-gas pipeline include, but are not limited to, noise, air, water and land which directly affect the entire ecosystem.

NOISE

The natural gas powered turbine compressors and refrigeration units proposed emit a high, piercing scream which, when run at full power, can be heard fifteen miles or more away, dependent on terrain and weather conditions. Mufflers apparently cannot be installed without loss of horsepower. Tripling the horsepower of the turbines, as discussed with Alberta Trunk Pipeline personnel, would increase the noise level proportionately and also its range. Alberta Trunk Pipeline, Limited, Canada, constructs its compressor sites in forested areas to muffle the sound. How would this be accomplished in the tree-less Arctic? Will a buried dry-gas line muffle the sounds—rumblings, stresses and strains produced by friction in high pressure lines? What effect will these noise levels have on wildlife inhabiting these regions? (Animals and birds have the ability to hear sounds undetectable to man.) Will caribou be forced to abandon traditional migration routes, feeding and calving areas? Will polar bear sows be forced to abandon cubs during their rearing stage while the pipeline is under construction and traditional land-based denning areas once the pipeline becomes operational? (Polar bear in zoos require complete seclusion from noise during this period.) What will happen to the wary snow geese who have established an historic feeding, resting and concentration area before continuing their southward flight? Will they be forced to by-pass and abandon this staging area due to the high noise level? (Birds of the year do not have the strength to reach their next resting and feeding areas enroute to wintering grounds without this stop.) What about the peregrine falcon and golden eagle which nest along the ramparts of Canning River and Old Woman Creek? Will they be forced to abandone nest sites as a result of this invasion of their solitude? What about the Dall sheep, grizzly bear, muskox, wolf, wolverine and martin who require wilderness for their survival? Will the noise and disturbance force them to seek hunting and feeding ranges elsewhere? Where will these birds and animals go? They presently occupy habitats which are essential to their needs. Where else can they find the same requirements? What mitigation plans need to be developed for loss of this wildlife if this proposal goes through?

Noise and disturbance caused by operation of aircraft (fixed-wing and heliocopters) hauling personnel, equipment and the enormous quantities of material required on alternate routes will produce the same effects to wildlife by constant harassment.

AIR

Air pollution results from operation of oil and wet- and dry-gas powered engines. During construction, sulphur dioxide (SO_2) emissions will be high, resulting from diesel, gasoline and jet fuels which will be of relatively short-term duration. The natural gas powered compressors and refrigeration units pose a problem of long-term duration—the lifetime of the pipeline—results of which will endure for hundreds of years to come. Though natural gas is virtually free of SO_2, generally less than 1 ppm., what effect will this pollution have on tundra vegetation, especially lichen-rich areas? It is known that as little as .03 ppm. SO_2 has damaging effects on lichen, an effect which is cumulative. The longer lichens are subjected to SO_2 emissions, the more lethal the effect. What, then will be the effect on the tundra biome surrounding and downwind of compressor stations in the direction of prevailing wind? Will loss of lichen reduce thermal insulation of the tundra mat or will this loss be replaced by other vegetation? What effect will loss of lichen insulation have on permafrost and ice-rich soils? Will this action result in soil slumping and formation of thaw ponds or lakes alongpipeline routes? How can this secondary effect be controlled?

WATER

Water circulation on the surface of the tundra and within the active layer (soil thawed seasonally usually 2 to 8 inches deep) of the tundra mat slows with the first fall frosts, finally coming to stop with penetration of cold. Lakes, rivers and streams become ice-covered, many freezing to the bottom with lowering temperatures. Water continues to move under the ice in deep channels and pools in upper reaches of larger rivers in the mountains, coming to the surface in ice boils where downstream flow has been stopped by ice dams formed in shallow areas by freezing to the bottom. Surfacing water, resembling a large up-welling spring, spreads over the ice, freezes and adds to its thickness. (The fish life of the river, primarily Arctic char, congregate in these ice boils to wait out the winter. The Arctic grayling and white fish generally have moved downstream prior to waters freezing in, concentrating in brackish water lagoons at mouths of rivers.)

Spring breakup in the Arctic occurs practically overnight and can scarcely be imagined by the unintiated. Warming temperatures result in rapid scouring of the ice surface by the relatively warm up-welling water at ice boils. Snow cover rapidly collapses with resulting melt moving dowslope over the frozen tundra surface in a sheet-like mass to lower drainages and rivers. Rapid buildup of water on the surface of ice-covered rivers results in increased velocity and deep scouring. In some areas the ice layer is uplifted enmass, breaking into large blocks which move downstream, forming large ice jams and dams at the least obstruction with resultant upstream flooding. During breakup and periods of high water in the spring, northern rivers are normally turbid. The waters usually clear up by midsummer and remain clear into freezeup.

What effect will construction and installation of a buried, chilled (29 degrees F.) dry-gas line have on river and stream crossings? Will the chilled pipe result in buildup of a frost dam in the stream bed at these locations? Will ponded water result in increased bank erosion? What is the maximum scour depth to be planned for in years of severe icing and flooding? Will construction result in changing the main flow of water which will result in increased bank erosion?

What about the tremendous amounts of gravel to be excavated from planned river borrow pits? Will the increased sedimentation affect fish life?

Will these excavations result in additional deep scouring as the rivers seek their normal level? Will this construction impede movement of fish upstream during spawning runs? (Talking with fishery personnel conducting research for Arctic Gas on the Kavik River in 1973, they stated the system had a limited char fishery but could not state what the fishery was like prior to the oil industry excavating tremendous quantities of gravel for roads, airstrips and drill pads during 1968–69.) No base line information is available for northern rivers prior to this time. Limited investigations on fishery resources on the ANWR have been conducted by State and Federal agencies.

LAND

Pipeline construction will result in drastic disturbance to the ecology of this region. Besides the visible gravel bermed trench, the compacted snow-ice road and working platform will result in winter-kill of vegetation underneath for its full length and width. Weasel vehicle tracks are visible today on the Arctic tundra which were made by DEW Line personnel crossing from the coast to the mountains. Singel tracks made during this time compressed vegetation underneath, breaking the protective mat consisting of lichens, mosses and other plants, exposing the permafrost to the warming influence of the summer's sun. Erosion increases as melt proceeds with the process accelerating each season. Tracks once barely discernible when first made are now visible for miles across the Arctic Plain.

Use of tracked vehicles and dozers in the 1968–69 seismic work on State of Alaska lands to the west of the Arctic National Range has resulted in gullying ten to fifteen feet deep along most of the lines, depending on slope. Single tracks made by vehicles in winter are becoming more noticeable each year. No attempt at controlling or rehabilitating has been done. The same oil companies are involved in the Arctic Gas proposal on the Range.

During oil exploration activities on Naval Petroleum Reserve No. 4 (Pet 4) lands in the early 1940s, winter haul roads and tracked vehicle crossing the snow covered tundra a single time have left a labyrinth of waterfilled ditches, canals and mud morasses on the relatively level Arctic Plain. The tundra ecosystem is so fragile that a single vehicle crossing leaves a track that deepens with time, becomes a ditch which radiates disruptively into the adjacent tundra like ripples in a pond. One of the first to note that the tundra was composed of a fragile environment was John Reed, Director of the Arctic Institute in charge of the Navy's exploration of Pet 4. He stated, " . . . vehicle tracks are likely to remain visible for years because of the slow recovery of tundra vegetation. Even winter tracks may long be visible because the compacted snow affects the following summer's growth." Once the protective tundra mat has been destroyed by compression, the erosive process becomes irreversible and will continue into the millenium until nature has reached its own level of equilibrium.

What effect will winter-kill of vegetation resulting from snow or ice road have on the land? Will the subsequent exposure of permafrost result in a second Hickel Highway which becomes an eroding mass and partly a canal the full length of the line? How will erosion during the rapid spring melt be controlled? Will native plant species be used in rehabilitation? How many years will this take and what will be done during the interim? Revegetation experiments in the Arctic by the oil companies have been a failure to date. What plans has Arctic Gas made besides using a gravel berm over the pipe?

The buried chilled (29 degrees F.) dry-gas line will result in aggrading of permafrost into the gravel berm overlaying the trench, resulting in a frost dam the total length of the line. How will this frost dam affect natural circulation of water through the active layer? What effect will this dam have on drainage upslope of the line? Will thaw pools be formed with subsequent icing and killing of vegetation surrounding and underneath, with formation of thaw ponds and lakes the direct result of permafrost exposure?

One last and final question. Does the Alaskan Arctic Gas Consortium have the wisdom to predict the quantitative effects of pipeline construction and disturbance to this Arctic environment—its soils, vegetation, biological communities and wilderness values—and is it prepared to bear the total costs, social and otherwise, of this intrusion ad infinitum?

To maintain the integrity of the National Environmental Policy Act of 1969 only one alternative need be considered—the Alyeska Pipeline route established by Congress. Since this corridor is an established fact, the least environmental damage would result in constructing an adjacent gas line to Big Delta, then following the Alaska Highway east to the Canadian border and continue into or through Canada as the Canadians direct. According to recent newspaper releases, Canada could go it alone if need be as they apparently have discovered natural gas in sufficient quantities to construct their own line.

EIPaso Alaska Co.,
Washington, D.C., March 22, 1976.

Mr. Henry Lippek,
Senate Commerce Committee,
Dirksen Senate Office Building,
Washington, D.C.

Dear Han: Pursuant to our conversation of today, I am attaching the following items:

1. The press release issued March 15 by Arctic Gas, announcing the termination of their Northern Border line at Kankakee, Illinois, and their adoption of displacement to effect deliveries to eastern markets.

2. Copies of pages 8 and 9 from the December 1975 Interior report to the Congress concerning Alaskan natural gas transportation systems. These pages discuss the advantage of displacement in lieu of constructing new pipeline facilities.

3. Excerpts from the cross-examination of FPC staff witness David C. Lathom, which relates to the feasibility of displacement.

4. Excerpts from the FPC transcript sworn under oath by the actual members of the Arctic Gas consoritum, describing how they would receive natural gas via the El Paso displacement plan.

As you can deduce from both the FPC staff testimony and that of the Arctic Gas members themselves, in every case save two El Paso will be making direct deliveries to members of the consortium. Also, as can be seen from Arctic Gas' recent modification, their ultimate proposal will utilize displacement at least as extensively as El Paso proposes.

If we can elucidate this area any further prior to the Wednesday hearings, please give me or Lou Dell'Osso a call.

Sincerely,
BRIAN T. PETTY,
Senior Representative.

Enclosure.

CHANGE IN ARCTIC GAS LINK TO SAVE $60 MILLION YEARLY

Washington, D.C.—A change in the length of the Northern Border Pipeline to carry Alaskan natural gas from the Canadian border to the eastern area of the United States "could bring savings to consumers of over $60 million per year," William W. Brackett, Vice Chairman, Alaskan Arctic Gas Pipeline Company, announced today. "This savings could be attained without affecting the total amount of new gas delivered to eastern markets," he added.

Brackett's comment was made in connection with an announcement by Northern border Pipeline Company, that it would adopt a Federal Power Commission staff proposal to end this portion of the Arctic gas system at Kankakee, Illinois, near Chicago, rather than in Pennsylvania as originally proposed.

The Northern Border pipeline would join the Arctic Gas pipeline at Port of Morgan, Montana. That "companion pipeline" would move gas through Montana, North Dakota, South Dakota, Minnesota, Iowa, and Illinois—providing gas along the way to connecting facilities.

Although the Northern Border line would end in Illinois, under the new plan, areas east of Chicago would continue to be served by the same pipelines which now serve those areas, just as they would under the original proposal.

The altered proposal, according to Brackett, would mean that the Alaskan Gas would physically stop at the facilities of pipelines now serving the midwestern area. The Alaskan gas purchased by companies serving areas as far east of Chicago as the Atlantic seaboard, would thus stop in the midwest, but in return, the midwestern companies would exchange to the eastern companies, gas which they own in Texas and Louisiana areas, particularly the prolific Louisiana producing federal lands in the Gulf of Mexico.

The eastern companies would then carry that Texas and Louisiana gas in their existing lines to their service territory.

"The amount of gas supply would be the same for each area of the country as it would have been under the other configuration," Brackett stated, "in that each area would receive the amount of new gas equal to the amount of Alaskan gas that it purchased.

"While initial operating costs can be reduced by $60 million annually or more," he added, "the annual savings can be expected to grow as the transported volumes of Arctic natural gas are increased in the years ahead."

The Arctic gas system would originate at Prudhoe Bay, Alaska, where some 10 percent of America's total proved natural gas reserves are located. It would proceed eastward into the MacKenzie Delta of Canada, tapping other natural gas reserves there, and move some 2,500 miles southward to the lower Canadian/United States border.

Congress is currently considering legislation which would approve the Arctic gas project, and with timely approvals, according to Brackett, Alaskan natural gas can be flowing to consumers throughout the United States in the 1981–82 time frame.

For further information contact Jim Beall/ Alaskan Arctic Gas Pipeline Company/Washington D.C. Phone/202/331-0933.

*　　*　　*　　*　　*　　*　　*

Displacement or exchange agreements are common in the natural gas industry. The two displacement plans described here would be much larger than any previous examples. These plans would have to be approved and agreed to by the various pipeline companies involved, the Federal Power Commission, and in many cases, by the courts after review of the FPC decision. If all of the companies involved have an interest in seeing Alaskan natural gas reach its final destination, they should be able to agree upon a displacement plan without much difficulty. If a company does not have an interest in Alaskan natural gas, it may have little or no incentive to allow the use of its facilities to carry out a displacement plan. Thus far no company has been forced by the FPC to enter into such an agreement against its wishes, but it is possible that the FPC could find the means to do so. As part of its approval of either basic transportation system, the FPC will also have to approve the use of a displacement plan for either system. Finally, there is also the possibility of delays caused by legal appeals and court review of all decisions made by the FPC. In sum, however, the advantages of a large scale displacement plan would seem to outweigh the disadvantages. Displacement avoids both the cost and the environmental impact of new pipeline construction and makes a more efficient use of existing facilities.

* * * * * *

[Volume No. 111]

OFFICIAL STENOGRAPHERS' REPORT BEFORE THE FEDERAL POWER COMMISSION

Subject.—In the Matter of: El Paso Alaska Company, et al., Docket No. CP75-96, et al.

Presiding JUDGE. Okay. I gather there is no further matters with PGT, ITAA and Northwest. We will recall Mr. Lathom.

DAVID C. LATHOM

resumed the stand, and having been previously duly sworn, testified further as follows:

CROSS EXAMINATION (RESUMED)

By Mr. HANSCHEN:

Q. Mr. Lathom, when we concluded our discussion yesterday morning we were talking about design parameters relative to the price of natural gas. Do you recall that?

A. Yes. I do. Could you wait just a minute until I get a copy of my testimony? Okay, Mr. Hanschen. I am ready.

Q. We had also discussed earlier in the morning that the Staff's transportation and displacement scheme was based on using existing pipeline facilities whenever possible. Mr. Lathom, in designing the transportation and displacement scheme, did you consider the amount of gas that would be utilized as fuel?

A. Not specifically, Mr. Hanschen, other than the ways we have discussed it repeatedly with Mr. Hargrove and yourself.

Q. And this was just that it be a general and important consideration, but you did not do it on a pipeline-by-pipeline basis. Is that right?

A. That's correct. Other than that I would add that basically, in very large measure, compressor fuel balances out to a net of zero in that many of the systems we are unloading, other systems we are reloading. So that generally, compressor fuel balances out.

Q. To arrive at this conclusion, what computations did you make?

A. No specific computations.

Q. So it is just kind of an intuitive reaction by yourself? Is that it?

A. No, it is far beyond intuitive. It is simply an engineering fact.

Q. Mr. Lathom, in balancing this out, this is looking at the total project, is that correct? It is not looking at one participant in the project.

A. That's correct. Our overall point of view is that there are six Northern Border companies involved here and two California companies, or possibly altogether four in California. But basically two large distributors within California. And the balancing out is all among those eight companies.

Q. I take it that the Northern Border Pipeline design that has been filed with the Commission shows the delivery of the gas at Monchy at a particular pressure. Is that correct?

A. Right. If we are discussing Monchy now, yes, I think the Northern Border filings show it. And because it is a new—the Northern Border line is a new 42-inch line, they already take advantage of the pressure that is available at the international border.

Q. Well, now, they take advantage of the pressure, but isn't additional compression needed on the Northern Border Pipeline to transport the gas through that system?

A. Oh, definitely. Under the fully powered concept.

Q. Conversely, under the filing made by PGT is there any additional compression needed by PGT on their line?

Mr. HEISLER. Which filing now is this, Mr. Hanschen? There are so many designs, and the record will be extremely muddy.

By Mr. HANSCHEN:

Q. I direct you to the 1180 design, the illustrative 1580 design, and I believe the other material submitted earlier this morning.

A. Mr. Hanschen, you know, I don't want to—I am not attempting at all to play games with you. I understand possibly the point you are trying to make. Under certain circumstances some systems, i.e., possibly some of the California systems, will—the displacement to those companies may involve additional fuel under certain circumstances, and that the balancing out is not necessarily true among each company. But as a general proposition, I will stand on the fact that basically if you look at the entire Staff presentation, compressor fuel is largely balanced out—I do not even say necessarily, because I have admitted to you I have not made the calculations because it requires an awful lot of assumptions. But basically, compressor fuel balances out. I do not say that necessarily means in every case and for every company it will balance out. So I won't concede your point if that is it, that it may involve expenditures of fuel to go to California.

Q. I am just not too sure that the compressor fuel will balance out at all, Mr. Lathom. On the delivery legs of this from the international border to the distribution points, there seems to be a net loss there when you compare the Northern Border Pipeline facilities that are fully powered with any of the PGT designs submitted in this matter.

A. I haven't quantified it. I will concede, so we can proceed here, that it will cost money to move the California gas through the Northern Border system, through Northern Natural, through El Paso. But when we looked at it, when we drew the bottom line, we compared that cost—those potential costs to a whole new approximately $700 million system to California that under our analysis would not be needed and that under your own assumptions could possibly only be needed for a five-year period. We are willing to expend the additional compressor fuel under those circumstances.

Q. Well, did you draw a bottom line on compressor fuel? Is that what I understood you to say?

A. Not specifically on compressor fuel.

Q. So this only got lumped into the general concept, is that right?

A. That is certainly correct, yes. I consider it a fairly minor factor.

Q. Are you indicating that the position that PGT should take in its negotiations with Northern Natural is that we should receive additional volumes in excess of the 433 million to be displaced because of the savings on the Northern Natural system?

A. No, that is not true at all. You would have an amount of gas contracted for coming from Alaska and you would expect to receive that volume of gas in California minus compressor fuel. The adjustments would be economic or rate adjustments. Not fuel—or not total through-put adjustments.

Q. So you envision there would be a charge by Northern Natural but that this charge would be reduced because of the savings accruing to their system?

A. Basically that is true.

Q. We were just talking about the displacement and we were using the initial years on the Northern Natural system, Mr. Latnom. At some point under the Staff study would actual transportation of the California volumes through the Northern Natural system be necessary?

A. Theoretically it is possible. From an engineering standpoint, it is certainly feasible; there is no question in my mind that the Northern Natural system can be reversed the same as any other system such as the El Paso's can be physically reversed at fairly low cost. But none of the studies we have made, none of the things we have looked at would indicate to us that that is likely in any time frame that we can identify. In other words——

Q. What time frame have you been operating with?

A. Well, going beyond ten or fifteen years down the road from 1981, to our judgment, becomes so speculative in trying to make the assumptions you are making. Now, let me make perfectly clear, I agree wholeheartedly that PGT and SoCal will want to have and must have long-term agreements to move their gas. But when you identify for me one specific element and say carry this twenty years down the road, it is almost impossible to do because there are so many other factors that have changed and that I would need you to assume for me. To give you an illustration, the reason I don't think Permian gas or Anadarko gas in the year say 1995 will be critical is that the PGT line, the existing PGT line, by your own witnesses testimony, exhibits, will be empty unless there is some dramatic new find of gas that nobody has yet identified for this record.

Q. Well, did you investigate the possibility that if the flow on the Northern Natural system were decreased by up to 437 MMcfD, what might have to be done at the Bushton plant to continue operations at normal levels?

A. No, sir, I did not. And this has gone pretty far on the Bushton plant. I have been able to identify in the last day in talking to Northern's counsel, one of their counsel who is here today, Mr. Ward, that our data that we imperfectly had available and have not had time to fully research it, but the Bushton plant, according to our knowledge, has a capacity on the order of a billion a day. And the Northern system has a through-put capacity of 2.25 or more per day. So that we are under the impression that less than 40 percent of the through-put of Northern goes through the Bushton plant.

I believe, since there have been so many questions, that it should be put on this record by Northern, and Staff will request that they project what will be going through the Bushton plant in 1981 and beyond, and we can settle this from the very best source.

Q. That probably should be investigated, Mr. Lathom. But you have made statements to the effect that the economic advantages of the transmission-displacement concept are so overwhelmingly favorable that it wasn't necessary to make determinations of that along this line. Or did I misunderstand your testimony?

A. I think that is too strong a statement. I have said that I believe each one of these elements in the equation of what it will cost to displace and transport gas as I and witness Kiely have laid out should be filled out. Each element should be identified and can be identified, I believe, on a reasonable timeframe. I have indicated we have not been able to do that yet. But every factor I was able to look at leads me to believe—and it is the reason we put this testimony in. We think transmission-displacement through existing relatively low-cost systems that will largely have excess capacity just almost has to be cheaper. I think I arrived at that conclusion in the same way that Pacific Interstate was able to enter into rapid negotiations with PGT and assume that they would displace gas rather than have PGT build new facilities in California.

Presiding JUDGE. What could be more reliable than your own line already in place using excess capacity to haul the gas?

Mr. GIBSON. If you are referring to the possibility of utilizing existing line. But if you are talking about the displacement, and that is what we are talking about here in this cross examination, that is—its reliability definitely comes into it.

Presiding JUDGE. My question goes to the fact that I thought Mr. Hargrove's cross examination of Mr. Lathom concerning Northern Border was questioning in a general interrogation that was neither hostile nor supportive in the sense that okay, tell me what your story is and I will tell you whether or not it is better if I can. I thought that was rather constructive. Now Mr. Hanschen's approach, though, seemed somewhat different. It is gosh, you have got a real bad idea here and let me see what I can do to pull it apart. It seems to me that the proposal that is being made, if true, if it costs out the way that is being suggested, and if one or two of the assumptions turn out to be true which we certainly will know before you lose any money in your construction scheduling by let's call it 1978 or early 1979, even, so the line would be in place by the time the gas would start to flow for the first time, it would be a benefit to you, and you would want to investigate this, and this would be a great idea if you hadn't already thought of it yourself.

Mr. HEISLER. Your Honor, your question leads me to a rather urgent one. If the line is to be built in '76 or '77 prior to being put in service, at what point in time, Mr. Gibson, would those facilities be put in the rate base of your cost of service tariff?

Presiding JUDGE. The witness has already testified earlier, Mr. Heisler, I think, that they would not do so; that there would be a slippage based upon when they would expect the gas to start to flow from Caroline Junction. Now, I could be in error, but I think what specific question was asked either Mr. Lepape or—I am not sure. It was one of the witnesses.

Mr. BERGAN. Reynolds, I think.

Presiding JUDGE. Reynolds stated that they would not intend to build the line until it was definitely ascertained when the gas would be flowing. That is why I moved my dates ahead, because I thought that was the original proposal anyway.

Mr. HEISLER. I have always been confused about the need for the additional cost of service tariff if it in fact ends up being a looping of the existing line. I have never been entirely clear about that.

Presiding JUDGE. That is a different issue again.

Mr. GIBSON. I think there is some misunderstanding in Mr. Heisler's mind as to what is suggested now in terms of tariff as compared to what is presently in effect on the PGT system, and there really is no difference in basic underlying design of the tariff. I think that Mr. Heisler can assure himself of that fact, if he would go back and look at PG-86.

Presiding JUDGE. Okay. But Mr. Gibson, that was an aside which I am happy was brought up and resolved. But you were going to respond to my earlier observation.

Mr. GIBSON. Well, I had responded in the regard, Your Honor, that we believe that there are some very serious questions apart from the ones that we had raised in this cross examination regarding cost. There are the concerns for reliability of transportation of any volumes other than in a more directly method utilizing systems that we have continuing relationships upon which we can rely. It should be no secret that we are extremely concerned—and when I say we, I should say I am speaking now for Pacific Gas and Electric Company, and not simply for PGT, which is simply the transportation company. We are extremely concerned about the implications of relying for some major portion of our continuing supply on gas pipelines across the center of this nation which may or may not be subject to curtailment and which we have gotten badly burned on already in terms of curtailment. Our supply from El Paso Natural Gas Company has been severely curtailed because of situations and concerns east of California. Largely we have had firm contracts for the sale of gas from El Paso Natural Gas Company cut into and completely disregarded, and we are not about to see that sort of thing happen again. We want direct supply, as direct and as reliable as possible. That is one of the major considerations in our minds.

Presiding JUDGE. Well, if Mr. Lathom's first schematic is correct, the cuts that you are going to have—or I will reverse it. The increased line capability that will be available to you is there. That is your own lines, that is your own reliable, and it is your own gas coming down if everything else falls into place. Wouldn' you wish to actively consider that rather than put up another billion dollars to build a line—well, 700 million to build a line?

Mr. GIBSON. If Pacific Gas Transmission Company does in fact have the kind of excess capability that Mr. Lathom suggests, of course that would be utilized. There is no question about it. And that is not really the issue here, because we are quite sure that Mr. Lathom's basic assumptions are gravely in error. And that is the reason why I stepped to the next question. But that is a matter to be developed, I suppose, in the cross examination of Mr. Kiely, and also we expect to further develop it in great detail on rebuttal.

Presiding JUDGE. Okay.

Mr. HEISLER. Your Honor, you have asked repeatedly for Staff to set forth its views and its positions. And in view of the statement made by Mr. Gibson, I would like to just in very brief, succinct form give my view. You describe the so-called tariff issue as something entirely different, and I am afraid I can't see it as entirely different. In my judgment, if you have a cost of service tariff, the costs are simply divided by the Mcf's moved in the—so to speak, as the bus fare goes up, you have fewer and fewer riders. I cannot accept the company's willingness to utilize existing capacity from the tariff question. As I say, quite frankly, I think the tariffs proposed here have some serious policy implications. You do reduce incentives to cut costs if you award tariffs of the natures that are proposed here.

Mr. GIBSON. Mr. Heisler—or Your Honor, I am sorry. Mr. Heisler, if that is his concern, is perhaps confusing the name of a cost of service tariff with the principles that guide the regulation of pipeline rates in general before this Commission. It is by no means, I think it is quite clear—it is by no means a unique feature of a cost of service tariff that the fixed costs of a pipeline must be covered by its ratepayers after that pipeline has been put in service. However, that is not an issue which should be considered as unique or different on a cost of service tariff or a fixed rate tariff. A pipeline operating under either one would have the same problem, obviously. And if Mr. Heisler has some concern about how the cost of service tariff operates in that regard or in any other regard, PGT would be happy to bring back its witnesses on the cost of service tariff and make them available for Mr. Heisler's cross examination, because I feel there is a grave misunderstanding here.

Mr. BERGAN. Your Honor please, I think counsel interjects somewhat of a red herring in this issue when discussion is had with respect to curtailments on the El Paso system, or on any other system. My understanding of the fact of curtailment is that it is imposed on a supplier, and in the system proposed by Staff El Paso is not a supplier, it just happens to be one link in a transportation chain. I think the issue of curtailment is something that is far beyond the problems that Mr. Gibson mentioned.

Presiding JUDGE. I will address myself to Mr. Gibson's rationale for reliability at a later time. But I was very interested in knowing why what appeared to me to be a reatlively hostile tenor of cross examination was being mounted to a proposal which was not being put forward, it seemed to me from hearing Mr. Lathom yesterday and I guess last Friday, as being other than a type of proposal which should merit the closest consideration by a party.

Q. So then I take it you believe there is a high probability, as you expressed it elsewhere in your testimony, that after those dates supplies would not be forthcoming from Canada for export?

A. I would prefer, since it is right in the middle of the thrust of witness Kiely's testimony, that you direct that question to him.

Q. I see.

You suggested at transcript 17,226 that you wouldn't expect a pipeline to enter into a transmission-displacement arrangement unless overall it saved them transportation costs vis-a-vis a whole new system. Do you recall that?

A. Yes, sir.

Q. And elsewhere you have testified to the economic benefits that you expect from transmission-displacement, principally because new facilities wouldn't have to be constructed. Is that right?

A. That is correct.

Q. Is it your belief, then, that in these transmission-displacement arrangements, that the consumers in each region of the country would benefit from the savings that you envision?

A. Most definitely. I have indicated numerous times this is somewhat unique in that it appears to us that through a fortunate set of circumstances really there are no losers here; there are benefits for everybody. One of the chief benefits for your company and the applicants is a reduced financing requirement. I believe it will be an overall cost savings to transport gas for consumers in the East and in California, and in the Midwest.

Q. Well, just so I am perfectly clear on that, I understand your testimony to be in the aggregate there are net economic savings. My question attempts to break down the aggregate, then, to determine whether you believe that net savings would flow let's say specifically to those consumers receiving gas from Southern California Gas Company.

A. I am very aware of the thrust, I believe, of your question. If I could use an analogy, my brother is in the real estate business, and he said to me numerous times that the only good real estate deal is one where everybody has some piece of the action. If one party is left out, that deal will ultimately fall through or cause repercussions. I feel that applies here. I do not believe any one of the participants should be required to carry an undue burden or be disadvantaged by this displacement-transmission system. Insofar as I have been able to analyze it—and I have thought about it in great detail—I think literally each and every individual company will come out ahead here as well as the consumers. And I do not expect SoCal or PG&E to participate or enter into this arrangement unless they are satisfied that they will come out ahead. I guess I have one further caveat: not on a one-year look at it, though. If you are able to help the Staff and this record, I certainly hope you don't present 1981 and leave it there. You certainly have to look at the first five or ten years of what is happening. And I think you have to have in place basic agreements that will cover the full 20-year period. And some of the things the Judge has said here concerned me immediately, Your Honor, in that you talk about not having to decide on what facilities to be built until '78, '79 or '80. There is an element of truth in what you say, but I believe, based on my experience in this industry, the agreements at least of the order of the type of agreement in PG–122 have to be in place in order to finance and to have this displacement work.

I agree with you that there is no reason why in your own terms you can't make it better as time goes by, but you have got to have the basic agreements. And I anticipate that those can be worked out before the final financing of this project.

Presiding JUDGE. Just to clarify my statement, Mr. Lathom, so it shouldn't cause you any great concern, what I was alluding to was the fact that you could go either way, and since the facilities are not going to be built, the financing would follow from the basic agreements, and if at a later period of time, as the plans became more definite, it was determined that a different mix was better, you would still have plenty of time to make those changes without causing any great harm or great cost to either the pipelines involved or the consumers. Now, that is the scenario I painted. I am not suggesting it is the full story. But it would seem to me that if you had the type of letter agreements shown as Exhibit No. PG–122, I believe, in place and it subsequently turned out that the Canadian Government permitted substantial amount of additional Canadian gas to flow to the United States, there would still be time to plan or approve your PGT proposed looping and have it in place prior to the time the first Prudhoe Bay gas flowed. It is a possibility, and I am not suggesting how it would go.

But unlike the basic decision of when you start to build from Prudhoe Bay and either cross Canada or cross Alaska, this is not as exact in timing. That is the only point I was making. And that is open for grabs. You can dissuade me from that understanding.

The WITNESS. All right. I am glad you clarified it that way. I think that is precisely correct.

Presiding JUDGE. Mr. Loch.

By Mr. LOCH:

Q. Mr. Lathom, in a way isn't it necessary that the decision in this case, the initial decision which would, I take it, issue a certificate to one of the two main applicants here—isn't it really necessary to decide on transmission-displacement versus new facilities before that certificate issues?

A. I guess I have problems with what you are saying in that there are complex procedural problems here. It appears to our Staff's point of view that really, if we proceed on the basis we have so far, rightly, wrongly or otherwise, we are going to have phased decision in this case. I can't call it anything else.

So no, I don't believe you need to know or certificate anything more than the main trunk lines in Decision Phase 1. I think this is the precise conclusion that El Paso-Alaska has come to.

Mr. GIBSON. I would say of course it is.

The WITNESS. Well, I would add to that comment that Staff looked with some amazement at the El Paso filing originally, but as time went on and the facts of the situation became more to bear, we understood the procedural problem that we all faced El Paso happened to identify probably earlier than some of the rest of us.

By Mr. LOCH:

Q. In connection with the transmission-displacement concept, it is your understanding, isn't it, that those receiving gas by way of displacement would have to make long-term arrangements for the transportation of gas?

A. That is exactly what I thought I tried to say. At least of the order of magnitude of this PGT–122, Exhibit 122.

Q. Well, considering that the transmission-displacement concept rests on what you have called the high probability of a decline in receipts of gas from Canada and linked with a trend towards excess capacity in Lower 48 pipelines, is it your belief that those receiving gas by way of displacement could negotiate long-term agreements for pipeline capacity to carry such gas?

A. Mr. Loch, it certainly is. And I think any time you look at risks—and I am more than willing to admit there are risks associated with the Staff proposals. I think you have developed most, if not all of them. But risk always has to be considered in a context. We looked at the risk of having new high-cost facilities built that might be used for a period of time of less than five years and possibly, if we are correct, not at all. That is a very grave risk, and I simply as a Staff member wonder how I could recommend to the Commission for their full consideration that type of prospect. They would be faced with a very, very difficult decision. And as a Staff member, part of our job is to minimize the difficult choices that the Commission chooses.

I wouldn't want to have to decide between no project at all for a period of time in this critical gas supply situation and one that is fully designed, runs all the way to Delmont, all the way to California, with very high capital costs and no gas supply contracts backing that up. That is an awesome prospect to the Staff people.

Presiding JUDGE. Well, Mr. Lathom, would you have the same awful prospect if the proposal were Gas Arctic and Canadian Arctic and Northern Border only to Kankakee on the one side and on the other the El Paso proposal to go from Prudhoe to Point Conception or wherever we end up, without those same gas supply contracts?

The WITNESS. The elements of risk that I pointed out, or that awesome decision is still there in some respect, but we felt that we had done the maximum amount we could to reduce back-up to the trunk line facilities. In our judgment, Alaskan Arctic to Kankakee is basically trunk line. You can't do anything with the gas in Monchy. There must be 5000 souls living in Monchy. You can't do anything with the gas at Valdez. I agree with you there are risks there. But as I said, we are attempting in our own small way to reduce as much as possible the risks that might be faced if there are no producer contracts. I can't disagree with you, though they are still there in some measure.

Presiding JUDGE. Well, now, the total risk reduction as you see it from reducing the Gas Arctic proposal to so-called trunk line considerations only at this stage is how much money? Where do I look to see that dollar value as you would put it together? That would be the facilities from Kankakee to Delmont and the PGT facilities from Kingsgate to the California-Oregon border and the Canadian Arctic facilities from Caroline Junction to Kingsgate, I assume.

The WITNESS. Right. Staff witness Kiely's yet to be identified exhibit that shows the total cost savings under Staff Cases 1 and 2, which is JMK-6, and hopefully will be identified as ST-12, if you look at the bottom two lines, extreme right-hand column, for Staff Case 1 there is $1,064,959 of capital expenditures that would not have to be made. And Staff Case 2 is laid out below it.

Q. Now, on a somewhat more philosophical plane, do I take it correctly, Mr. Lathom, from your testimony, that as a result of your experience here at the Commission and as a result of the studies which you and Mr. Kiely undertook to lead to the Staff proposal—and parenthetically, this question could be put just as well to Mr. Kiely as it could to you, I suspect. Do I take it correctly that you came to the conclusion that the concept of displacement is by no means unusual in today's gas transmission market?

A. I take that for a fact. I believe it is beyond dispute. And the real question to me—I think the Judge has raised it from time to time, and it is a legitimate question—is what Staff is proposing here or what El Paso is proposing significnatly different in size or a significant expansion in size and complexity to render it something different in kind, let's say in philosophical terms, than what we have seen in the past, rather than difference in degree. I conclude in my mind it simply is not. I will confine it to the Staff proposal. We are only searching to displace under our Staff Case 1 approximately 850 or less than 900 MMcf per day. The Northern Natural-El Paso exchange is on an order of magnitude of 600 MMcf per day. I don't think it is any more complex than the PGT-ITAA proposal here. I really don't believe it is more complex or more difficult than things we have seen.

I hope that answers your question.

Q. Did you take occasion to review the filings by the major gas transmission companies in their annual Form 2's, those portions of it that report the exchange gas transactions?

A. No, Mr. Bergan. There are many things that we would have liked to do to improve our showing. One, and if we had had, you know, a luxury of more time ourselves or further assistance, I would have liked to and what we would plan to do is look at the existing tariff filings of the pipelines, because you can identify existing transmission-displacement concepts by the special rates that exist for them. And I believe that would be a very interesting study. But we simply didn't have time to do it.

Q. I take it that you would have no problem, though, in agreement with me that there are reflected in the year-end 1974 filings by the major gas companies hundreds and hundreds of millions of cubic feet of exchange gas transactions.

A. I think that is factually correct. And again, as we looked at what we thought was occurring in the industry, I think it is somewhat unique in the entire 60- or 70-year history, however far back you want to go in the industry, to have a fully developed network, one of the most advanced energy-moving networks in the world, no question about it, that may, and most probably will be under-utilized. I don't think we have evern faced that before. I think it will mean that there will be many more arrangements of this type on either short-term or long-term arrangements.

Mr. Bergan. Your Honor, that completes the questions I have for Mr. Lathom.

Witness J. C. Pyle Northern Natural November 19, 1975

Q. So how much must be transported—must be delivered at Dumas of the firm obligation?

A. 550 million of the firm obligation.

Q. Now, would you modify the sentence beginning on line 10 which says assuming that the El Paso exchange agreement is still in effect for the full 620 MMcfD, Northern would have to add major facilities if the Alaskan gas is received at Dumas in addition to full exchange volumes.

A. I would modify it to make it plural, exchange agreements.

Q. Well, the volume has to be changed too, does it not? There is no obligation on El Paso to deliver 620 million a day to Northern?

A. No, sir. But if you are—

Q. Under any combination of exchange agreements.

A. That is correct. The intent of this statement, though, is to say that if in effect El Paso is redelivering and exchanging 620 million a day, to go above that volume is going to require additional facilities.

Q. All right. I understand.

A. If El Paso is delivering less than 620 million, and say if they are delivering at the 575 or the 550 MMcfD rate, then to add to that Arctic volumes or Alaskan gas volumes would not require those facilities.

Witness D. B. Grubb Natural Gas Pipeline November 20, 1975

Q. All right. Again staying with page 4, you describe the burden in line 26 of an extended outage or reduction. Mr. Simpson, what, in your judgment, is the risk of an extended outrage or interruption? Do you have any particular risk in mind?

A. That is a very difficult question for me to answer. The aspect of this project—and as I understand it, the difficulty at certain times of the year in making repairs if such were required by an outage might be difficult. The cost of the project and the projected cost of service are so great that an outage for any prolonged period of time would result in a substantial cost of service burden.

Q. Is this something that you discussed with your financial people in Peoples and in Natural Gas Pipeline Company of America?

A. Yes, sir, it has been generally discussed among myself and all of my associates.

I might add here that this is a matter of substantial concern to potential investors of the project, and we are so advised by our financial advisors.

Q. Have you or your financial advisors discussed this problem with any potential investors or investment houses?

A. I have not. The extent to which our financial advisors may have done so, I do not know.

Q. At the outset of your testimony you said you did study whether or not assumed Alaskan volume could be taken into your system at Station 192. And I am not sure I ever got really the result of the study. What was the result of that study?

A. We could haul Natural's volumes from 192 in 1985, whenever it comes in. 1982. I might add Natural's at that time anticipated contracted volumes which we no longer have. Understand?

Q. Yes. Having made that study and come to that conclusion, Mr. Grubb, will you tell me why you answered Interrogatory 4 as you did on page 5? Or should I address that to your counsel?

A. No, I wrote the answers for the most part.

Presiding JUDGE. Is there a spare copy floating around in the hearing room? Thank you.

The WITNESS. Your question related to since we had made studies for Purvin and Gertz reflecting the ability to move Natural's volume from 192 north, why did I respond to the question on page 5 of my interrogatories?

By Mr. CONNOLLY:

Q. Yes.

A. I presume you are asking me why in any event we cannot predict with any degree of certainty what facilities would be necessary.

Q. No, sir. I am asking you why you didn't answer the question. If you want to take the responsibility for not answering it.

A. No, I will take responsibility for answering the question, Mr. Connolly.

We—and as pointed out in Mr. Moehle's letter, in concluding we should again emphasize that Natural would not necessarily agree to the transportation methods suggested by Mr. Mitchell, nor to the spare capacities listed for the Purvin and Gertz study for the following reasons. And we can sit here and talk about spare capacities and systems forever. But with the hope that we will move some gas from coal gas projects, with a hope that we will achieve cross-system exchanges—and I could go on with this list now about cascading temperatures, lower pressures in gathering systems, etc., etc. It is going to be more difficult for us—

Q. But you did have an answer—

Mr. HARGROVR. Let him finish the answer.

Mr. CONNOLLY. I thought he had, Mr. Hargrove.

Mr. HARGROVE. He was in the middle of an answer.

Presiding JUDGE. You were saying, Mr. Grubb?

The WITNESS. I was saying—

Presiding JUDGE. You were somewhere on cascading temperatures.

The WITNESS. Next question.

By Mr. CONNOLLY:

Q. Are you finished?

A. I am finished now, yes, sir.

Mr. CONNOLLY. No further questions.

Presiding JUDGE. Mr. Grubb, you could make certain assumptions that gas would be delivered sometime to what was put in the El Paso Exhibit No. 121-A—

The WITNESS. I am sorry. Could I see that exhibit? Are these the ones?

Mr. CONNOLLY. Yes.

Presiding JUDGE. That is the one.

The WITNESS. Okay.

Presiding JUDGE. And come to certain conclusions as to whether gas could be moved along your Amarillo line, couldn't you, in 1985? And then you would have different cases, Case 1 would be whether your Dakota gas, coal gasification program is on, and Case No. 2—any number of different cases.

The WITNESS. Surely, we could do that, yes.

Presiding JUDGE. Why didn't you?

Mr. HARGROVE. How many cases do you want?

Presiding JUDGE. Well, one can always make up assumptions as you are so quick to point out, Mr. Hargrove. It gets to be a rather better answer than just not answering it at all.

The WITNESS. I think I—I don't know where I stand in this respect, so you have to help me if I err here. But it was certainly my intention that these these were my notes to begin with when I came here, and I think somebody had requested, whether it was our counsel or Mr. Connolly, that they be furnished ahead of time.

Mr. CONNOLLY. Staff.

The WITNESS. Staff did. They were notes. I had anticipated having them in front of me to respond to other questions. I merely felt that this, subject to the rest of the interrogation, would bring out the questions that—

Mr. GERHART. Excuse me, Your Honor. I think there is one additional point.

Presiding JUDGE. Well, now you interrupted the witness. Do you want me to jump up like a walrus and say I want the witness to respond?

Mr. GERHART. If you wish to object, Your Honor—

Presiding JUDGE. Yes, I object to the interruption. I have been listening to counsel argue for days in this case and none of it is evidence.

Mr. Grubb?

The WITNESS. Yes, sir.

Presiding JUDGE. Did you finish your response?

The WITNESS. I had, yes, sir.

Presiding JUDGE. Okay. Mr. Gerhart?

Mr. GERHART. With your permission, Your Honor, I would just like to make one observation, and that is that the question that Staff addressed to us in the interrogatory does not ask us whether we would transport the gas. It merely asked us what facilities would be necessary and what location if we received contracted Alaskan gas.

Presiding JUDGE. Yes. That is the problem with the answer.

Mr. CONNELLY. It is a non-answer.

Presiding JUDGE. Now, taking a look in that Exhibit F, 1 of 3, it would seem to me that the Amarillo line is a dual line with partial looping. Is that correct? Or do you have two complete lines going north of Station 112?

Mr. CONNOLLY. I think he answered three, Your Honor.

Presiding JUDGE. Well, I am looking at it and it seems to me a portion of it seems to be looped if you accept the schematic.

Mr. CONNOLLY. The looping would be the fourth.

Presiding JUDGE. Well, that is what I wanted to find out.

The WITNESS. Your question is whether there are three lines leading north from—they are leading north from 191. There are two lines from 112 to 191, Your Honor.

Presiding JUDGE. All right. Then from 191 all the way up to just shy of 113 is three lines with partial looping for a fourth?

The WITNESS. That is correct.

Presiding JUDGE. Have you made any determination of how much horsepower and how much additional looping would have to be put on that line in order to pick up the El Paso gas, assuming that from Block 107 onward you had to pick up a coal gasification plant by 1985?

The WITNESS. No, sir, I have not.

Presiding JUDGE. How much of a study is that, taking the figures off of Mr. Mitchell's study on 121–A? EP–121–A?

The WITNESS. Are you talking about in terms of time to respond to something like that? How long would it take to do it?

Presiding JUDGE. Yes.

The WITNESS. Two weeks to respond.

Presiding JUDGE. Do I understand you to be telling us that Question 4 would not require that type of a study, in your opinion? Because the way I interpret Question 4 that the Staff posed to you that is exactly what it would require.

The WITNESS. I think our problem here stems from the fact that we are talking about your company received contracted Alaskan gas. Now, my interpretation of that is that we don't have any contracted Alaskan gas, and that in part had a great deal to do with what I said here.

Presiding JUDGE. When I recall all the times Mr. McKinney and others jumped on Mr. Connolly for the rather crabbed answers El Paso might have given them I really find very ill favor in looking at this response and considering it reasonable with that interpretation of the question.

Okay.

Sometime before the end of this case you are going to have to answer that question, Mr. Grubb. If it is not posed to you by El Paso directly, I will pose it because I think the question is reasonable and I think the answer is comprehensible.

Okay. Mr. Anderson?

Mr. CONNOLLY. I had anticipated, Your Honor, filing a formal interrogatory to get an annwer to that. I didn't think the witness had it in hand. Therefore I wasn't going to ask it now. I take it you do not have it in hand, do you?

The WITNESS. No, sir, I do not.

Mr. CONNOLLY. I intended to do that.

Presiding JUDGE. If you will file that interrogatory in a tight manner that doesn't admit to the type of interpretation, for want of a better word, that we have heard today, I will be happy to direct that it be answered.

Mr. Heisler.

By Mr. HEISLER:

Q. Mr. Grubb, do you know the top gas and deliverability capability of the Sayre Storage Field at present?

A. Yes, sir, I do, I believe.

Q. Can you give that to me?

A. The top gas—take that back. The deliverability is 300 million feet a day —300 million cubic feet of gas a day, and we have a total inventory—recoverable inventory of 40 billion feet annually.

WITNESS D. H. SEELY, JR. PANHANDLE EEASTERN NOVEMBER 21, 1975

Q. And your intention was that you wanted the gas either way.

A. That is correct.

Q. Under date of November 7, 1975, Mr. Seely, there was delivered to Panhandle's counsel interrogatories addressed to a group of potential witnesses, among whom your name appears. And the question that was put is as follows: "As an alternative to the proposed facilities and the acceptance of Alaskan gas through the Northern Border system, what facilities would be necessary and at what locations would your company receive contracted Alaskan gas, if such gas was available by displacement over the El Paso Natural Gas Pipeline system?"

The answer that has been furnished by your counsel this morning reads as follows: "The most suitable location for receipt of volumes of gas from El Paso Natural Gas is at the Liberal, Kansas, compressor station, the point designated by El Paso as its delivery point in its original application. Other possible locations are in Moore County, Texas, at Panhandle's Sneed and Sunray compressor stations, about 12 miles from the existing El Paso Natural Gas company system." Do you have that answer in front of you?

A. No, I do not.

Q. Do you have the question in front of you?

A. I do not. I should explain that I played no part in the preparation of replies to these questions.

Q. Well, that would indicate that somebody gave at least passing consideration to the problem posed by the interrogatory, does it not?

A. I should think it would, yes.

Q. And can you tell us who that is?

A. I cannot.

Q. So that your answer a few moments ago that you didn't know of any study being done is limited—or is to be delimited by the results of the answer I have just shown you?

Mr. FLOOD. If you are assuming this is a study I guess that is right. We had an interrogatory which I pointed out was addressed to Mr. Seely, but Mr. Seely was not the answerer. The company answered it, and we put it in the record, and we suggested the points where there could be an interconnection. And the Sunray and Sneed stations are in Potter County and El Paso's line runs up in that area. That does not mean there is a study made of that. It simply is pointing out areas where there is an interconnection of—possible interconnection. Obviously we can take the gas at Liberal.

Mr. CONNOLLY. Well, does the answer intend to mean that the volumes that you hope to get from Alaska can be received at Liberal or at Sneed station without additional facilities?

Mr. FLOOD. Not at Sneed station without additional facilities. Mr. Connolly. At Liberal, yes.

Mr. CONNOLLY. What additional facilities are required at Sneed station?

Mr. FLOOD. I think if you look at our answer we talk in terms of Sunray and Sneed. We would be capable of handling it at those two stations.

Mr. CONNOLLY. Who is the person that gives you that kind of information?

Mr. FLOOD. It was provided by Panhandle's Engineering Department in Kansas City. I don't know the specific individual.

Mr. CONNOLLY. Well, that individual I think needs to be identified, Your Honor please. And I need to take his deposition, unless Mr. Flood—if Mr. Flood is unwilling to produce him as a witness.

Mr. FLOOD. Your Honor——

Presiding JUDGE. Did I understand your earlier answer, Mr. Flood, was that you could pick it up at Sneed station and Sunray together without additional facilities on the Panhandle system?

Mr. FLOOD. That is my understanding.

Presiding JUDGE. So all we are talking about, then, is possible extra compression say between Sneed station and Sunray if it were in fact tendered at Sneed instead of Sunray?

Mr. FLOOD. We are talking about a possible loop or compression, I don't know. I am not going to get into the engineering of it.

Presiding JUDGE. Has anybody told you the dollar cost of that engineering?

Mr. FLOOD. No.

Presiding JUDGE. Did anybody make a guesstimate?

Mr. FLOOD. No.

Presiding JUDGE. Could you supply to Mr. Connolly the name of the individual who would be able to state what that cost would be?

Mr. FLOOD. We could supply the cost, if you would like.

Mr. CONNOLLY. I think we need to know volumes around those stations, Your Honor, what compression is there now, what flows there are in order to make this a little more meaningful.

Presiding JUDGE. I think Mr. Flood is willing to supply that to you. Are you willing to supply complete information as to that aspect of the question, Mr. Flood?

Mr. FLOOD. Yes. I think we can supply what the flows are.

Mr. CONNOLLY. And the other information that I just alluded to?

Mr. FLOOD. What other information is that?

Mr. CONNOLLY. Maybe the thing to do is to in this instance—we could try interrogatories first rather than a witness.

Presiding JUDGE. Okay.

Mr. CONNOLLY. And we will seek to do that.

Presiding JUDGE. Because I think you are talking about a very narrow question.

Mr. CONNOLLY. I do too.

Presiding JUDGE. In this instance.

You would submit an interrogatory to Mr. Flood, or possibly just talk it over with him.

Mr. CONNOLLY. I would like really a formal interrogatory because I want it sworn to so it can be introduced into evidence.

Presiding JUDGE. Well, we have been accepting counsel's statement in supplying information for the record as evidence, Mr. Connolly, unless an objection is heard, and I have heard none yet in 11,750 pages.

Mr. CONNOLLY. All right.

Presiding JUDGE. Is this a good time for a break?

Mr. CONNOLLY. Well, I think maybe I am done with the witness if I can get another question out.

Presiding JUDGE. Go ahead.

By Mr. CONNOLLY:

Q. Mr. Seely, are you in a position to tell us what the capacities are on Panhandle's present system out of the Panhandle and on Trunkline?

A. No, I am not.

Q. Who would that witness be? Who would that person be?

A. I presume for Panhandle it would be their chief engineer, vice president for engineering, Mr. Hannah.

Q. What is his full name?

A. L. C., I believe, H-a-n-n-a-h.

Q. Hammah?

A. L. E. Hannah. Ha-n-n-a.
Q. Strike the "h"?
Mr. HEYING. No "h."
By Mr. CONNOLLY:
Q. H-a-m-m-a, right?
A. "N."
Q. Oh. Hanna. I see.
A. And for Trunkline Gas Company, I presume that would be Mr. A. W. McAnneny, M-c-A-n-n-e-n-y.

Q. All right.
You have none in the Gulf Coast area.
A. Not to my knowledge.
Q. All right. Now, is your answer intended to permit the inference that 153.5 million cubic feet per day could be received at any of those points of interconnection?
A. No, it is not. Perhaps I should give you the capacities of those interconnections. As the facilities now exist.
Q. Most helpful.
A. The capacity of the first one, Columbia Gas Transmission, is 194 million cubic feet per day.
Q. What do you mean by that answer? The capacity at the point of interconnection?
A. That is the capacity of the interconnecting facilities. The measuring equipment.
The second one with Columbia Gulf is 105 million cubic feet per day.
Under Natural Gas, the first one is 11 million cubic feet per day; the second is 36 million cubic feet per day, but in that case the measuring equipment is for the purpose of delivering to Natural Gas Pipe Line of America. The metering equipment would have to be reversed.
The third Natural Gas Pipe Line interconnection is 57 million cubic feet per day. The fourth one is 26 million cubic feet per day, and the fifth one is 7 million cubic feet per day.
Under Trunkline Gas Company, the first interconnection is 63 million cubic feet per day, the second is 62 million cubic feet per day, and the third is 58 million cubic feet per day.
Q. Now, are these the capacities of the present-day interconnections? Is that right?
A. Yes, sir.
Q. What are the actual flows at those points of interconnection today?
A. I don't have that information available at the present time.
Q. Can you get it?
A. I can get it, yes.
Q. Would you provide that to us, please?
A. All right.
Mr. CONNOLLY. Mr. Weiler?
Mr. WEILER. Yes.
Mr. HARGROVE. I am not sure that I am clear as to what you are asking for there. You are asking for the amount of gas that is flowing through the interconnection?
Mr. CONNOLLY. Yes.
By Mr. CONNOLLY:
Q. I want to make sure I have the numbers right. The capacity of the interconnection at Lavaca County is 11 a day?
A. Right.
Q. At Brazoria No. 1 is 36, if I can use that term; Brazoria No. 2 is 57. Right?
A. Right.
Q. Then I want to ask you about the Wharton County connection of Trunkline. That is 63, right?
A. Right.
Q. I get 167 million, right?
A. I don't understand what you have added up.

Q. I have added up the three I have just repeated to you: Lavaca, Brazoria No. 1, Brazoria No. 2, and Wharton.

A. Could be. I haven't added it.

Q. Take my word for it and assume it is correct, will you, please?

A. I will take your word for it.

Q. If Texas Eastern's entitlement to North Slope gas for 153.5 million cubic feet per day were delivered to one or a combination of those stations, could Texas Eastern take those volumes into its system without additional facilities?

A. Line No. 5 would not be able to take that volume of gas.

Q. That is what I call Brazoria No. 2?

A. No. Lavaca.

Q. Oh. Line No. 5.

A. And Wharton.

Q. Neither could alone, is that right?

A. Pardon? Neither could alone—well, the pipeline facility itself couldn't. That transmission facility could not handle that much volume.

Q. All right. Now, I said either alone or in combination. Now will you answer the second part of the question?

A. Alone, no. In combination, possibly.

Q. Well, what does the possibility depend upon?

A. The magnitude of the volumes that you introduce at those points.

Q. In combination can all five—excuse me—all four in combination take 153.5 without additional facilities?

A. Yes.

Q. Are each of those four stations located in the Texas Gulf area?

A. Yes.

Q. Can you tell me how close they are to Refugio?

A. Mr. Connolly, I can't give you an exact number, but I think it would be in the order of magnitude of 150 miles, possibly 200.

Q. Now, to re-canvass a question I asked you a few moment ago, all four of those stations, Lavaca, Brazoria and Brazoria—the two Brazoria stations and Wharton could in combination handle volumes amounting 153.5 million cubic feet a day without additional facilities. Do you mean north of those points?

A. Yes.

Q. And would that mean all the way up your system?

A. Yes.

Q. Now, could you handle such volumes from Refugio to those points?

A. Yes.

Q. So if El Paso were to construct a line from Waha to Refugio as planned and to deliver volumes up to 153.5 million cubic feet a day at Refugio, Texas Eastern could take those volumes into its system without the construction of additional facilities. Is that right?

A. Yes.

Mr. Connolly. Thank you. No further questions.

Witness Billy H. Kidd Transwestern December 2, 1975

Q. All right. Have you examined, Mr. Kidd, the testimony of Mr. Mitchell and his stick diagrams and testimony of Mr. A. H. Carameros, specifically Exhibit 13, showing how those gentlemen would propose to operate the Transwestern system as part of a transportation system for delivery of Alaskan gas if that system were reversed and if this Commission should certificate a transportation system for Alaskan Gas which would land it on the West Coast of the United States?

A. I have not examined any testimony of Mr. Mitchell or Mr. Carameros in regard to their exhibits. I have reviewed the diagram, Figure 4 of 9, that I received in this room two weeks ago. And that was the basis of my calculation, the horsepower required at P–2 to make the delivery shown on this Figure 4 of 9.

Q. In other words, you agree that with the additional horsepower indicated on that stick diagram, the requisite deliveries could be made to Michigan Wisconsin?

A. The stick diagram I have doesn't show any horsepower is added.

Presiding Judge: 4 of 9 is what? 121–A?

Mr. Connolly. Yes, Your Honor.

Presiding Judge. Okay.

By Mr. Connolly:

Q. That does not show. But you say you would need compression in order to make the delivery?

A. At P–2.

Q. At P–2. How much?

A. 4,600 horsepower.

Q. 4,600 horsepower. All right. Now, I want you to assume that 6560 horsepower compression was added each at stations P–1 and P–2, and that the compressor stations in existence on Transwestern's system between Waha and Needles be manifolded to permit reversed operation. I want you to assume the following flows. Eastward at Needles, 112 to 137 MMcf a day. A transfer from El Paso Natural Gas to Transwestern near the Arizona state line of 323 to 334 MMcf a day.

A. Excuse me. Transfer——

Q. Window Rock.

A. Transfer from——

Q. El Paso Natural Gas to Transwestern near the Arizona-New Mexico state line. And we can assume it would be at Window Rock.

A. How much volume transfer?

Q. 323 to 334. I want you to assume, therefore, an eastward flow into Roswell of 446 to 460 MMcf per day, a southward flow from Roswell toward Waha of 110 to 125 million a day, a northeast flow from Roswell to a Michigan Wisconsin intersection northeast of Pampa Junction of 330 to 333 million cubic feet per day.

A. all right.

Q. I wish you further to assume deliveries at Waha to El Paso Natural of between 535 to 539 million cubic feet a day.

Presiding Judge. Isn't this getting a little complex?

Mr. Connolly. All right.

The Witness. Deliveries to El Paso at Waha of how much?

By Connolly:

Q. 535 to 539 million.

Mr. Weiler. We haven't got to that point yet, but he is obviously——

Mr. Connolly. Let me finish the question first, please, before you undertake to criticize it.

Mr. Weiler. All right.

By Mr. Connolly:

Q. I want to know whether any substantial facilities would be required to handle these flows other than the new facilities which I asked you to assume as part of the hypothetical. If there are additional facilities which would be required, I would like to know what they would be and what their costs.

Mr. Connolly. Now, Your Honor, I know that the man cannot answer this probably off the top of his head. I can't make him read somebody's testimony, but I think I can put to him a hypothetical question and ask for an answer. And obviously I think he is entitled to study it before he answers it, and so I would like the record to be left with a direction that he do study it and answer it within a requisite period of time.

Mr. Weiler. Your Honor, I object to any such direction. We have been willing to give Mr. Connolly the data that we do have. However, I object to making Mr. Connolly's calculations for him.

Now, this is a——

Presiding Judge. Well, he made them all. Actually, all he is saying is will you corroborate them. It is a relatively clever question as far as that objection is concerned, Mr. Weiler.

Mr. Weiler. I understand that he is asking our witness to make this calculation.

Presiding Judge. Mr. Mitchell made a calculation which I assume Mr. Connolly helped frame, and he is asking the witness if it isn't true that on your system that in fact this would be the case.

Mr. Weiler. If Your Honor please——

Presiding Judge. Why do you object to answering?

Mr. Weiler. I object, Your Honor, because it takes an independent study by us to answer the question. He can say he doesn't know right now and that would be his answer, because he doesn't know.

Presiding JUDGE. Does it take an independent study—I am sorry. Let's take them one at a time. Does it take an independent study, Mr. Kidd, to answer the question, or can you just follow these volumes through with what you know of the system and the stick diagrams that you have and give us an answer?

The WITNESS. I would have to make a study.

Presiding JUDGE. Well, what are we talking about? There are studies and there are studies.

The WITNESS. We would have to take all the assumptions that Mr. Connolly has outlined and calculate the flow capability, the horsepower requirements at the two stations that he has given me an assumption for, we would also have to assume that we turned our stations around and back-flow down the pipeline. The pipeline was not designed in that direction of flow for the hydraulic gradient that you would encounter, so it would have to be evaluated on that basis all the way back into each delivery point that Mr. Connolly has assumed.

I don't know how much time it would take. He has also asked me to estimate the cost of additional facilities.

Presiding JUDGE. Well, additional facilities are roughly, what, $300 a horsepower on your compression?

Mr. CONNOLLY. No, in fairness, my question said if facilities were required in addition to those which I asked him to assume, would he identify them and give us the approximate cost.

WITNESS GARY C. MICHALSKI MICHIGAN-WISCONSIN DECEMBER 8, 1975

Q. So if you looked at the Case II projections of increased gas supply and the two variables of North Slope production, you would have a range of between 2.3 and 3.8 billion cubic feet a year for fuel.

A. That is correct. Increased fuel.

Q. Now, you can say, since you wanted to—you said you wanted to expand on Case IV. Go ahead and do it.

A. Well, Case IV is the same as Case II. The mathematics would be the same. You would subtract 2.7 off of the 6.0 million, if you assume the 2.25 Prudhoe Bay supply, which would give you an an increased fuel load. Is it 3.3? And under the 3.3 Prudhoe Bay supply, it would take the difference between the 8.2 and the 2.7, and that equates to 5.5.

Q. Now, I take it if—it would appear from your Table 2 that if FIC Case II supply figures have any validity, and if we assume that those volumes are to be realized, that you could move your share of North Slope gas at a 2.25 billion cubic feet per day production rate at Prudhoe through the Michigan-Wisconsin southwest line without any new facilities. Is that right?

A. Are we still addressing Table 2?

Q. Yes.

A. That you can't derive from Table 2.

Q. I beg your pardon?

A. You cannot pick that information off of Table 2. You have to flip back to Table 1. Your conclusion is correct, but your reference is not.

Q. All right. So if you assume a 2.25 billion cubic feet a day rate of production of Prudhoe and you assume that Michigan-Wisconsin's share of those volumes as anticipated under your Exxon contract are delivered to you by displacement through an El Paso and El Paso-Transwestern system, those volumes could be taken assuming FPC Case I future supplies without any additional facilities.

A. This volume was assumed accepted at the Natural Gas Pipe delivery point and Northern Natural. We assumed we would receive that gas at line pressure. Therefore no new facilities would be required. Should we accept it at Transwestern as Mr. Mitchell has testified, there will be some facility required on that.

Q. Even for the lower volumes.

A. Yes. The pressures—well, you would certainly require horsepower to compress the lower-pressure Transwestern gas—I believe it is lower. And that is why Mr. Mitchell has proposed it. I can't say whether you would need intermediate horsepower in all the cases here.

Q. On an FPC Case II future supply projection, and assuming a higher North Slope rate of production of 3.3, I take it, if deliveries were made by El

Paso at Hugoton and at—what is the other point?—Greensburg, the only additional facilities needed to receive that gas would be 4000 horsepower addition at New Windsor station?

A. Did you say if El Paso made deliveries at those two locations?

Q. Yes.

A. That is correct.

Q. And one finds that out on Table 1. Is that right?

A. That only 4000 is required.

Q. Right.

A. That is correct.

Q. Now, you have made no calculations whatsoever about taking your North Slope gas in some sort of split, some of it in the Southwest line and some of it in your Louisiana line. Have you?

A. We have not made any study of that.

Q. What pressure did you assume on the Transwestern line?

A. I didn't assume any pressure on the Transwestern line. I don't follow your question.

Q. I mean what——

A. We assumed the gas would come in from Natural Gas Pipe and from Northern Natural at line pressure.

WITNESS ROBERT W. DAVIS COLUMBIA DECEMBER 9, 1975

By Mr. CONNOLLY:

Q. So we can identify by reference to Figure 121–A, 5 of 9, in the language of your answer Rayne Compressor Station is at the junction of your east lateral, your west lateral, and what you call your Pecan Island?

A. No, sir. On your drawing it is right there at the fork of where the two laterals connect to the line going north.

Q. All right, fine.

Now, we have established by Mr. Kessock, as he affirms in these answers, that north of Rayne Columbia can take its projected Alaskan volume. Now, the question, as I understand it, is that you can take south of Rayne and east of Rayne all Columbia's projected volumes. Correct?

A. We can take, as the circles demonstrate, from the location at Erath and Garden City the volumes shown here for Tennessee and Natural.

Q. Well, I think the answer says more, but let's get that in a minute.

Incidentally, at Garden City——

Mr. KARLSEN. Pardon me, Mr. Connolly. What answer are you referring to of Mr. Kessock's now?

Mr. CONNOLLY. I will get to it in a minute. Eight.

By Mr. CONNOLLY:

Q. Do you still have an operable compressor station at Garden City?

A. No, sir, that is the tailgate of a plant at Garden City.

Q. What is the name of the plant?

A. Garden City. Exxon, Garden City.

Q. And to put a name to a location on this Figure 5 of 9, is Garden City the point at which the El Paso exhibit, 121–A, 5 of 9, shows 200 million from NGPL?

A. I think not. Of course it is my interpretation of this diagram. But I think the Natural gas is at the Henry plant and the Tennensee gas is supposedly at the Garden City plant. That is my interpretation.

Q. So that the record is clear, and I take it Mr. Mitchell nods that is what he intended too.

Turn to page 10. It appears to me that you are saying—or Mr. Kessock is saying at line 11—line 12 of page 10 that Columbia Gulf has affirmed if the volumes of Alaskan gas totalling 600 MMcf per day were delivered into either or both of these points at a pressure of 1,000 to 1200 pounds, sufficient capacity could be available in those systems.

A. That is correct.

Q. So that either at the Henry plant in the Erath Field or at Garden City, assuming the projections of gas supply as postulated are true, either one of those two points could take 600 million a day.

A. Yes, sir.

Q. So to just button this down so there is no mistake about it, where Figure 5 of 9 in EP–121–A shows 200 at the Henry plant from Natural Gas Pipe and 300 from Tennessee at Garden City, your testimony is that either place could take 600.

A. Yes. I am assuming we all recognize that the present delivery point measuring stations would have to be enlarged. Yes.

Q. And obviously it would assume something about which you cannot testify, that the facilities of Tennessee or Natural Gas Pipe were adequate to take the 600 to that point.

A. That is correct.

Q. Mr. Kessock's answer—I don't know whether you have examined this or not to know or not. He states at line 4 introduction of Alaskan gas into the west lateral as proposed by El Paso would probably necessitate additional facilities in the Columbia Gulf system. Is he thinking of the—or do you know, if you studied—a delivery point mentioned by Mr. Mitchell at the intersection of the United line with your west lateral? National Gas Pipeline.

A. Yes. I am not sure which one he has in mind.

Q. Natural Gas Pipe, yes.

A. But I can state that the west lateral is fully loaded and all of our gas from offshore comes into that line as you show a line coming from offshore and we are delivering gas to Tennessee at that green line on an exchange arrangement in order to help unload the west lateral.

So there is no capacity available without additional facilities.

Q. What kind of facilities would you have in mind?

A. I am not sure I understand your question, Mr. Connolly.

Q. What facilities would be needed to take 600 million a day off the west lateral?

A. It would certainly have to be looped all the way to Rayne.

Q. So what you are saying is, I take it, that—what do you call your line going out in the Gulf? Is that your Pecan Island?

A. That is what we call the Bluewater Project, going from that interconnection shown on the west lateral which is Egan and going out to Block 245 offshore.

Q. Is that called Pecan Island?

A. No. Pecan Island happens to be down there just where the water and land meet. And it is a compressor station.

Q. I see.

So I take it that what you are saying is that deliveries to Columbia should not be made either on your west lateral or your Bluewater lateral. They should be made east of Rayne station.

A. Either east of Rayne or north of Rayne on the main line.

Q. Look at page 10, line 13—line 12 through 14, I guess. 14 or 15. It is difficult to say. Columbia Gulf has affirmed that if volumes of Alaskan gas totalling 600 MMcf per day were delivered into either or both of these points at a pressure of 1,000 to 1200 pounds, sufficient capacity could be available in those systems.

If by 1982 your deliveries—your flowing gas at those points was down as much as 60 percent, could gas be delivered into that east lateral at lower pressures?

Mr. KARLSEN. Pardon me, Mr. Connolly. 60 percent from what level? What Mr. Kessock——

Mr. CONNOLLY. Current level.

Mr. KARLSEN. 60 percent.

Mr. CONNOLLY. Below current levels.

The WITNESS. So long as we could enter Rayne at a suction pressure of 675, I would assume that we could accept the gas at lower than 1200 pounds.

Mr. CONNOLLY. Mr. Karlsen, you just posed something to me that I think needs clarification. As of what time does Mr. Kessock's answer speak? In the back of my head, what you just said went through it and I looked down there and I think there is a gap in his answer.

Mr. KARLSEN. I was under the assumption that he was speaking as of the dates and times and pressures that you are speaking of in 5 of 9. And that is why I raised it, that you might have been changing the years. But I don't want the record to reflect some different times and dates on this issue.

Mr. CONNOLLY. I think the answer has been responsive although it wasn't a direct answer to my question. What the gentleman has just said was as long as they get the gas to Rayne at 675, they can handle it. So I suppose that is not directly responsive but really is a better answer than I sought.

Mr. Mitchell says 675 absolute or gauge? Just to nail it.

The WITNESS. Let me take gauge.

Mr. CONNOLLY. That is all I have. Thank you.

Presiding JUDGE. Mr. Heisler.

Mr. HEISLER. Your Honor, I think the responses which Mr. Kessock has helpfully provided obviated the need for me to ask any questions. I have nothing.

Presiding JUDGE. How many main piplines does Columbia Gulf Transmission have heading north from looking at page 5 of 9 of the Exhibit 121–A?

The WITNESS. We have three. Two 30-inch lines and one 36-inch line.

Presiding JUDGE. Wasn't there a newspaper article within the last couple of days referring to your president's suggestion that by the early '80s you were going to convert one of those three to an oil pipeline? Or are you familiar with such study even if you didn't look at the newspaper article?

The WITNESS. Yes, I saw the article in the Washington paper.

Presiding JUDGE. What does that say about Mr. Kessock's future projections on page 10 as to anticipated gas supply which could reduce the available capacity to handle the El Paso gas if delivered?

The WITNESS. I think that the newspaper article indicated that a feasibility study had been made to evaluate a coal slurry line and that consideration should be given to converting it to a crude line. If we took one of the lines out of service, then that would cut the capacity approximately 600 million a day.

Presiding JUDGE. Well, let's go the other way. Let's just say that you had the capacity to take one out because you didn't have gas moving through it. You could leave the line and you could move this 600 Mcf at no additional cost for facilities, couldn't you?

The WITNESS. Yes, sir. Not for facilities, but operating costs would be there.

Presiding JUDGE. Operating costs are going to be there for moving gas anyhow, any way you move it and by whoever moves it.

The WITNESS. That's correct.

Presiding JUDGE. Mr. Karlsen?

Mr. KARLSEN. I was just a little concerned about what you said with regard to cost and I wondered if I could have that portion of the question again.

Presiding JUDGE. The question or the answer?

Mr. KARLSEN. Your question.

Presiding JUDGE. The cost of facilities was the only words I used which had cost in it.

Mr. KARLSEN. I thought you were speaking about operating cost.

Mr. HARGROVE. You said something about operating cost, Your Honor.

Presiding JUDGE. No, only in response to the witness' statement. I said operating costs are going to be there for moving gas whenever you move gas.

Mr. HARGROVE. They vary with volume.

Presiding JUDGE. I realize that too. I wasn't suggesting that it costs the same operating cost to move one Mcf as it costs to move 600 MMcf.

Do my questions raise a question for you, Mr. Connelly?

Mr. CONNOLLY. Yes.

[From Science, Vol. 190, No. 4216, Nov. 21, 1975]

News and Comment

METHANOL AT MIT: INDUSTRY INFLUENCE CHARGED IN PROJECT CANCELLATION

Cambridge, Massachusetts. Academic institutions in theory provide a testing ground for ideas which is somewhat insulated from the push and pull of the world outside. But, as they take advantage of the energy R & D dollars now so tantalizingly available from government and industry, these institutions may risk compromising or appearing to compromise their academic independence. The cancellation of a research project on methanol (methyl alcohol) as a substitute motor fuel for gasoline at the Massachusetts Institute of Technology's Energy Laboratory offers a case in point. In the opinion of the scientists who initiated and led the project, it was killed because the laboratory yielded to influence from the oil and automobile industries.

Authorities at MIT deny that outside influence had any bearing on the decision, and they say that the project—which was to involve the testing of a blend of methanol and gasoline in 200 faculty and student cars—was terminated because it was technically weak and inappropriate for a university. Yet the attendant circumstances, which include the active involvement of an Exxon employee as well as the fact that the laboratory had received $1 million in grants from Exxon and Ford, put the termination in an ambiguous, and perhaps suspicious, light.

The project in question began some 18 months ago at a time of considerable debate over the feasibility of using methanol in automobiles. Several academic researchers were touting methanol's potential, and among them Thomas B. Reed of MIT's Lincoln Laboratory was perhaps the most vocal. Spokesmen for several oil and automobile companies, notably Exxon, Chevron, and General Motors, were contesting the feasibility of methanol fuels. Reed, a 49-year-old chemist who holds 10 patents and whose specialty is crystal growth and high temperature processes, had in his spare time experimented extensively with his own automobiles and those of his colleagues. He found that adding about 10 percent methanol to a tank of gasoline improved performance, gave better mileage, and reduced pollutant emissions. Results similar to Reed's have since been reported by West Germany's Volkswagen, now generally acknowledged as the leader in methanol research. In this country, however, oil and automobile companies have continued to report that methanol-gasoline blends cause drivability problems.[1]

Because of the ensuing publicity, Reed received an unsolicited $100,000 grant for methanol research. The money, ironically, came from a Minnesota oilman, John B. Hawley, who had become concerned with impending petroleum shortages. Reed took the money to MIT's Energy Laboratory—then newly formed and struggling for funds—which eagerly adopted Reed, the money, and the methanol program. A major component of the program was to be a fleet test designed to settle the question of drivability and to explore any problems that might arise from the use of methanol-gasoline blends.

Primed by Reed's enthusiasm, plans for the fleet test and related research began to take shape in the summer of 1974. Albert G. Hill, then vice-president for research at MIT, gave permission for the test, and a major chemical company offered to donate a large quantity of methanol. Reed hired a test director and an industrial consultant, and they began contacting organizations with experience in fleet testing for advice on the practical details. The city of Cambridge gave permission for MIT to refurbish an abandoned gas station near the campus and leases for the property were negotiated and drawn up.

In December 1974, however, energy lab director David C. White informed Reed that the fleet test was under review. In January, most of Reed's remaining funds were transferred out of his account—without his knowledge or consent, according to Reed. And in early February, after a meeting of energy lab administrative heads and others at which Reed presented his test plans and rationale, White canceled the project. Reed, who has since returned to Lincoln Laboratory, says "industrial opposition to the fleet test and to the credibility it would have given methanol fuels played in my opinion a major role in the program's cancellation." He believes "the use of methanol as a motor fuel is no longer a technical question, but a political one with implications for our national energy policy."

White and many of his colleagues in the energy lab who were party to the decision see things differently. There appear to be four principal areas of contention.

---

[1] "Controversy over alcohol fuels is not new despite the extensive German experience with them during and before World War II. According to S. J. W. Pleeth in his book [*Alcohol—A Fuel for Internal Combustion Engines* (Chapman Hall, London, 1949), pp. 221 and 227], The bias aroused by the use of alcohol as a motor fuel has produced results in different parts of the world that are incompatible with each other. In general we can detect two schools of thought with regard to the use of alcohol as a motor fuel. Countries with considerable oil deposits (such as the United States) or which control the oil deposits of other lands (such as Holland) tend to produce reports antithetical to the use of fuels alternative to petrol; countries with little or no indigenous oil tend to produce favorable reports. . . . The contrast between the two cases presented is most marked: one can scarcely avoid the conclusion that the results arrived at are those best suited to the political or economic aims of the country concerned, or of the industry which sponsored the research."

First is the question of whether the energy lab's industry money and contacts have made it susceptible to influence. The laboratory's hopes for establishing its own research program have for the past year and a half been nourished primarily by the two unrestricted $500,000 grants from Exxon and Ford (specifically, the Ford Motor Company Foundation), grants that arrived shortly after the Hawley money. In addition, the laboratory's advisory board includes 7 oil and automobile industry people among its 24 members. And the laboratory as a whole makes no secret of its desire for still greater interaction with industry in the energy field. Hill, who was active in landing the Ford and Exxon grants, says that there were no strings attached to the money. He thinks there may have been some discussions concerning the methanol project with those companies, but that, as far as influence being attached to their money, "we are man enough—no, person enough—to stand up to anybody." Reed is not so sure.

OIL AND AUTO TIES

A second point in contention concerns the institutional loyalties of the key participants in the actions that led to the demise of the methanol fleet test. The precipitating event seems to have been a recommendation by a mechanical engineering professor, John B. Heywood, and by a visiting scientist, John P. Longwell, that the test be canceled. Heywood is head of MIT's Alfred P. Sloan Automotive Laboratory, and much of his research on engines has been supported by the auto industry; Longwell is an Exxon research scientist who was on loan to MIT as a visiting professor to help it set up the energy research program. Their recommendation was contained in a letter to White dated 19 December 1974. The letter said that "the methodology developed to evaluate and quantify vehicle operating problems during the fleet test program is inadequate." Also, it referred to those conducting the project as people of "limited experience in this area" and observed that there were other tests of methanol-gasoline blends already under way. Heywood and Longwell also said that the test would have little national significance and was inappropriate for the energy laboratory. In its stead, they proposed more basic research on the chemistry of methanol-gasoline blends and their behavior in laboratory engines.

Heywood and Longwell took part in the meeting in early February at which the project was canceled. Reed says he specifically raised with White the question of whether their participation constituted conflict of interest. White does not recall the question being raised, and he believes their participation was entirely appropriate in that he regards them as the most knowledgeable experts at MIT on motor vehicle engines and fuels. And, although acknowledging that institutional alliances can affect technical opinions, White does not think that Longwell's Exxon affiliation was relevant to or affected his scientific judgment.

A third matter concerns the $100,000 for the methanol program, which was in an account under Reed's control in his capacity as principal investigator. Late in January 1975, and shortly before the fleet test was canceled, the energy lab transferred $30,000 to another account for laboratory engine tests with methanol blends under Heywood's control. Reed, who says that he never agreed to the transfer and did not learn of it until March, believes it was intended to make it appear that he had spent all his funds, thus adding weight to the arguments for canceling the fleet test. White and Jan Louis, who in January became White's lieutenant in charge of methanol, deny the charge. They say they are sure Reed was told about the transfer, and they insist there was an earlier understanding that Heywood would get the money from Reed's account. Moreover, White points out, he did provide Reed with additional money later on (after the fleet test was canceled), so that the total Reed spent during his stay at the energy lab came to the full $100,000.

Finally there is what Reed now sees as an attempt to restrict public debate concerning methanol's potential. Shortly before the Heywood-Longwell recommendation to White, a lead article by E. E. Wigg of Exxon appeared in *Science* (29 November 1974) challenging the feasibility of methanol-gasoline blends. Since the article was explicitly a critique of an earlier article by Reed (*Science*, 28 December 1973), Reed prepared a rebuttal letter to the editor. White, however, asked Reed not to submit it, saying that it would do no good to stir up controversy. Reed went along with the request although he now wishes he had not. White says he remembers that it was, in his opinion, too ad hominem. In fact, the thrust of the letter appears to be technical. It points out that Wigg's critique was based on tests with only a few automobiles and a fuel blend which Reed believes to have been excessively rich in methanol; where the experimental conditions overlap, Reed says, Wigg's results are reasonably similar to his.

Beyond these specific points of contention, there appears to be a wider difference of opinion between Reed and many of the energy lab scientists regarding the significance of methanol to the national and international energy picture. Reed believes that synthetic fuels are an urgent matter and that methanol offers an opportunity for the country to begin substituting for imported oil in the near future. Support for Reed's view is most evident in Europe, where methanol as a motor fuel is being widely and enthusiastically investigated. Volkswagen has had a major research program for several years, and in combination with the West German government and other industrial companies (including the German branch of Shell Oil), has been conducting an extensive fleet test since March of this year. In Sweden, Volvo and the government have started a 3-year effort that will include fleet tests of cars as far north as the Arctic Circle. In both countries the use of methanol-gasoline fuels in the near future as a means of lessening the almost total dependence on imported oil is being seriously considered. In South America, Brazil is reported to be already introducing methanol-gasoline blends into general use. In the United States a variety of industrial organizations are considering plans to build coal- or wood-based methanol plants, but the oil and automobile companies appear to be holding back. A bill recently introduced into the California legislature that would have required methanol-gasoline blends to be sold in that state by 1980 was strongly opposed by oil and auto company spokesmen and eventually killed. No existing U.S. research efforts on methanol use are comparable in scale to the MIT fleet test, which might possibly have had considerable national impact, as Reed claims.

The alternative point of view—that methanol should be discounted for the present as an energy option because shortages of oil are not imminent and the United States can live very well on imported oil—does have supporters beyond the major oil companies. White and many of his colleagues at the energy laboratory subscribe to this argument. At issue in the MIT affair, then, is whether the decision to cancel the fleet test went beyond honest differences of opinion.

Reed certainly believes that it did, and although he continues to pursue research on synthetic fuels and to interact with the energy lab on some matters, he is obviously badly shaken by the experience. In recent correspondence with his Minnesota benefactor, Hawley, he received a second check, this time for $50,000, to further his methanol work. The check, however, was made out to MIT, and Reed, rather than risk a repeat of the whole affair, sent it back.

White, while rejecting any suggestion of improprieties, says that a more carefully designed test would probably have attracted the cooperation of Heywood and Longwell and have been approved. But this merely raises the question of why the test was not redesigned, rather than canceled. It would not appear to have been beyond salvaging. One energy lab scientist, who did not want to be named, says "the design may have been a little sloppy, but to say that it wasn't scholarly is ridiculous."

This ambiguous incident is troublesome because it raises the specter of universities adjusting their perspective as to what is important and their research programs to mesh more smoothly with government and industry. Even the suspicion of improper influence tends to weaken confidence in academic independence and hence the potential for university leadership in energy research matters.

Northwest Pipeline Corporation Transportation of Alaskan Gas Fairbanks Corridor Route

The Federal Power Commission (FPC) proceeding for the selection of the system to be utilized for the transportation of Alaskan natural gas from Prudhoe Bay to the lower 48 states was initiated by order of the FPC issued on January 23, 1975 and the hearings commenced on May 5, 1975.

Northwest Pipeline Corporation (Northwest), wholly-owned subsidiary of Northwest Energy Company, has been a party to this proceeding (Docket Nos.

CP75–96, *et al.*) since its inception. A complete review of the evidence presented to date has convinced Northwest that neither of the pending applications of El Paso Alaska nor Arctic Gas best serves the overall public interest.

It is the opinion of Northwest that the public interest could best be served by delivery of Prudhoe Bay gas to the lower U.S. via a pipeline traversing the State of Alaska and Canada along the alternative route designated as the "Fairbanks Corridor." The facts brought to light in this proceeding suggest that the Fairbanks Corridor route offers the most environmentally acceptable, economic and feasible method of satisfying the majority of the interests in a manner that is beneficial to the consumers of both Alaska and the U.S.

Northwest's Alcan Pipeline Project following the Fairbanks Corridor, as illustrated in Figure 1, would be designed to transport Prudhoe Bay gas through a 42-inch pipeline parallel to the Alyeska Pipeline System in Alaska from Prudhoe Bay to Delta Junction. From Delta Junction to Fort Nelson, British Columbia the pipeline route would be adjacent to the Alcan Highway. At Fort Nelson, a portion of the gas would be diverted into expanded Westcoast Transmission Company, Ltd. facilities for delivery to Sumas, Washington. The remainder of the gas would be transported via a 36-inch pipeline from Fort Nelson to Zama Lake, Alberta, for delivery to Empress through expanded facilities of the Alberta Gas Trunk Line Company, Ltd.

The Mackenzie Delta gas, when available, would be transported by the proposed Foothills Pipe Lines, Ltd. 42-inch pipeline system from Mackenzie Delta to the 60th parallel, where it would deliver gas to the proposed Alberta Gas Trunk Line (Canada) system which would connect to the existing Alberta Gas Trunk Line system at Zama Lake. The connection at Zama Lake would supply Mackenzie Delta gas to the expanded Alberta Gas Trunk Line system, and through an exchange with Prudhoe Bay gas, the expanded Westcoast Transmission Company, Ltd. system.

Northwest believes that there is sufficient time to consider the Alcan Pipeline Project without impeding the realistic date for commencement of gas deliveries from Alaska. On the contrary, the system proposed by Northwest could be ready for delivery of Prudhoe Bay gas sooner than either of the other proposed systems. Northwest holds these beliefs for the following reasons:

Northwest's studies indicate that construction along the Fairbanks Corridor will be much less difficult and permissible during more months of the year. As a result, Northwest estimates that initial deliveries of Prudhoe Bay gas will commence three years after receipt of government approvals and financing compared with five years for Arctic Gas and even longer for El Paso.

The Fairbanks Corridor route has the distinct advantage of support from "environmentalists," thus the project could be expected to proceed on schedule without opposition from environmental activists. The data and experience gained through the environmental impact assessment of the Fairbanks Corridor, which was conducted by the Department of Interior (DOI) and FPC, will minimize the time needed in preparation and review of the complete environmental impact statement.

The FPC proceedings have revealed problems in regard to the production, pricing and purchase agreements which indicate that the route selection may not be the critical time constraint.

CONSTRUCTION ADVANTAGES

Northwest's studies indicate that engineering and construction of the facilities along the Fairbanks Corridor route will require about two years less time than either of the other routes. This time saving would more than offset any anticipated delay necessary to prepare, file and prosecute an application with the FPC for the Alcan Pipeline Propect. The support for the conclusion of reduced engineering and construction time is summarized below:

The pipeline route parallels existing all-weather roads; i.e., the Alyeska access road from Prudhoe Bay to Fairbanks and the Alcan Highway from Fairbanks to Fort Nelson.

A sophisticated communications system exists along the entire route.

The existing Alyeska pipeline work pad could be utilized (subject to negotiations with the owner).

An existing products pipeline right-of-way can be utilized from Haines Junction to the junction with the Alyeska pipeline near Delta Junction, a distance of approximately 400 miles.

Existing construction facilities along the Alyeska pipeline (camps, air strips, etc.) can be utilized (subject to negotiations with the owner).

Construction experience exists along the Fairbanks Corridor route which could allow competitive bidding. This should have the effect of reducing and controlling construction costs.

Alaskan and sub-actic construction techniques along the proposed route have been developed and this information can be used in determining engineering design, realistic costs, and construction requirements along the proposed pipeline route.

Construction equipment along the Alyeska pipeline is in place and available for use (subject to negotiations with the owner).

Minimum amount of construction required on the coastal plain of the Beaufort Sea.

Use of the Alyeska pad from Prudhoe Bay to Delta Junction would allow pipeline construction to be scheduled over a nine-month period from March 1 to December 1.

Pipelining along most of the route from Delta Junction to Fort Nelson would be conventional summer construction, thus eliminating many of the uncertainties in arctic pipeline cost estimating.

Use of excess capacity coupled with an incremental looping program in the existing Alberta Gas Trunk Line System and Westcoast Transmission System should yield the lowest delivered energy cost.

ENVIRONMENTAL ADVANTAGES

The DOI and the FPC submitted Final Environmental Impact Statements in March, 1976 and April, 1976, respectively. Both of these voluminous statements include a thorough analysis of the Fairbanks Corridor route. The FPC statement recommends the Fairbanks Corridor route as the most environmentally acceptable project. Further, the DOI issued a report dated February 1976 which concludes that the Fairbanks Corridor route provides the greatest net national economic benefit. Northwest generally agrees with the environmental evaluation of the Fairbanks Corridor, as presented by the FPC Staff and the DOI, however, without a formal certificate application on file, the FPC may not legally be able to grant authorization for this alternative. The very purpose of the requirement in the National Environmental Policy Act of 1969 to study alternatives is to assure that all avenues have been investigated and when a superior, viable alternative surfaces as a result of these studies, that it can be implemented.

The environmental staff of the FPC, after an in depth review of the environmental data and analysis, arrived at the conclusion, as reported in the Final Environmental Impact Statement, that the Arctic Gas Pipeline proposal is more environmentally preferable than the El Paso LNG proposal, but that neither proposal should be approved. Rather, the Fairbanks Corridor route, exclusive of the Mackenzie Delta lateral, was the preferred route for delivery of Prudhoe Bay gas. In addition, if Mackenzie Delta gas becomes available, it was suggested that the Foothills Pipe Lines, Ltd. project could be constructed for delivery of that gas to existing facilities of Westcoast Transmission Company, Ltd. and The Alberta Gas Trunk Line Co., Ltd.

The DOI has submitted their Final Environmental Impact Statement in which they have made direct comparison of the various alternative routes proposed for the Arctic Gas System. Although not specifically recommending any particular route, this report reveals that a pipeline constructed along the Fairbanks Corridor route would pose the least detrimental environmental impact. In addition, it has also received favorable economic analysis from the DOI.

The foregoing discussion relating to the Fairbanks Corridor assessment by the DOI and FPC has been based upon that alternative as presented by the Alaskan/Canadian Arctic Gas Pipeline applications. A major economic and environmental improvement would be realized by the Alcan Pipeline Project following the Fairbanks Corridor, as proposed by Northwest, because of utilizing existing Canadian pipelines in Alberta and British Columbia instead of constructing an entirely new system across Canada, as proposed by Arctic Gas.

As a result of the thorough environmental analysis which has been completed by the DOI and FPC, the task of preparing the Environmental Impact Statement regarding the facilities in the State of Alaska will be greatly eased. The only additional environmental impact assessment necessary, will be for the facilities required to transport the gas within the western U.S. These facilities will be adjacent to existing facilities and wll not involve significant environmental impact.

TIME CONSTRAINTS

It is becoming apparent to Northwest that basic consideration of the commitment of the gas for sale may be the critical time constraint rather than the route selection. None of the Alaskan gas from Prudhoe Bay is committed under gas purchase contracts at this time to Northwest's best knowledge. The Federal pricing mechanism for the gas has not been established. The production plan for the field in order to maximize oil recovery has not been agreed upon by the producers or approved by the State of Alaska. Therefore, at this point in time it is not known what annual volumes of natural gas will be available, how it will be priced, or the terms and conditions under which it will be sold to pipeline purchasers. In face of all of this uncertainty, Northwest believes that the Fairbanks Corridor approach can be presented and resolved within the same time frame that the gas supply problems can be resolved.

SUMMARY

The tremendous advantages of Northwest's proposed Alcan Pipeline Project for arctic gas delivery arises from the large scale use of existing roadways, rights-of-way, utility corridors and Canadian pipeline facilities. The viability of this pipeline system is aptly illustrated by the following summary of advantages:

Lowest investment for delivering Prudhoe Bay gas to the United States. (Figure 2)

Lowest transportation cost for delivering Prudhoe Bay gas to the United States. (Figure 2)

Supported by federal and private environmental groups.

Year-round construction possible in some areas; up to 9 months most areas.

Earliest completion and delivery date—three years from date of permit receipt.

Provides economic growth base for Alaskan interior (Fairbanks).

Can be designed for economic operation at the lower gas production rates realistically expected during the first years of production.

Permits economical phasing in as additional gas supplies develop along the north slope. (Mackenzie Delta gas via Foothills Pipe Lines)

Reduced cost and phased construction enhance financibility.

Proven 42-inch pipeline technology assures greater reliability.

More conventional pipeline construction lends itself to competitive bidding and more reliable cost estimates resulting in fewer cost overruns.

Only approximately 65 miles of highly sensitive, non-stable, fragile soil to be traversed as compared to approximately, 460 miles of similar conditions along the Arctic Gas Pipeline prime route.

Crosses several potential gas fields within the State of Alaska.

Follows existing all weather roads and utility corridors.

Year-round access to all areas in event of emergency.

Potential for sharing operating costs with Alyeska.

Avoids the uncertainties regarding the Canadian Native Claims Settlement Issue.

In brief, the Alcan Pipeline Project, as proposed by Northwest, has many of the advantages of both the Arctic Gas System and Trans-Alaska LNG System with few of the disadvantages of either system.

Northwest believes that presentation of an application to construct and operate facilities along the Fairbanks Corridor route will not delay the realistic delivery date for Prudhoe Bay gas. Further, Northwest suggests that it is timely, in light of the DOI's and FPC's Environmental Impact Statements, to commence prosecution of a formal application for the Alcan

Pipeline Project. Planning and preparation of an application with the FPC to construct and operate a pipeline system along the Fairbanks Corridor route in Alaska has commenced and Northwest has received the cooperation of Westcoast Transmission Company, Ltd., and The Alberta Gas Trunk Line Company, Ltd. in planning for the transportation of the gas through Canada. Northwest has also received the support of the major natural gas distribution companies serving the Pacific Northwest region for this project.

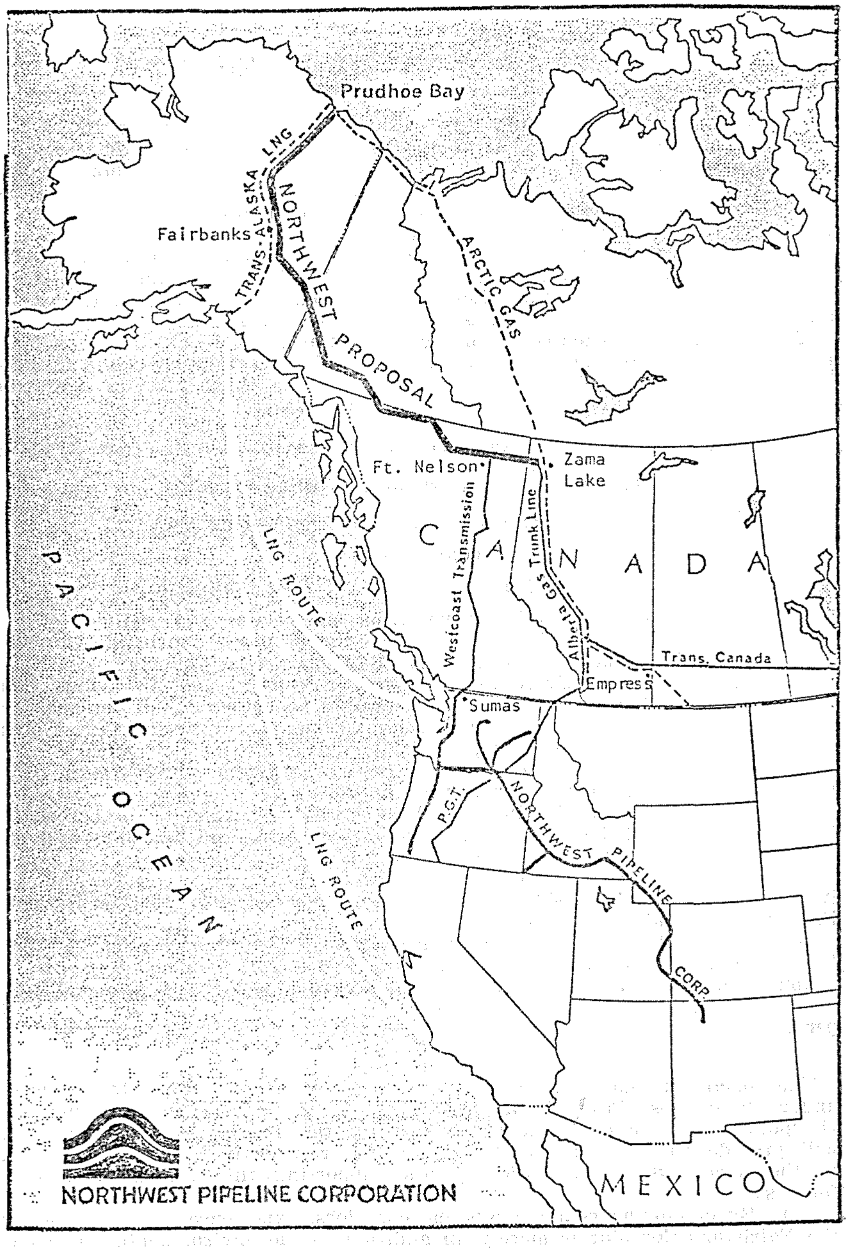


FIGURE 2.—ARCTIC GAS DELIVERY SYSTEMS COST COMPARISONS

	El Paso LNG	Arctic Gas project	Northwest's Alcan Pipeline project: Prudhoe Bay only	Northwest's Alcan Pipeline project: Prudhoe and Delta
Prudhoe Bay supply (billion cubic feet per day)	3.2	2.25	2.4	2.4
MacKenzie Delta supply (billion cubic feet per day)		2.25		1.6
Delivered to U.S. border (billion cubic feet per day)	2.8	2.1	2.2	2.2
Capital investment (in billions of dollars) 1975 constant dollars	$7.62	$6.68	$4.65	$6.84
Unit Transportation cost (dollars per million Btu)	$1.48	$1.04	$1.00	$1.02

The volume, investment and unit cost data shown above for the Arctic Gas Project and Northwest's Alcan Pipeline Project reflects the facilities for deliveries at Sumas, Washington or Kingsgate, British Columbia for gas destined for U.S. western regional markets, and at Empress, Alberta for deliveries through Saskatchewan to the U.S. mid-western and eastern regions. The facilities for delivery from Empress, Alberta to mid-western and eastern U.S. markets would be the same with either project. The figures shown for the El Paso LNG Project are for delivery of the gas to the first pipeline interconnection in California, after regasification. The facilities and cost required for displacement within the U.S. have not been included.

The unit transportation costs for the Arctic Gas Project and the Alcan Pipeline Project are for delivery at Kingsgate, British Columbia and Sumas, Washington, respectively. These costs are for the third year of operation and do not include the cost of purchased gas or fuel.

ENGINEERING AND ENVIRONMENTAL OVERVIEW ARCTIC GAS PIPELINE SYSTEMS

(Prepared for: Northwest Pipeline Corp.)

(Prepared by: Gulf Interstate Engineering Co.)

CONCLUSIONS

I. Construction Feasibility and Cost Estimate

The conclusions that can be drawn from our review and analysis of the construction feasibility and overall cost of the proposed Fairbanks Corridor route for the transportation of Prudhoe Bay gas are as follows:

(a) The route is entirely feasible from a construction viewpoint. Construction over a large part of the route would be conventional summer construction. Because of the ease of construction along the proposed route, system costs and schedules can be developed with a high degree of confidence.

(b) Gas could commence to flow thru the system three years after receipt of the necessary governmental approvals.

(c) Energy Systems Engineering Ltd. (ESEL) estimated total cost, in 1975 dollars, at $4,650,349,000 for Prudhoe Bay gas and $6,836,063,000 for both Prudhoe Bay and Mackenzie Delta gas.

(d) ESEL estimated total capital system costs, escalated to the year of investment, at $6,151,943,000 for Prudhoe Bay gas and $9,308,986,000 for both Prudhoe Bay and Delta gas.

(e) Rule-of-thumb calculations indicate that 1975 cost of service (without fuel gas) is in the order of $1.00 per MMBtu for Prudhoe Bay gas at ultimate flows at Sumas, Washington and Empress, B.C. At an assumed BTU content of 1145 Btu/ft.^{3}, the cost of service would be approximately $1.15 per MCF.

II. Environmental

The conclusion that can be drawn from our review of the data tabulated under References, Part IV of this report, is that, from an environmental viewpoint, construction of a pipeline along the Fairbanks Corridor route will provide the most acceptable means of transporting Prudhoe Bay gas to the lower 48 states. Major points supporting this conclusion are as follows:

(a) By employing common pipeline corridors, experience and engineering, the Fairbanks Corridor is merely an addition to the environmental effects of the existing pipeline system in Alaska and parts of Canada.

(b) The existing data and stipulations which define the Alyeska pipeline are directly applicable to the Fairbanks Corridor pipeline in Alaska.

(c) Previous work done on the Haines products pipeline and the Alcan Highway provides some environmintal data pertinent to the proposed Fairbanks Corridor line.

(d) A reservoir of private and governmental personnel has developed the expertise to protect all segments of the environment in and around the Alyeska line. These people can readily apply their knowledge to the Fairbanks Corridor line.

(e) Environmentally acceptable construction could be performed year-round on approximately 80% of the Fairbanks Corridor line.

(f) Emergency/contingency plans exist for the Alyeska line. Comparable plans can be readily initiated for the Fairbanks Corridor line.

III. Socio-Economic

The conclusion that can be drawn from our review of the data tabulated under References, Part IV of this report, is that, from a socio-economic viewpoint, construction of a pipeline along the Fairbanks Corridor route will provide the best means for transporting Prudhoe Bay gas to the lower 48 states. Major points supporting this conclusion are as follows:

(a) Construction of the proposed Fairbanks Corridor pipeline would provide continued employment for an established Alaskan work force.

(b) Construction of the Fairbanks Corridor line would extend present income levels and provide permanent economic benefits to Alaska.

(c) The towns and cities near the Alyeska pipeline are better able to handle the influx of construction activities. There are existing medical, housing, emergency and community facilities in Fairbanks and Whitehorse that are already developed.

(d) The Fairbanks Corridor pipeline will provide significant increases in the Alaska tax base.

(e) The Fairbanks Corridor pipeline will transport natural gas to Fairbanks and other interior communities, including either of the two areas presently proposed as the site of a new capital of Alaska.

(f) The proximity of the Fairbanks Corridor route to the Petroleum IV and other Western Alaskan reserves will provide a means of transporting gas from those reserves.

(g) The wages paid to operations and maintenance personnel will provide a continuing benefit to residents of Alaska.

INTRODUCTION

Northwest Pipeline Corporation retained Gulf Interstate Engineering Company to provide:

(a) A review and expert opinion of the construction feasibility and overall cost of transporting Prudhoe Bay and Mackenzie Delta gas via the Fairbanks Corridor pipeline system as was presented recently by Foothills Pipe Lines Ltd. in response to a request by a joint committee on Commerce and Interior and Insular Affairs of the U.S. Senate. In addition, comments on the construction feasibility of the prime Arctic Gas Pipeline route were requested.

(b) An overview of the environmental and socio-economic aspects of the "Fairbanks Corridor" pipeline system and the prime Arctic Gas Pipeline route for transporting Prudhoe Bay and Delta gas to the lower 48 states.

The construction feasibility and cost review were subcontracted to Energy Systems Engineering Ltd. and are contained herein as Part III.

The environmental and socio-economic overview was prepared by the Environmental and Regulatory Affairs Department of Gulf Interstate Engineering Company and is contained herein as Part IV.

CONSTRUCTION AND COST ANALYSIS FAIRBANKS CORRIDOR PIPELINE SYSTEM

(Performed for: Gulf Interstate Engineering Co.)

(Prepared by: Energy Systems Engineering Ltd.)

1.0 INTRODUCTION

This report summarizes the results of a review and analysis of the construction feasibility and overall cost of a proposed "Fairbanks Corridor" pipeline system for the transmission of natural gas from Prudhoe Bay to the Canada/U.S. border at Sumas, Washington, and to Empress on the Alberta/Saskatchewan border. Northwest Pipeline Corporation requested that Gulf Interstate Engineering Company (GIEC) provide an independent evaluation of the construction feasibility, overall costs, environmental aspects and socio-economic impact of the concept that was presented recently by Foothills Pipe Lines Ltd. (FPL) in response to a request by a Joint Committee on Commerce and Interior and Insular Affairs of the U.S. Senate. Energy Systems Engineering Ltd. (ESEL) subcontracted those portions of the study related to construction feasibility and overall costs.

1.1 Terms of Reference

The study was to be conducted in accordance with the following terms of reference:

(a) ESEL was to gather and collate all construction and cost data available through information filed by Canadian Arctic Gas Pipeline Ltd. (CAGPL), El Paso Alaska Company, and Foothills Pipe Lines Ltd. (and associated systems). In addition, all the construction and cost details of the Fairbanks Corridor Concept were to be made available directly by Foothills and its member companies. All of the above material was to be used to provide the necessary cost backup for examining the proposed system.

(b) ESEL was to assess the proposed system from a construction feasibility and timing standpoint.

(c) ESEL was to assess the costs of the proposed system, and provide an estimate based on previous arctic pipeline cost estimates, as well as independent investigations of cost parameters. Costs were to be presented in terms of 1975 and escalated dollars, and a "rule-of-thumb" cost of service was to be provided.

1.2 Sources of Data

Due to a time constraint, no original cost data were generated during the study; costs were examined using existing in-house data, FPL working papers, and previous arctic pipeline submission costs. Current arctic pipeline practices and costs were examined, and the possible impact of the Alyeska project was assessed. Marine Pipeline Construction of Canada Limited provided assistance in the areas of construction timing, spread requirements, and construction costs. Material used in assessing the cost of the proposed system included the following:

(a) El Paso Submissions re: proposed Trans-Alaska pipeline.
(b) Foothills Pipe Lines Ltd. Application to the NEB.
(c) FPL working papers re: the Fairbanks Corridor Alternative.

These sources and other references are detailed in Appendix "A".

1.3 System Concept

The specific Fairbanks Corridor examined in the study was put forward by Foothills Pipe Lines Ltd., and all system natural gas flows, fuel requirements, deliveries and facility requirements presented by FPL were used as the basis for system analysis. The total system provides for the movement of Prudhoe Bay gas and Mackenzie Delta gas. The system required for Prudhoe Bay gas would come on stream first (1981), followed by Delta gas two years later (1983). The system volume buildups are detailed in Table 1 - 1 (FPL Table). The volumes of the total system analyzed in the study are projected to 1985 with a total of 4 BCFD, consisting of 2.4 BCFD from Prudhoe Bay and 1.6 BCFD from the Delta. The system from the Delta to the 60th parallel would be capable of handling an ultimate feed of 2.4 BCFD when fully powered.

The system as presented by FPL, is detailed in Tables 1 - 2 and 1 - 3. Prudhoe Bay gas would be transported by a 42" pipeline parallel to the Alyeska pipeline system to Delta Junction. There it would leave the Alyeska route and parallel the Alcan highway, following the Haines Pipeline Corridor, to the U.S./Canada border. The 42" line would continue to parallel the highway from the border to Fort Nelson, B.C., where it would feed 31% of the gas into expanded Westcoast Transmission Company Limited (Westcoast) facilities for transport to Sumas. The remainder of the gas (69%) would be carried via a 36" line from Fort Nelson to Zama Lake, where it would feed expanded Alberta Gas Trunk Line Limited (AGTL) facilities for transport to Empress.

The Mackenzie Delta gas would be transported by the proposed FPL 42" system from the Delta to the 60th parallel, where it would feed the AGTL (Canada) system. AGTL (Canada) would transport the gas to the Zama Lake/AGTL connection, where it would feed the AGTL system, and an exchange would take place with the Prudhoe Bay system gas (see Table 1 - 1).

TABLE 1-1.—FAIRBANKS CORRIDOR GAS BALANCE

Description	In-service Jan. 1, 1981		In-serivce Jan. 1, 1982		In-service Jan. 1, 1983			In-service Jan. 1, 1984			In-service Jan. 1, 1985		
	Prudhoe Gas, million cubic feet per day at 1,145 Btu	Billion Btu per day	Prudhoe Gas, million cubic feet per day at 1,145 Btu	Billion Btu per day	Delta Gas million cubic feet per day at 1,043 Btu	Purdhoe Gas, million cubic feet per day at 1,145 Btu	Billion Btu per day	Delta Gas million cubic feet per day at 1,043 Btu	Prudhoe Gas, million cubic feet per day at 1,145 Btu	Billion Btu per day	Delta Gas million cubic feet per day at 1,043 Btu	Prudhoe Gas, million cubic feet per day at 1,145 Btu	Billion Btu per day
Prudhoe Bay-Alaska/Yukon Border:													
Receipt	1,000.0	1,145,000	1,500.0	1,717,500		2,000.0	2,290,000		2,400.0	2,748,000		2,400.0	2,748,000
Fuel	11.3	12,938	23.0	26,335		44.5	50,952		79.6	91,142		79.6	91,142
Delivery	988.7	1,132,062	1,477.0	1,691,165		1,955.5	2,239,048		2,320.4	2,656,858		2,320.4	2,656.858
Alaska/Yukon Border-Fort Nelson:													
Receipt	988.7	1,132,062	1,477.0	1,691,165			2,239,048		2,320.4	2,656,858		2,320.4	2,656,858
Fuel	8.1	9,275	19.4	22,213		45.6	52,212		80.2	91,829		80.2	91,829
Delivery	980.6	1,122,787	1,457.6	1,668,952		1,909.9	2,186,836		2,240.2	2,565,029		2,240.2	2,565,029
Split at Fort Nelson:													
31 percent to West Coast Transmission	304.0	348,080	451.9	517,426		592.1	677,955		694.5	795,202		694.5	795,202
69 percent to Alberta Gas Trunk Line	676.6	774,707	1,005.7	1,151,526		1,317.8	1,508,881		1,545.7	1,769,827		1,545.7	1,769,827
Fort Nelson-Zama Lake:													
Receipt of Prudhoe Gas	676.6	774,707	1,005.7	1,151,526		1,317.8	1,508,881		1,545.7	1,769,827		1,545.7	1,769,827
Less exchange to West Coast Transmission						198.6	227,374		255.1	292,040		327.9	375,480
Fuel			4.8	5,496		4.7	5,381		8.0	9,160		[1]6.6	7,557
Delivery	676.6	774,707	1,000.9	1,146,031		1,114.5	1,276,126		1,282.6	1,468,627		1,211.2	1,386,790
Richards Island-60th parallel:													
Receipt					800.0		834,400	1,200.0		1,251,600	1,600.0		1,668,800
Gas to communities								7.5		7,823	9.9		10,326
Fuel					4.7		4,902	10.8		11,264	26.8		27,952
Delivery					795.3		829,498	1,181.7		1,232,513	1,563.3		1,630,522
60th parellel-Zama Lake:													
Receipt					795.3		829,498	1,181.7		1,232,513	1,563.3		1,630,522
Fuel					[1]1.0		1,043	[1]3.0		3,129	[1]2.0		2,086
Delivery					794.3		828,455	1,178.7		1,229,384	1,561.3		1,628,436
Zama Lake-Empress:													
Receipt	676.6	774,707	1,000.9	1,146,031	794.3	1,114.5	2,104,581	1,178.7	1,282.6	2,698,011	1,561.3	1,211.2	3,015,226
Less exchange to West Coast Transmission					218.0		227,374	280.0		292,040	360.0		375,480
Exchange given to Prudhoe gas						198.6	227,374		255.1	292,040		327.9	375,480
Fuel	[1]27.1	31,029	[1]40.0	45,800	[1]23.1	[1]52.5	84,206	[1]35.9	[1]61.5	107,861	[1]48.1	[1]61.6	120,700
Delivery	649.5	743,678	960.9	1,100,231	553.2	1,260.6	2,020,375	862.8	1,476.2	2,590,150	1,153.2	1,477.5	2,894,526
Fort Nelson-Sumas (West Coast Transmission):													
Receipt	304.0	348,080	451.9	517,426	218.0	592.1	905,329	280.0	694.5	1,087,242	360.0	694.5	1,170,862
Fuel													
Delivery													

[1] Estimated.

TABLE 1-2.—FAIRBANKS CORRIDOR PIPELINE SYSTEM—FACILITIES SUMMARY FOR PRUDHOE BAY NATURAL GAS

Section	Ultimate volume (million cubic feet per day)	In service month/year	Distance (miles)	Diameter (inches)	Wall thickness (inches)	Number of station	Horsepower for compression	Horsepower for chilling
Alaska: Prudhoe Bay to Alaska/Yukon border.	2,400	January 1981	730	42	0.540	14	371,000	210,000
Yukon and British Columbia: Alaska/Yukon border to Fort Nelson.	2,320	do	792	42	.540	17	461,300	75,000
British Columbia and Alberta: Fort Nelson to Zama.	1,545	do	144	36	.450	2	53,000	----------
Westcoast—looping on an existing system through to Sumas, Wash.	695	do	[1] 770	36	.375	(2)	----------	(2)
Alberta Gas Truck Line—looping on an existing system through to Empress, Alberta.	1,545	do	[1] 780	42	.375	(2)	----------	(2)

[1] Total distance of transportation, not miles of actual loop installed.
[2] Not available—these numbers could not be abstracted from the information received by GIEC.

TABLE 1-3.—FAIRBANKS CORRIDOR PIPELINE SYSTEM—FACILITIES SUMMARY FOR PRUDHOE BAY NATURAL GAS

Section	Ultimate volume (million cubic feet per day)	In service month/year	Distance (miles)	Diameter (inches)	Wall thickness (inches)	Number of station	Horsepower for compression	Horsepower for chilling
Foothills—Mackenzie Delta area to 60° N.	[1] 1,600	January 1983	817	42	0.540	8	212,000	120,000
Alberta Gas Truck Line (Canada)—60° N to Zama, Alberta.	1,560	do	81	42	.469	1	30,000	----------
British Columbia and Alberta—Fort Nelson to Zama.	360	do	144	36	.450	2	53,000	----------
Westcoast—looping on an existing system through to Sumas, Wash.	360	do	[2] 770	36	.375	na	----------	na
Alberta Gas Truck Line—looping on an existing system through to Empress, Alberta.	1,200	do	[2] 780	42	.375	na	----------	na

[1] Ultimate volume as at Jan. 1, 1985. Facilities can be expanded to maximum of 2,400 million ft.^{3}/day.
[2] Total distance of transportation, not miles of actual loop installed.

2.0 SUMMARY

Examination of the Fairbanks Corridor Route concept as presented by Foothills Pipe Lines Ltd. indicates that the proposed system is entirely feasible from a construction standpoint. Some of the positive aspects relating to the proposed route include the following:

(a) The pipeline route parallels existing all-weather roads; i.e., the Alaskan highway from Delta Junction to Prudhoe Bay and the Alcan Highway from Fairbanks to Fort Nelson.

(b) A sophisticated communications system exists along the entire route.

(c) The existing Alyeska pipeline work pad could be utilized (subject to negotiations with the owner).

(d) An existing products pipeline right-of-way can be utilized from Haines Junction to the junction with the Alyeska pipeline near Delta Junction, a distance of approximately 400 miles.

(e) Existing construction facilities along the Alyeska pipeline (camps, air strips, etc.) can be utilized (subject to negotiations with the owner).

(f) Construction experience exists along the Fairbanks Corridor Route which could allow competitive bidding. This should have the effect of reducing and controlling construction costs.

(g) Alaskan and sub-arctic construction techniques along the proposed route have been developed and this information can be used in determining engineering design, realistic costs, and construction requirements along the proposed pipeline route.

(h) Construction equipment along the Alyeska pipeline is in place and available for use (subject to negotiations with the owner).

(i) Minimum amount of construction required on the coastal plain of the Beaufort Sea.

(j) Use of the Alyeska pad from Prudhoe Bay to Delta Junction would allow pipeline construction to be scheduled over a nine-month period from March 1 to December 1.

(k) Pipelining along most of the route from Delta Junction to Fort Nelson would be conventional summer construction, thus eliminating many of the uncertainties in arctic pipeline cost estimating.

(l) Use of excess capacity coupled with an incremental looping program in the existing Alberta Gas Trunk Line System and Westcoast Transmission System should yield the lowest delivered energy cost.

The overall effect of the above features of the subject route and system is that cost estimates and construction schedules can be developed with a high degree of confidence as compared to a system that follows a route that does not enjoy the same advantages.

The cost of the total system is given in Table 2–1, and totals are shown below:

	1975 cost	Escalated cost
Prudhoe Bay gas system costs	$4,650,349,000	$6,151,943,000
Delta gas system costs	2,185,714,000	3,157,043,000
Total	6,836,063,000	9,308,986,000

The above costs include an estimate of the impact of the cost escalations and problems encountered by the Alyeska project. In the opinion of ESEL/GIEC, submissions by CAGPL and El Paso have not fully recognized these problems. Our estimates, therefore, do not provide a good comparison with the estimates of other systems. To obtain a common-basis comparison of cost estimates, CAGPL and El Paso estimates should be increased substantially. The Prudhoe Bay system estimates includes the Fort Nelson-Zama Lake interconnection costs, but credit would probably be received in terms of tariff charges to FPL as part of a Zama Lake exchange agreement. Costs of the expanded AGTL and Westcoast systems have been allocated in terms of the volume throughputs of the two sources.

A cost of service calculation, in terms of 1975 dollars, has been developed for the Fairbanks Corridor concept.

Transportation costs have been developed on the basis that the existing Westcoast Transmission system, Alberta Gas Trunk Line system, and the connecting link between Fort Nelson and Zama are "shared" facilities. It does not represent the rates which would be applicable if only the Prudhoe Bay gas were transported, or if only the Mackenzie Delta gas were transported. The transportation costs indicate roughly the prorated (by volume) costs and corresponding rates that can be attributed to either major gas source area. Calculations are included in Appendix "B", and the transportation costs are summarized below:

	Transportation cost (dollars per million Btu)
Prudhoe Bay Gas (1984 volumes):	
(a) Delivered to Sumas	1.00
(b) Delivered to Empress	1.05

TABLE 2-1.—FAIRBANKS CORRIDOR PIPELINE SYSTEM—CAPITAL COST ESTIMATE—SUMMARY

	1975 costs	Escalated costs (in thousands of dollars) 1978	1979	1980	1981	1982	1983	1984	Total
Alaska section—Prudhoe Bay gas	$2,265,698	$635,085	$1,209,398	$784,998	$224,785	$76,612			$2,930,878
Alaska/Yukon Border to Fort Nelson—Prudhoe Bay gas	1,450,770	346,804	748,288	489,403	208,272	100,711	$4,080		1,897,558
Existing systems expansion Prudhoe Bay gas	933,881		112,370	542,153	223,915	206,333	194,073	$44,663	1,323,507
Total cost for Prudhoe Bay Gas	4,650,349	981,889	2,070,056	1,816,554	656,972	383,656	198,153	44,663	6,151,943
Total cost for Mackenzie Delta gas	2,185,714		97,900	621,700	977,505	1,080,753	267,008	112,177	3,157,043
Total cost for Fairbanks Corridor	6,836,063	981,889	2,167,956	2,438,254	1,634,477	1,464,409	465,161	156,840	9,308,986

3.0 ALASKA SECTION

3.1 System Facilities

The Alaska portion of the system would consist of 730 miles of pipeline crossing the State of Alaska from Prudhoe Bay to the Alaska/Yukon border. The route of the proposed pipeline parallels that of the Alyeska system as far as Delta Junction. From Delta Junction to the border, the pipeline parallels the Alcan highway and utilizes an existing pipeline right-of-way.

System inputs over the buildup years would be as follows:

	Input million cubic feet per day at 1,145 Btu
January 1, 1981	1,000
January 1, 1982	1,500
January 1, 1983	2,000
January 1, 1984	2,400

The pipe considered was 42" OD x 0.540" wall, Grade 70, with a low-temperature specification. Maximum operating pressure would be 1250 psi, and the system at 2,400 MMCFD would require 14 compressor stations of 26,500 hp each, with additional refrigeration horsepower required at all stations.

3.2 Construction Program

The construction of the pipeline system required for the initial gas flow will take three years from the date of permit receipt, the first year being devoted to equipment and material move-in. The construction of additional compressor stations will follow, as field deliverability increases to require additional capacity.

The successful and economic construction of a pipeline system in Alaska, as in any frontier region, is subject to a number of concerns. These include logistics and construction support problems, labor scarcity and cost, weather hazards, and, in the case of arctic pipeline construction, design and construction problems associated with a fragile environment and permafrost. The route for the Fairbanks Corridor System which parallels the Alyeska system to Delta Junction and then follows the Alcan Highway to the border, has a number of positive aspects relating to construction, including:

(a) The presence of existing all-weather roads adjacent to the proposed route provide year-round access.

(b) A sophisticated communication system exists along the route.

(c) Existing camps, air strips, etc., on that portion of the line between Prudhoe Bay and Delta Junction (subject to negotiations with owner).

(d) An existing pipeline right-of-way from Delta Junction to Haines Junction (Yukon) can be utilized.

(e) Construction equipment along the Alyeska right-of-way is available for use (subject to negotiations with owner).

(f) Geotechnical data and environmental data from Prudhoe Bay to Delta Junction is available.

(g) Archeological sites from Prudhoe Bay to Delta Junction have been located.

(h) The existing Yukon River Bridge was designed to support a second pipeline.

The presence of the facilities and equipment required for the Alyeska project must be a major determinant in the selection of a pipeline system for Prudhoe Bay gas. A major part of the cost of the Alyeska project is in coordinating and providing civil works and logistics required for pipeline and station construction. In their examination of the Fairbanks Corridor concept, FPL have assumed that camps, equipment, and stockpile sites required for Alyeska could be utilized for the gas line. They have also formulated their construction concept on the use of the Alyeska pad for pipeline construction. The use of this pad offers many advantages in terms of construction costs. The chief advantage lies in the scheduling of pipeline construction; construction can be accomplished from March 1 to December 1, a period of nine months.

Previous construction programs proposed by El Paso and CAGPL assumed that the pipeline construction would take place during the winter months. These construction programs have a number of problems associated with them, including the following:

(a) Equipment—merely keeping equipment running during the winter months of an arctic construction project can be a major problem. At -50°F, machines must be kept running 24 hours per day, fuel requirements are immense, oil no longer flows, batteries freeze up, metal becomes brittle, plastic cannot flex, and the results of these problems are reflected in decreased productivity and increased costs.

(b) Labor—productivity of labor during the winter months of northern Alaska or Canada is generally much lower than in the summer months.

(c) In northern latitudes there is no daylight in late December and early January. Construction in darkness during -50°F weather could be unsafe and impractical. The right-of-way would have to be lighted, which would be impractical for a pipeline construction spread. Pipeline construction is a sequential series of operations, and to maintain the required production rates for economical installation, crews must be properly spaced to allow for variations in crew productivity.

(d) Pipeline workers have traditionally taken several weeks off during the winter over the Christmas season. It would be very difficult to schedule effective construction during this period.

(e) Winter construction requires the use of snow roads for equipment movement and ditching operations. The capability of providing snow roads on the schedule required for pipeline construction is uncertain. Any failure to provide the required snow roads would be reflected by a decrease in spread productivity and an increase in construction cost.

Decrease in construction productivity can have far-reaching consequences apart from the obvious increase in costs. Failure to achieve the required production in a season could delay the pipeline project for a year or more.

Use of the existing facilities associated with the Alyeska project removes a number of uncertainties which have become a major consideration in arctic pipeline construction. Logistics are simplified, a large part of the civil works requirements for a frontier construction project are unnecessary, and costs become more predictable. The use of the existing pad and summer construction make the project more manageable, and scheduling more certain.

The construction of the Alaska portion of the Fairbanks Corridor System has been assessed on the following basis:

Use of the existing Alyeska facilities (i.e., camps, construction pad, Yukon River Bridge, access roads) along the Alyeska corridor for 540 miles to Delta Junction.

(b) Use of the Alcan Highway for right-of-way access, and the abandoned Haines line right-of-way for construction from Delta Junction to the Alaska/Yukon border (190 miles). It has been assumed that there would be no requirement for a gravel pad on this portion of the system.

Construction of the Alaska portion of the Fairbanks Corridor System would require six construction spreads working 137 days through the summer seasons for two seasons. The production requirements have been allocated over an assumed 745 miles (730 miles + 2% terrain and wastage) as follows:

Spread	Maximum pressure[1]	Miles	Average production (feet per day)	Season
1	0-110	110	2,100	May 15 to September 30.
2	110-225	110	2,200	Do.
3	225-345	120	2,300	Do.
4	345-467	122	2,350	Do.
5	467-600	133	2,550	June 1 to October 15.
6	600-745	145	2,800	Do.
	Average production 2,400.			

[1] 0.0 is at Prudhoe Bay and 745 is at the Alaska/Yukon border.

The daily spread production has been based upon visual inspection of the pipeline route, discussions with Gulf Interstate personnel familiar with the Alyeska project, and with Foothills Pipe Lines Ltd. construction people.

Pipeline construction has been scheduled for summer work. Clearing and grading operations would be scheduled for early spring through to late fall ahead of the mainline operations. Road and pad maintenance would be a year-round construction requirement.

The section from Delta Junction to the Alaska/Yukon border would be, for the most part, conventional summer construction. It was assumed that no pad would be required. Muskeg in this section would be scheduled for late winter installation.

The Atigun Pass and major river crossings along the route would be constructed with crews separate from mainline pipeline operations.

3.3 Cost Estimates

Most of the costs developed for the Alaska portion of the Fairbanks Corridor system have been based upon 1975 costs submitted to the Federal Power Commission by El Paso Alaska Company during direct testimony, November 7, 1975. An independent analysis of pipeline construction costs has been performed by Marine Pipeline Construction of Canada Ltd., based upon previous estimates made in regard to arctic pipelining. Pipe prices used by El Paso were confirmed by suppliers.

Due to a time constraint, no significant original work could be attempted on the cost estimates. Costs were necessarily factored from filed information, or from existing in-house data related to other projects. The basic approach to the estimate for the Alaska portion of the system has been to modify the El Paso costs (with the exception of pipeline construction costs), using engineering judgment and factors based on differences between the two systems. The El Paso system would be a 42″ pipeline operating at 1680 psi, with a pipe wall thickness of 0.750 inches. The system includes 12 stations, 11 refrigerated, with two 23,400 hp compressor units at each station. Adjustments were made for refrigeration and compression horsepower, number of stations, tons of steel, line length, etc.

Total pipe tonnage for the El Paso system would be in the order of 730,000 tons, with a unit cost of approximately $775 per ton landed at Anchorage. Pipe for the Alaska portion of the proposed Fairbanks Corridor system would total approximately 485,000 tons, due to the lighter wall thickness (0.540 wall) and the shorter length of the system.

Particular emphasis has been placed upon the cost of pipeline construction, due to the escalation of costs experienced by the Alyeska project. The methodology used to arrive at spread costs was to convert the cost components of a typical northern Canada summer construction spread (i.e. labor, materials, fuel, equipment costs) to a per foot basis, and then apply the appropriate factors for differences in production and wage rates, etc., to establish representative estimated basic costs. To this total were added unit costs to allow for problems peculiar to the Alaska terrain and environmental restrictions.

Estimates have been developed in terms of 1975 dollars, and escalated to the year of installation or equipment purchase. Escalation factors used have been taken from the Foothills NEB filing, and are summarized below:

Composite escalation rates	Percentage change from prior year		
	1976	1977	1978
Pipeline materials	6.5	5.9	5.0
Pipeline installation	8.0	7.2	6.4
Land, freight, communications	7.5	5.2	4.8
Compressor and meter station materials	6.5	5.6	4.9
Compressor and meter station installation	9.2	8.2	7.2
Operations and maintenance facilities materials	7.5	5.6	5.2
Operations and maintenance facilities installation	9.2	8.2	7.2
Operations and maintenance and support facilities equipment	6.4	5.0	4.5
Support facilities construction	8.5	7.4	6.6
Project average	7.2	6.1	5.4

The foregoing composite escalation rates have been derived from estimated escalation rates for particular categories, i.e. line pipe, construction wages and salaries, construction machinery and equipment, etc. It has been assumed that the high level of inflation has peaked and will approach historical rates in succeeding years to 1978, then will remain constant.

Estimates include a 5% contingency, and an allowance for the cost of funds required during construction (AFC), at an annual rate of 12½%.

A summary of the system capital costs is given in Table 3–1. Total system costs are given below:

1975 cost	$2,265,698,000
Escalated cost	2,930,878,000

There are many uncertainties involved in predicting construction costs in Alaska at this time, due to the lack of detailed analyses of the Alyeska cost escalations, and an assessment of how these costs will impact future pipeline construction. The estimates developed during this study are based upon the knowledge of Gulf Interstate personnel with experience in Alaskan construction, and upon the assessment of Marine Pipeline Construction of Canada, of the cost of the special construction required to overcome these problem areas. The costs, in the opinion of ESEL/GIEC, reflect the best estimate available at this time, utilizing the construction concept of summer work on the existing pad, and including an allowance for a number of general concerns. These concerns include the following:

TABLE 3–1.—FAIRBANKS CORRIDOR PIPELINE SYSTEM—CAPITAL COST ESTIMATE—ALASKA SECTION

730 Miles—42 Inch—0.540"—Foothills Design Basis—14 Stations, Format and Categories Modified After El Paso Filing

	1975	Escalated costs (in thousands)					
	costs	1978	1979	1980	1981	1982	Total
Land and land rights	$184	$218					$218
Rights-of-way	4,249	5,035					5,035
Structures and improvements	52,567		$20,193	$15,587	$39,557		75,327
Pipeline:							
Materials	489,655	289,876	304,320				594,196
Installation	786,720	193,848	515,695	329,242			1,038,785
Stations:							
Materials	184,282		66,161	50,231	125,496		241,888
Installation	72,380			30,561	23,727	$60,546	114,834
Measuring stations	5,339			7,111			7,111
Communications	8,900		5,527	5,794			11,321
General plant	11,996	1,007	8,643	5,752			15,402
Sales tax	650	385	404				789
Total direct job costs	1,616,922	490,369	920,933	444,278	188,780	60,546	2,104,906
Engineering and construction	64,431	14,539	38,677	26,985	1,780	4,541	86,522
Temporary facilities	23,200	27,817					27,817
Services and supplies							
Field staff	8,560	2,636	4,937	2,388	1,017	406	11,384
Field overhead	12,126	3,678	6,907	3,332	1,416	454	15,787
Total indirect job costs	108,317	48,670	50,521	32,705	4,213	5,401	141,510
Engineering supervision							
Home office services							
Purchasing and expediting	48,509	14,711	27,628	13,328	5,663	1,816	63,146
Overhead							
Total office costs	48,509	14,711	27,628	13,328	5,663	1,816	63,146
Contract project management fee	24,254	7,356	13,814	6,664	2,832	908	31,574
Intangible Plant	8,158	8,158					8,158
Subtotal, Direct plus Indirect plus office	1,806,160	569,264	1,012,896	496,975	201,488	68,671	2,349,294
Contingency at 5 pct	90,308	28,463	50,645	24,849	10,074	3,434	117,465
AFC	369,230	37,358	145,857	263,174	13,223	4,507	464,119
Total	2,265,698	635,085	1,209,398	784,998	224,785	76,612	2,930,878

(a) A large amount of civil work is required for haul road repair and pad maintenance; i.e., for low water crossings, pad composition, 24-hour winter haul road maintenance in the Atigun Pass, and 18 to 24-hour washing down of the haul road during summer months for dust control (common also to the Alaskan highway through the Yukon and northern B.C.).

(b) A number of non-standard construction items encountered by Alyeska may carry over into future pipeline construction. These include deep ditches in the flood plains area, elaborate spur-dike construction, and a very expensive revegetation program.

(c) Extra construction costs which have been allowed for in most arctic pipeline estimates include:

The failure of "arctic ditchers" to perform to expectations, necessitating blasting for excavation in permafrost areas.

Much of the material being excavated has a tendency to pull like rock; as a result, instead of a standard ditch, a rock-type ditch is obtained.

Equipment repair costs are escalated considerably in frontier areas.

Most of the ditch excavated cannot be dewatered economically, and a large number of concrete weights are required.

Pipe coating over the ditch is very expensive in the winter due to the necessity of heating the inside and outside of the pipe to get a good bond.

Since ditch cannot be dug with conventional ditch machines, spoil is rough, and select fill material is being used to prevent damage to the pipe coating.

Final clean-up is a very costly operation, because the spoil is too wet to work in the summer, and in the winter it is frozen and cannot be moved.

Due to environmental restrictions, stream crossings can be made only at certain times of the year, thus interrupting the normal sequence of construction operations.

(d) Numerous labor problems have been encountered on the Alyeska project which could be encountered by future pipeline projects. On the average, these problems have occurred more frequently than on past projects. They include:

A climate which appears to have a marked effect on the productivity of men and equipment, and on the labor rates expected by the unions.

The inability to get the ditch required for overall spread production has significantly increased the number of people per spread, and has resulted in a corresponding increase in support staff.

Labor relations can have a considerable impact on productivity and labor rates. Because pipeline construction is a sequential operation, overall productivity is drastically affected by the failure of any one crew to obtain the required production.

(e) Unexpected environmental restrictions have caused problems for contractors. There is more than one environmental inspection team per spread, and each has a different area of responsibility. A system of checks and balances appears to be necessary to ensure that contractors are not totally subject to the interpretation of the guidelines by an individual inspector.

(f) On any large construction project, contractor cost control is very important. Contractors must be motivated on future arctic pipeline projects to assume cost responsibility, as it is unlikely any project management organization can keep costs down without definite economic incentive for the contractor groups.

The differences between previous trans-Alaska pipeline estimates and the ESEL/GIEC estimate are chiefly in the following areas:

(a) A contingency allowance has been included for modifying the existing Alyeska construction facilities where necessary to provide for the installation of the additional line. These costs are difficult to define at this time, and may change considerably in future estimates. Substantial savings in construction costs will result if no modifications are required.

(b) River crossings and associated environmental restraints and construction requirements make this a major cost item. Costs included in the ESEL/GIEC estimate include 45 million dollars for river crossings.

(c) Costs have been included for the fabrication and installation of 100,000 concrete weights (30% of the line).

(d) Costs for select fill have been included in the estimates in permafrost and rock areas.

(e) An allowance has been included for pad maintenance and haul road maintenance.

(f) Costs have been included for drilling and blasting permafrost (30% permafrost assumed).

(g) An important cost difference is caused by a spread production of 2,400 feet per day, a result of the problems itemized previously.

Further examination of the costs of the Alyeska project may reveal that costs will be lowered through knowledge of arctic construction gained on the

Alyeska project. The scale of operations of a 48″ hot oil line requiring above-ground construction, and a 42″ gas line are significantly different.

The 42″ project would be much more manageable, and the learning-curve effect on costs could be considerable. The use of berm techniques, rather than attempting to make ditch, could increase production considerably.

It should be noted that the impact of the problems encountered in the Alyeska pipeline construction has not, in our opinion, been fully considered by Alaskan Arctic Gas or by El Paso submissions. To obtain a common-basis comparison with these systems would require a substantial increase in their cost estimate. There are many unknowns and many opinions generated in cost estimating in Alaska at this time, and these costs are worthy of a detailed examination in the near future.

4.0 ALASKA/YUKON BORDER TO FORT NELSON

4.1 System Facilities

The system from the border to Fort Nelson would consist of 792 miles of pipe adjacent to the Alcan Highway. The system would receive the deliveries of the Alaska portion of the Fairbanks system, recounted below:

	Input million cubic feet per day at 1,145 Btu
January 1, 1981	988.7
January 1, 1982	1,477.0
January 1, 1983	1,955.5
January 1, 1984	2,320.4

The pipeline would consist of 42″ O.D., 0.540″ wall, Grade 70 pipe with a low-temperature specification. Maximum operating pressure would be 1250 psi, and the system would require 17 compressor stations, at ultimate flow, described below:

HP

MP—20—26,500, chilled.
MP—72—26,500, chilled.
MP—122—26,500, chilled.
MP—173—26,500, chilled.
MP—233—26,500, chilled.
MP—283—26,500.
MP—328—26,500.
MP—375—26,500.
MP—413—26,500.
MP—451—26,500, aerial cooler.
MP—491—26,500, aerial cooler.
MP—533—26,500, aerial cooler.
MP—572—26,500, aerial cooler.
MP—617—29,200, aerial cooler.
MP—667—29,200, aerial cooler.
MP—715—29,200, aerial cooler.
MP—767—29,200, aerial cooler.

Note 1: 00 is at Alaska/Yukon border 792 is at Fort Nelson, B.C.

As is in the Alaska section, construction of the pipeline system required for the initial gas flows would take three years, the first year of which would be devoted to civil work construction and equipment and material move-in. The construction of additional compressor stations will follow as field deliverability increases to require additional capacity.

The pipeline route of this section of the system would be adjacent to the Alcan Highway, simplifying logistics and construction. Pipe would be moved into stockpile sites in the winter, and construction would, for the most part, be conventional summer construction. The route lies in the southern fringes of the discontinuous permafrost zone, and permafrost is not expected to be a major problem. Pipeline through muskeg areas (the major part on the Fort Nelson end) would be laid using conventional winter construction techniques.

Construction of the system would require three construction spreads working over a two year period. The proposed construction scheme would break the system into 9 sections. These are described as follows:

Section 1—MP 00 to MP 50=50 miles, winter construction.
Section 2—MP 50 to MP 168=118 miles, summer construction.

Section 3—MP 168 to MP 286=118 miles, summer construction.
Section 4—MP 286 to MP 404=118 miles, summer construction.
Section 5—MP 404 to MP 522=118 miles, summer construction.
Section 6—MP 522 to MP 642=120 miles, summer construction.
Section 7—MP 642 to MP 692=50 miles, summer construction (mountainous).
Section 8—MP 692 to MP 742=50 miles, winter construction.
Section 9—MP 742 to MP 792=50 miles, winter construction.

The spreads would be assigned to these segments as described below:

Spread "A"—286 miles

Commences February 1, 1979 on Section 1; complete April 30, 1979.
Continue to Section 2 June 1, 1979; complete October 15, 1979.
Commence Section 3 June 1, 1980; complete October 15, 1980.

Spread "B"—218 miles

Commence January 15, 1979 on Section 8; complete April 15, 1979.
Continue to Section 7 June 1, 1979; complete October 15, 1979.
Commence Section 6 June 1, 1980; complete October 15, 1980.

Spread "C"—288 miles

Commence January 15, 1979 on Section 9; complete April 15, 1979.
Continue to Section 5 June 1, 1979; completed October 15, 1979.
Commence Section 4 June 1, 1980; complete October 15, 1980.

The following section describes the production rates and general assumptions behind these rates:

PRODUCTION RATES & GENERAL BREAKDOWN

Spread "A"

Section 1.—Set up for an average production rate of 4200 feet per day or 65 (65′ av.) jts/day. This is to be constructed during the winter of 1979 because of the amount of muskeg areas to be encountered.

Section 2.—Set up for an average production rate of 5000 feet per day or 77 (65′ av.) jts/day. Clearing is to be done during the winter of 1979, and allowance has been made for extra supervision, camp, etc. Balance of construction operations are to be carried out during the summer of 1979.

Section 3.—Set up for an average production rate of 5000 feet per day or 77 (65′ av.) jts/day. Clearing is to be done during the winter of 1980 and allowance has been made for extra supervision, camp, etc. Balance of construction operations are to be carried out during the summer of 1980.

Spread "B"

Section 8.—Same rates and scheduling as Section 1 of Spread "A".

Section 7.— Set up for an average production rate of 2720 feet per day or 42 (65′ av.) jts/day. This section is approximately 25% rock ditch. Main reasons for low production are rock ditch, grade and limited access. Clearing on this section is to be done during the winter of 1979.

Section 6.—Same rates and scheduling as Section 3 of Spread "A".

Spread "C"

Section 9.—Same rates and scheduling as Section 1 of Spread "A".

Section 5.—Same rates and scheduling as Section 2 of Spread "A".

Section 4.—Same rates and scheduling as Section 3 of Spread "A".

Production rates given above are those required as an average over the total work period. Crews were sized to achieve higher production rates to allow for 25% loss of production.

The pipeline construction rates are based upon visual inspection of the route, and on the construction experience of Marine Pipeline Construction of Canada Ltd. Pipeline construction in the Fort Nelson area has been successfully and economically completed in the past, and the Fort Nelson area is served by both rail and highway. Canadian experience in muskeg pipeline construction is considerable, and this would present no new problems. The construction of a 792 mile 42″ line over a two-year period is well within the capabilities of Canadian contractors, and it is anticipated that bidding for this project could be put on a competitive basis, and a high degree of contractor cost responsibility could be established.

4.3 Cost Estimate

Cost estimates have been based upon the filed costs for the Foothills Pipe Line Ltd. system, and upon FPL working papers for the Fairbanks Corridor system. The basic approach to the estimate of the Alaska portion of the system has been followed in the estimates of this portion of the system; i.e., FPL system costs have been adjusted for differences in the two systems, an independent analysis has been made of construction costs, and pipe prices have been checked through contact with suppliers.

There are many similarities between the proposed Foothills system and the Fairbanks Corridor system, since the same design approach has been used for both systems; i.e., same pipe diameter, wall thickness, similar lengths, same number of stations of similar size, etc. The chief differences in the cost of facilities are in the reduced requirements for support facilities; i.e., general civil works, and in pipeline construction costs.

Construction cost estimates have been obtained by adjusting the costs of a typical arctic pipeline summer spread for the construction concepts and production rates described previously. Direct construction cost estimates for the nine sections of the line were as follows:

	1975 costs
Section 1, 50 miles—$72.07/ft =	$ 19,027,000
Section 2, 118 miles—50.36/ft =	31,375,000
Section 3, 118 miles—50.36/ft =	31,375,000
Section 4, 118 miles—50.36/ft =	31,375,000
Section 5, 118 miles—50.36/ft	31,375,000
Section 6, 120 miles—50.36/ft =	31,929,000
Section 7, 50 miles—86.00/ft =	22,704,000
Section 8, 50 miles—74.07/ft =	19,555,000
Section 9, 50 miles—72.07/ft =	19,027,000
Total, 792 miles=4,182,000 ft =	237,742,000

The above costs include move-in and move-out, mobilize and demobilize, supervision and field office, service and equipment repair, all normal main line operations including testing, rip-rap allowance, camp and catering costs, clothing and incentive pay, an allowance for 10% permafrost blasting, and a 5% contingency.

The following costs not included in the spread breakdown were added to the above spread costs:

	1975 costs
Supply and haul weights	$33,600,000
Water crossings	30,000,000
Select backfill	7,650,000
Mainline valves	800,000
Compressor station tie-ins	3,240,000
Cathodic protection	594,000
Rock grade	6,390,000
Rock ditch	13,520,000
Total	$95,794,000
Overall cost	$333,536,000

Foothills pipe costs were used in the estimate, but direct system costs (1975 base) could be increased by as much as 70 million dollars by possible changes in the pipe specifications. It is possible, however, that relaxing the low-temperature specifications on the southern half of the system where gas chilling no longer takes place could significantly decrease the total system pipe costs.

Estimates have been developed in terms of 1975 dollars, and escalated to the year of installation or equipment purchase, using the previously recorded escalation factors. Contingency and AFC have been added. A summary of the system capital cost is given in Table 4–1. Total system costs are given below:

1975 cost	$1,450,770,000
Escalated cost	1,897,000,000

A general comment on the cost disparity between construction costs on the Alaska portion of the line and the costs of the system from the Alaska/Yukon border to Fort Nelson is in order. It is possible that the Alyeska project costs will have some impact on costs and construction practices in northern Canada. The wages in Alaska are twice as high as in the Yukon. In addition, production in Alaska has been slowed as a result of problems discussed previously. These differences result in a labor cost ratio from Alaska to the Yukon of approximately 4 to 1. It is possible that the wages on the Canadian side of a common pipeline project would be increased toward the Alaska costs. No allowance has been made for this possibility, as it is very difficult to assess at this time.

TABLE 4-1.—FAIRBANKS CORRIDOR PIPELINE SYSTEM—CAPITAL COST ESTIMATE-ALASKA/YUKON BORDER TO FORT NELSON

792 Miles-42 Inch-0.540"-Foothills Design Basis-17 Stations, Format and Categories Modified After Foothills Pipe Lines Ltd. Filing

	1975 costs	Escalated costs (in thousands)						
		1978	1979	1980	1981	1982	1983	Total
Land	$1,867	339	944	508	518			2,309
Land rights	1,244	632	753	137				1,522
Pipeline materials	321,772	209,536	179,985					389,521
Pipeline installation	351,196	3,647	306,289	159,875				469,811
Compressor station materials	147,098		34,467	51,641	108,240			194,348
Compressor station installation	81,174			22,224	34,682	73,097		130,003
Support facilities	125,000	62,100	50,312	29,652	15,050	6,416	3,420	166,950
Operations and maintenance facilities:								
Material	16,566	6,518	6,857	2,869	4,832			21,076
Installation	8,918		3,991	4,279	1,825	3,130		13,225
Equipment	7,334		4,474	4,675				9,149
Meter stations:								
Material	2,055		2,544					2,544
Installation	4,100			5,970				5,970
Communications and control	13,000	2,370	8,073	5,859				16,302
Subtotal	$1,081,324	285,142	598,689	287,689	165,146	82,643	3,420	1,422,729
Prepermit	10,000	12,000						12,000
Head office and preoperations	30,000	3,600	10,900	18,200	6,600			39,300
Engineering at 4 pct	43,250	11,405	23,948	11,508	6,606	3,306	137	56,910
Contingency at 5 pct	54,060	14,257	29,934	14,384	8,257	4,132	171	71,135
AFC	232,136	20,400	84,817	157,622	21,663	10,630	352	295,484
Total	1,450,770	346,804	748,288	489,403	208,272	100,711	4,080	1,897,558

5.0 EXPANSION OF EXISTING SYSTEMS, AND SYSTEMS REQUIRED FOR MAC KENZIE DELTA GAS

5.1 Expansion of Westcoast Transmission Company, Ltd., and Fort Nelson to Zama Line

The Westcoast Transmission system is the main natural gas transmission system in British Columbia. The system which will be transporting Prudhoe Bay and Delta gas (via exchange) currently transports approximately 1300 MMcfd. The major sources are all in B.C.; however, there is an existing interconnection with the AGTL system.

The existing system has a receipt point at Fort Nelson (point of receipt for arctic gas) and an existing delivery point at Sumas (point of delivery for arctic gas). The facilities required to move arctic gas will consist of looping and installation of additional compression. The total distance from Fort Nelson to Sumas is approximately 770 miles.

The pipeline and compression design and construction is conventional 36" pipelining and will require only a small amount of winter construction in the northern sections.

Unlike the AGTL system, Westcoast has not forecast significant declines in their existing gas sources and as a result there is not a great cost saving associated with the utilization of spare capacity. However the utilization of existing facilities allows the installation of facilities to be incremented and spread over a longer period of time; capacity can be readily added as required.

The additional facilities required for the Westcoast portion of the Prudhoe Bay volumes were determined incrementally by direct comparison of a base case which consisted of Westcoast estimated capital expenditures over the forecast period with no Prudhoe Bay volumes.

The receipt volumes and corresponding loop required for the arctic gas are listed below:

[In million cubic feet per day]

Year	Prudhoe Bay	MacKenzie Delta	Total	Pipeline loop Mile	Inch
1981	304	0	304	163.8	36
1982	452	0	452	143.0	36
1983	592	218	810	247.9	36
1984	695	280	975	78.1	36
1985	695	360	1,055	83.4	36
Total				716.2	36

The cost estimates for the additional facilities were based on 1975 cost of pipe, current vendor quotes for compression and 1973 bid costs (escalated to 1975) for installation.

The total Westcoast estimate was for the installation of 20 separate looping sections. Compression costs were estimated on the basis of three typical installations which cover the three different situations that Westcoast forecast for adding compression.

Escalation factors used by Westcoast in their comparison of costs were much higher (8% per year throughout) than those used by FPL and AGTL. As a result for the purposes of this evaluation, all of Westcoast's costs were converted back to 1975 values and re-escalated by the factors used by FPL and AGTL.

The section of line from Fort Nelson to Zama has been considered as a separate pipeline for the purposes of this evaluation. This link is required for both Prudhoe Bay deliveries to AGTL, and for Mackenzie Delta deliveries to Westcoast; i.e., an exchange will take place at the Zama Lake connection. The line consists of 144 miles of 36'' pipe, with two compressor stations totaling 53,000 hp.

In developing the cost of facilities required for the Prudhoe Bay natural gas, this link was considered as part of the Prudhoe Bay system because the line will be installed for the Prudhoe Bay gas prior to the Delta gas coming on-stream. A credit must therefore be given to the Prudhoe Bay system in the form of a transportation charge when the Delta gas comes on stream.

In actual fact, although this line must be installed in 1981 for the Prudhoe Bay gas, in 1983 when Delta gas comes on stream the flow in this loop will actually be lower than it would have been if the Delta gas did not come on stream. This situation results from the exchange of Delta gas at Zama originally dedicated to flow through the Westcoast system with Prudhoe Bay gas at Fort Neslon.

Westcoast Transmission Company Limited has a great deal of experience in actual design and construction of facilities. Current costs for materials and construction are also readily established by the Westcoast staff resulting from their experience in operation and construction. Therefore we feel that the cost estimates for the Westcoast portion of the Fairbanks Corridor Study as performed by Westcoast are realistic.

5.2 Expansion of the Alberta Gas Trunk Line System

The Alberta Gas Trunk Line system is the main natural gas transmission system in Alberta. The sources of gas for this system are currently all within the Province of Alberta. The AGHL system currently moves an average of approximately 5,000 MMcfd from the Province.

The existing system has a pick-up point at Zama (point of receipt for arctic gas), and has a major delivery point at Empress (point of delivery for arctic gas). The additional facilities required for the Arctic gas will consist mainly of looping and addition of compression.

There will be cost savings resulting from utilizing the existing system as the existing sources deplete and excess capacity becomes available.

Pipeline design and construction of the 42″ and 30″ looping for the Alberta section will be conventional, with only a small amount of winter construction in the northern portion of the Province. The total distance from the Zama connection to Empress following the existing system is 778 miles.

[In million cubic feet per day]

Year	Prudhoe Bay	MacKenzie Delta	Total
1980–81	677	0	677
1981–82	1,001	0	1,001
1982–83	1,313	576	1,889
1983–84	1,537	899	2,436
1984–85	1,539	1,201	2,740

The costs of facilities for the AGTL portion of the proposed Fairbanks Corridor pipeline system were developed by FPL from comparison of cases 3, 4, and 5 from the response to the National Energy Board (NEB) Deficiency Letter No. 8 to Foothills Pipe Lines Ltd.

These three cases contained complete design, facilities, construction schedules, construction costs, etc. for different flowing conditions. The flows proposed for the Fairbanks case fall between either cases 3 & 4 or 3 & 5, depending on the year. The required facilities for the Fairbanks case were arrived at by interpolation between the appropriate cases which have already been developed for the NEB.

The initial on-stream dates and changes in flows are the same for the Fairbanks case as for the cases studied for the NEB.

The Alberta Gas Trunk Line Company Limited has a great deal of experience in actual design and construction of facilities and has current costs for materials and construction. AGTL has a large and competent staff continually developing forecasts, design and optimizing procedures. Therefore we feel that the cost estimates for the AGTL portion of the Fairbanks Corridor Study performed by AGTL are realistic.

5.3 Pro-Rata of Expansion Costs

The cost by the AGTL and Westcoast systems have been allocated to Prudhoe Bay or Delta system costs in quantities proportioned to the volume throughputs as given in Table 1–1. As noted previously, the Fort Nelson to Zama line costs have been included in the costs of the Prudhoe Bay system, although some debit in the form of a transportation charge would undoubtedly be assessed against the Delta gas as part of a Zama Lake exchange agreement.

TABLE 5-2.—FAIRBANKS CORRIDOR PIPELINE SYSTEM—CAPITAL COST ESTIMATE EXISTING SYSTEMS EXPANSION—MACKENZIE DELTA NATURAL GAS

	1975 costs	Escalated costs (in thousands)							
		1978	1979	1980	1981	1982	1983	1984	Total
Fort Nelson to Sumas (westcoast expansion)	$144,395				54,605	127,916	2,808	28,677	214,006
Fort Nelson to Zama									
Zama to Empress	275,956					247,437	128,700	43,000	419,137
Total 4	420,351				54,605	375,353	131,508	71,677	633,143

5.4 Foothills Pipe Lines Ltd. and AGTL (Canada)

The transmission lines required for the Fairbanks Corridor System for MacKenzie Delta gas are virtually identical to the proposed FPL and AGTL (Canada) systems at a flow of 1.6 BCFD. These systems are over-sized from a pipe diameter standpoint, as they would be capable of operations at an ultimate input of 2.4 BCFD when fully powered. Costs for these systems as estimated by FPL and AGTL are given in Table 5–3 along with the total costs of the expanded system for Delta gas.

TABLE 5-3.—FAIRBANKS CORRIDOR PIPELINE SYSTEM—CAPITAL COST ESTIMATE MACKENZIE DELTA NATURAL GAS

		Escalated costs (in thousands)							
	1975 costs	1978	1979	1980	1981	1982	1983	1984	Total
Mackenzie Delta to Alberta Gas Truck Line (Canada)	$1,680,800		97,900	617,400	836,900	675,700	135,500	40,500	2,403,900
Alberta Gas Truck Line Line (Canada) to Zama	84,563			4,300	86,000	29,700			120,000
Zama to Fort Nelson [1]									
Fort Nelson to Sumas (Westcoast Transmission Co., Ltd.)	144,395				54,605	127,916	2,808	28,677	214,006
Zama to Empress (Alberta Gas Truck Line expansion)	275,956					247,437	128,700	43,000	419,137
Total 5	2,185,714		97,900	621,700	977,505	1,080,753	267,008	112,177	3,157,043

[1] Cost of Zama to Fort Nelson section included in cost of Prudhoe Bay Natural Gas.

APPENDIX A.—*Reference Material and Basic Data Sources*

Company	*Title*
Alaskan Arctic Gas Pipeline Co.	Second supplement to application of Alaskan Arctic Gas Pipeline Co. at docket No. CP74–239, Dec. 30, 1974.
	Fourth supplement to application of Alaskan Arctic Gas Pipeline Co. at docket No. CP74–239, Mar. 3, 1975.
The Alberta Gas Trunk Line Co., Ltd.	Submission to the National Energy Board: Part 1, Supply & Requirements; Part 2, Gas Supply and Sales Contracts; Part 3, Facilities; Part 4, Financial; Part 5, Public Interest; all dated May 1975.
	Responses to National Energy Board, Deficiency Letter No. 8, Feb. 1976.
The Alberta Gas Trunk Line (Canada) Limited.	Submission to the National Energy Board: Part 1, Supply & Requirements; Part 2, Gas Supply and Sales Contracts; Part 3, Facilities; Part 4, Financial; Part 5, Public Interest; all dated May 1975.
Brackett, William W., Testimony.	Hearings before the Committee on Commerce and the Committee on Interior and Insular Affairs; U.S. Senate, 94th Congress, Second Session; Mar. 24, 1976.
Canadian Arctic Gas Pipeline Ltd.	Submissions to the National Energy Board, Section 14.e, Alternative Corridors and Systems of Transportation, Mar. 1974.
	Supplement to Applications and Exhibits relative to Alternative Routing for The Alaska Supply Lateral across the Mackenzie Delta; Aug. 15, 1975.
El Paso Alaska Co	Submission to the Federal Power Commission, volume II, Tab Z–1, Engineering and Cost Details, Sept. 24, 1974.
	First supplement to the application, volume 1, Mar. 3, 1975.
	Direct testimony and proposed hearing exhibits, dockets Nos. CP75–96 et al., Nov. 7, 1975.
Foothills Pipe Lines Ltd.	Submission to the National Energy Board: Part 3, Facilities; Part 4, Financial; Part 5, Public Interest; all dated April, 1975.
	Miscellaneous work sheets and notes on FPL's analysis of the Fairbanks Corridor Alternative.

Appendix B

Transportation Cost Calculations

(1975 Dollars)

An engineering cost of service calculation has been performed for each transportation component on the basis of the following formula:

COST OF SERVICE

$$\$/\text{MMBtu} = \frac{\text{Capital factor x (total undepreciated investment including AFC in 1975 dollars)}}{\text{Net energy delivered in MMBtu per year}} + \frac{\text{Annual operating cost in 1975 dollars}}{\text{Net energy delivered in MMBtu per year}}$$

A capital factor of 17.5 per cent has been employed for all components. This value was derived from an economic and financial review of the proposed Foothills Pipe Line. The "net energy delivered" in the above formula is the energy delivered to either the Sumas or Empress delivery points or a total of the two. The use of the ultimate systems delivery as the denominator in the above formula yields a correct overall systems transportation cost, but does not charge an explicit internal tariff for each component of the system. However, because the cost of fuel has been excluded from the operating costs of each system, the "constant volume" cost of service approach must be utilized for total consistency. To obtain a correct internal tariff for each component, it would be necessary to include a fuel cost for each system component which would reflect the cost of service of the upstream components.

The Prudhoe Bay gas transportation cost was based upon the totl 1984 undepreciated investment (in 1975 dollars) as 1984 is the first year of ultimate flow from Prudhoe Bay. The Mackenzie Delta gas transportation cost was based upon the total 1985 undepreciated investment (in 1975 dollars) as 1985 is the last year for this evaluation. However, flows from the Mackenzie Delta are forecast to increase beyond 185. The combined systems cost of service was based upon the total 1985 undepreciated investment (in 1975 dollars) as 1985 had the highest annual volume forecast in this evaluation.

The Operating and Maintenance costs (O & M) were based upon numbers supplied by Foothills Pipe Lines Ltd.

Transportation Cost Calculations

[1975 dollars]

1. Prudhoe Bay Gas:	
1984 total delivered Prudhoe Bay gas:	
Sumas (million Btu)	281, 541, 000
Empress (million Btu)	616, 941, 000
Total (million Btu)	898, 482, 000
(a) Prudhoe Bay to Fort Nelson:	
1975 capital cost, $3,716,468,000×0.175	$650, 381, 900
1975 operations and maintenance	65, 399, 300
Total cost of service	715, 781, 200
(b) Fort Nelson to Sumas:	
1975 capital cost, $264,305,000×0.175	46, 253, 400
1975 operations and maintenance	11, 855, 200
Total cost of service	58, 108, 600
(c) Fort Nelson to Empress:	
1975 capital cost, $669,576,000×0.175	117, 175, 800
1975 operations and maintenance	37, 712, 900
Total cost of service	154, 888, 700

Section	Cost	Volume (in million Btu)	Transportation cost (dollars per million Btu)
(a) Prudhoe Bay to Fort Nelson	$715,781,200	898,482,000	0.80
(b) Fort Nelson to Sumas	58,108,600	281,541,000	.20
(c) Fort Nelson to Empress	154,888,700	616,941,000	.25
Total to Sumas			1.00
Total to Empress			1.05

Environmental Overview Proposed Arctic Gas Pipeline Systems

(Prepared for: Northwest Pipeline Corp.)

(Prepared by: Gulf Interstate Engineering Co.)

INTRODUCTION

The selection of any pipeline route across Alaska and Canada, delivering natural gas to the northwestern United States, must address itself to a variety of criteria which both support and deprecate that selection. A "select route" can only be chosen when alternative routes are considered and the projected resultants of each construction plan have been carefully evaluated and compared. Proponents of any one of the several routes proposed for Trans-Alaska/Canada pipelines can usually select from the available data, those facts which support one proposal; similar data can be employed to denigrate the undesirable alternatives. Regardless of the route proposed, all relevant facts must be considered; those which support one particular route and those which mitigate against that route selection.

The major alternative pipeline routes, thoroughly researched and fully documented, can be easily identified as the Fairbanks Corridor route, much of which is in Alaska, and the Arctic Gas System route which is primarily a Canadian route. The proposed Fairbanks Corridor gas line affords some very unique advantages to the State of Alaska and to the U.S. economy as a whole, while the Arctic Gas System route favors Canada's economy. The committed delivery of gas to Fairbanks and other communities in proximity to the Fairbanks Corridor route has been advocated by the State of Alaska. The tax base and revenues accruing to Alaska from such an Alaskan route can be utilized for important developments now and in the future, as Alaska continues to expand and diversify its economy. The selection of the Fairbanks Corridor route is enhanced by the commitment to utilize American financial institutions, American labor and American capital goods in the development of the gas pipeline from Prudhoe Bay to the Canadian border. From the Canadian border to Ft. Nelson, the route would be essentially supplied by Canadian goods and services.

The proposed Fairbanks Corridor gas pipeline would transport Alaskan gas from Prudhoe Bay, Alaska, to Zama, Alberta, Canada. Thus, from Prudhoe Bay to Delta Junction (AK.) the gas line would parallel and share the corridor of the existing Trans-Alaska Oil Pipeline (Alyeska Line). A second corridor, the Haines products pipeline, would be shared from Delta Junction (AK.) to Haines Junction (Y.T.) The Fairbanks Corridor proposed route then parallels the Alcan Highway from Haines Junction (Y.T.) to Ft. Nelson (B.C.). A new corridor would be established from Ft. Nelson to Zama (Alta), another 140 miles east. The Fairbanks Corridor line would be 1650 miles long, (pg. 12), 954 miles (58%) of which is on existing pipeline corridors. The entire line is served by existing all-weather roads. The proposed pipeline will connect with the Westcoast Transmission System and the Alberta Trunkline system to transport the gas to the lower 48 states.

The Arctic Gas System proposed gas line would transport gas east from Prudhoe Bay (AK.) to Richards Island and Tununuk (N.W.T.). Collecting additional gas from the MacKenzie Delta area, the proposed pipeline would turn south and follow the broad, alluvial MacKenzie River valley to Ft. Simpson (N.W.T.). From Ft. Simpson to Zama (Alberta), the proposed line goes approximately south and east across the Great Slave (lake) plain.

Proceeding south from Zama, the Arctic Gas route generally parallels the existing Alberta Trunkline system to the lower 48 border. This proposed Arctic Gas System line is 2676 miles long (pg. 12); no existing pipeline corridors can be utilized along the first 1251 miles and little of this portion is accessible by all-weather roads.

The Fairbanks Corridor proposal includes utilization of existing capacity with additional facilities south of Zama. Expansion of existing facilities is, comparatively, an environmental advantage to new construction; therefore, we have limited our review to those sections from Prudhoe Bay to Zama.

1A. ENVIRONMENTAL QUALITIES OF FAIRBANKS CORRIDOR LINE

The origin at Prudhoe Bay is an Arctic coastal plain; continuous perma-frost with frequent intrusions of ice (ice lenses). These soils are typically silty, moraines and when the summer heat melts the upper surface (active layer 1.5 - 4'), such soils will not support heavy equipment. Winter activities are expedited by the very hard, dense matrix formed when these silty soils are solidly frozen. Arctic tundra is fragile in both winter and summer. The surface soils support a marginal vegetative cover of plants which are unique in that they exist in very cold, very wet (in summer) and very acidic soils. These plants must grow, mature and reproduce in approximately eight to ten weeks.

The very sensitive tundra ecology, as a whole, is intimately connected to the short growing season, the fragility of the soils and the vegetative cover which furnishes forage to a variety of animals. The fauna of the tundra includes many transient birds and mammals who visit the area for mating and/or feeding. Many predators feast upon the smaller mammals whose population explodes every summer. The luxuriant, but short-lived, summer plant life thus establishes an important food chain; birds, fishes, mammals and even invertebrates thrive during the short summer.

In the winter, the migrants have moved south, only a relatively small population of birds and mammals move about under the the snow. Some predatory birds and mammals exist on these snow dwellers, but biotic activity, though not really absent, is certainly quiescent in the winter season.

The destruction of tundra soils and vegetative cover during the winter or summer can have far reaching effects on the tundra ecology for years to come.

The proposed route of the Fairbanks Corridor pipeline is directed south from Prudhoe Bay, and after traversing approximately 60 miles of coastal tundra, enters the foothills and eventually the mountains of the Brooks Range at Atigun Pass. The Brooks Range features moderately high rugged mountains of mainly paleozoic and precambrian rock. This area requires the proposed route to wend its way through the naturally occurring mountain passes, frequently following stream beds, glacial scours and valleys. Some of the existing Alyeska corridor in these areas would have to be extended and/or the proposed Fairbanks Corridor could be re-aligned.

The entire Brooks Range and its foothills are founded upon bed rock. The overlaying soils may vary from a few feet to a few inches. This area is one of continuous perma-frost but not of the same fragile soils and plant cover as the tundra/Arctic coastal plain. The bedrock foundation allows heavy equipment to operate in the Brooks Mountain Range and surrounding foothills in either the winter or summer. Only the heavy "spring melt" water runoff may preclude year-round access to this area.

The fauna of the Brooks Range is not particularly unique, but the Brooks Mountain Range is important to any consideration of the nearby tundra ecology. The caribou herds which summer on the tundra migrate through the Brooks Range and as herbivores, they are an important aspect of the Brooks Range ecosystem. The Brooks Range system features permanent populations of raptor birds, sheep, bears, wolves, foxes, smaller mammals and a variety of fishes, and lower vertebrates, all deserving of protection. Many of these animals may range into tundra areas for feeding, mating and nesting. Any interruption of the nearby ecology can have vast implications on the Brooks Range ecosystem as well as the local tundra ecology. Impacts upon the Brooks Range ecology would, in turn, effect the nearby tundra. As an example, very late spring "break-up" provokes a rapid snow melt; water cascading down the mountain peaks and flooding the river plains can wash away or "drown out" many of the herbaceous plants. This loss of plant material can cause mass starvation for the last remnants of the Caribou herd migrating through the mountain ranges. The weakened caribou attract more predators and enhance the fecundity of those resident in the area. The presence of the weakened caribou as readily available food takes some predator pressure off the anadromous fish and other species preyed upon. These animals thus can increase their populations. The following season, this ecological upset becomes even more widespread.

The treeline starts in the southern extremity of the Brooks Range, an upland spruce-hardwood forest. South of the Brooks Range the soils and vegetation (tree cover is complete but stunted) are probably not as fragile and sensitive to "impact" as those north of the range. Granted, continuous perma-frost exists south to Bettles Field, (approximately 100 miles north of the Yukon River). Frequent ice intrusions can complicate construction techniques, but the soils are more readily reclaimed and except for trees, vegetative cover can be reconstituted in a few growing seasons.

The area north of the Yukon River to the southern edge of the Brooks Range features many braided stream drainages and broad alluvial valleys. These broad alluvial valleys are frequently water logged and swampy in summer; "spring breakup" and the usual flooding temporarily exclude almost any form of activities in May or June, but fall and winter seasons are ideal times for work in these areas.

The ecology of this upland spruce-hardwood association area between the Yukon River and Bettles Field, is again highly susceptable to soil and floral changes, but here the herbaceous plant cover is denser and more sustaining of a variety of animal life, than that which occurs in the coastal tundra, or the mountains. The winter season supports larger numbers and greater varieties of herbivores and predators. Man has intruded permanently into these areas, but the population is extremely sparse.

The spruce-poplar forest, starting north of Fairbanks and south of the Yukon River still features discontinuous perma-frost, but the soils are even less fragile than those north of the Yukon River. Vegetative cover is quite varied, but the trees are still stunted and grow very slowly. The tree cover is mixed, deciduous and evergreen, and does afford a greater abundance and variety of wildlife. The moose is an important addition to the list of animals found in these northern forests. The upland northern forest is not continuous; isolated stands of bottom land trees become denser and more frequent until the northern reaches of the Tanana Valley near Fairbanks show a nearly solid block of mixed evergreen and deciduous forest except where urbanization or development have occurred.

Previous construction in this forest area has left a very obvious corridor cleared of trees, but the secondary impact of construction upon the surrounding vegetation and animal biota has not obviously depleted the wilderness qualities of this northern forest. Construction, of the existing Alyeska Corridor and facilities have left a secondary impact in urbanized areas around Fairbanks.

The proposed Fairbanks Corridor gas line from Delta Junction to the Canadian town of Haines Jct. (Y.T.) would traverse an existing pipeline corridor. The Haines products pipeline has been constructed along this route (1954) and some preliminary environmental analyses have been done. An obvious cleared corridor exists between Delta Junction and Haines Junction; it lies close to the Alcan Highway along 80+% of its route.

Along this proposed route, (to Haines Jct. (Y.T.)), the forest becomes denser with a greater variety of trees and taller canopy. The consequent increased brush and ground cover provide a greater carrying capacity for the animal biota. Reclamation of the disturbed forest lands is incomplete in the sense that trees are permantly removed from the Haines products pipeline corridor, but secondary floral reclamation, i.e., brush, grasses, edible plants, has been rapidly achieved in forested lands. In any such forested lands, selective tree plantings can aid in erosion control and soil conditioning. Fertilization and seeding with exotic, as well as indigenous, plants can provide a rapid recovery of any construction sites.

The proposed Fairbanks Corridor route from Haines Junction (Haines products pipeline veers south to the Port of Haines AK) to Ft. Nelson in the Yukon Territories will parallel the Alcan Highway. This area from

Haines Junction to Ft. Nelson is one of primal wilderness; tall thick northern forests, rugged hills and peaks going to over 6,000 feet elevations. Canyon, Whitehorse, Watson Lake and Ft. Nelson are the major towns bordering this route and the wilderness attracts many tourists to all these towns. The forests here support a variety of game animals, moose, bear, caribou (both barren ground and woodland species) and even deer. The higher peaks are inhabited by sheep (Stone and Fannin) and prairie and waterfowl abound.

There is evidence of glaciation and erosion with many large meandering rivers. The Liard River is the primary drainage and braided streams have formed many elongated lakes in this area.

The soils, climate and rainfall support rapidly succeeding forest and marsh areas. Timber cut or burned areas are rapidly reinvaded by brushy plants. Lowlands are eroded away to lakes in some areas and filled in to become meadows in other areas. Everywhere there is evidence of rapid, natural succession, and the diverse physiography and plant life maintains a high carrying capacity for the varied animal populations.

The many lakes, streams, ponds and rivers that exist along this proposed Fairbanks Corridor route, require almost unique and individual description. Those rivers and streams north of the continuous perma-frost line (North of Bettles Field) are easily compromised by frost heave/slump, frost bulb formation, aufeis formation and extensive springtime erosion. Where Alyeska has crossed such rivers and streams, many of these natural phenomena have been "corrected". Erosion has been controlled with rock riprap and/or extensive dike construction.

These arctic drainage waters are important aspects of the arctic ecology as a whole. Both anadromous and catadromous fish, as well as water fowl and shore birds, rely heavily on the integrity and natural succession of these arctic drainages.

The waters south of the continuous perma-frost line are not as sensitive to thermal/mechanical damage as those arctic drainage streams, but certainly physical and chemical changes can compromise the ecological integrity of the streams all the way to Zama. Not only fish and mating-nesting birds, but a variety of furbearers and other animals use the streams and riparian areas to drink, eat, mate and reproduce.

The Fairbanks Corridor route would cross 21 major rivers in Alaska and 9 major rivers in Canada. Approximately 450 water crossings would be required; each small stream or pond plays an essential part in the microclimate and ecology of the surrounding area.

In summary, the proposed route of the Fairbanks Corridor, 1650 miles, traverses the very unique Arctic coastal tundra, the rather special Brooks Mountain Range and then ranges southward through classic subarctic and northern forests. This includes areas of high rugged mountain peaks, broad alluvial river plains, lakes, rivers and hundreds of streams. It is an area that man has invaded before; where he will continue to encroach. This vast, northern and arctic wilderness can be used by man and with conscientious efforts, his use can proceed without any notable adverse impacts upon the land.

1B. ENVIRONMENTAL QUALITIES OF THE PROPOSED ARCTIC GAS SYSTEM LINE

The proposed Arctic Gas System line (the "Prime Route") originates in Prudhoe Bay and travels in a southeasterly direction parallel to the Beaufort Sea coastline to Richards Island (N.W.T.). This proposed route, after entering the Mackenzie Delta Area at Tununuk Jct. then heads in a more southerly direction through the Northwest Territories toward Zama Alta.

The coastal arctic tundra along this route, Prudhoe Bay to MacKenzie Delta, is highly susceptible to the unmitigated impact of man's intrusion; such a route traverses the Arctic National Wildlife Range. The Arctic National Wildlife Range was set aside because the area is so sensitive in all aspects of its ecology. (See pages 1 and 2, re Tundra Ecology, Section A). The few intrusions upon the Range, radar and communication sites, seismic crews, have all left their permanent impact upon the Wildlife Range. Further intrusions upon this Wildlife Range would result in additional degradation which would not be widely accepted by state or federal agencies, environmental groups, or the public in general.

The environmental qualities of the proposed Canadian Arctic Gas Pipeline project are best addressed in sections. The route, as specified, originating at Prudhoe Bay, would cross more than 400 miles of continuous permafrost to the Mackenzie Delta area and Richards Island. This is the area of fragile, unstable soils, plant cover that has only a marginal existence and animal life intimately connected to the soil and vegetative cover of the tundra. There are no roads in this tundra.

From the Mackenzie Delta area (Tununuk Jct.) the route moves south to Ft. McPherson.

The Arctic Gas route would move south from the Ft. McPherson area, across the Peel Plain muskeg and finally enter the Franklin Mountain system; the tree line starts near Ft. McPherson. In the Franklin foothills and mountain area, the proposed route proceeds in a southerly direction following the Mackenzie river flood plain. The route passes through the Great Bear Plain staying west of the Norman Range (an alluvial lowland lies east of the range). There is a "winter" road connecting Ft. Norman and Norman Wells paralleling approximately 60 miles of the proposed route, but this road is impassable in the summer.

The route continues in a southerly direction and crosses the Great Bear River near Ft. Norman, parallels the Mackenzie River and crosses the McConnel Range (still part of the Franklin Mountains) which poses high rolling hills. Another "winter" road parallels the route from Ft. Norman south to approximately 63° latitude.

Proceeding further south, the area near Ft. Simpson (approximately 62° latitude) is the confluence of the Liard and the Mackenzie Rivers; a large delta/lowlands (the Great Slave Plain) exists here. An unpaved highway (N.W.T. - Rt. 1) comes from the east; the pipeline route goes south and slightly east of Ft. Simpson, crossing the Mackenzie River. At 60° latitude (further south) a segment of Canadian National Railroad crosses the Mackenzie Highway. The Mackenzie Highway provides a means of transporting goods into northern Canada from Edmonton and other centers.

An "all weather" gravel road exists between Ft. Simpson and the Steen River. From there a paved road leads south to major centers of transport (Edmonton). Zama can be supplied from this paved road. North of Ft. Simpson to Ft. Norman and beyond, there are only "winter roads". For a few miles south of Ft. McPherson, there are paved roads. Therefore, approximately 700 miles of the proposed Arctic Gas line route is inaccessible by existing roads.

The Mackenzie River Transport system is used in the summer months to transport goods into the interior of Northern Canada. Access from the Beaufort Sea is for about 6 weeks in July and August. Few large port or dock areas exist along the Mackenzie or Liard Waterways.

Physiographically the lands traversed by this proposed Arctic Gas line range from Arctic coastal tundra, south to Northern Rocky Mountain Forest. The tundra area is critical (See page 1, Section 1A), clearly only wintertime access is feasible and even the most conscientious efforts cannot avoid some primary, secondary and very long term impacts upon these lands.

In just 8 or 10 weeks, all the tundra vegetative cover must mature and reproduce itself. The herbivorous animals which migrate onto the tundra areas, consume tons of forage and in turn, supply food for the carnivores that also live in the summer Arctic. Fish and birds rely upon the thousands of small streams and ponds which form each summer when the upper layers of permafrost soils melt (active layer 1.5 - 4 feet). Each summer, new stream channels develop, washing fresh organic and inorganic nutrients toward the Beaufort Sea. Some braided streams silt-up and become lush grassy meadows. Others may erode away their banks and bottoms to form new lakes or roaring torrents. The entire tundra is a pond-dotted swamp in summer.

Vehicular and even pedestrian traffic tears up the delicate roots of lichens and herbaceous plants growing in the summer tundra.

Winter time traffic is less destructive to the soil and plant cover, but plant and animal life under the snow can suffer from the movement of heavy equipment.

Leaving the Arctic tundra, one enters the muskeg areas around Ft. McPherson and the Mackenzie Delta. This is approximately the northern extremity of the tree line. Without the stabilizing mechanics of large root systems, the treeless muskeg forms large watery polygons. Soil is water logged or ice bound and peat bogs abound. Still in continuous permafrost zones, these muskeg areas display frequent ice intrusions.

The Mackenzie River Plain near its northern terminous is one of braided streams, transient lakes, fragile soils and delicate plant cover. Even the most judicious route selection cannot avoid many stream and river crossings in this Mackenzie river plain. Each stream channel and/or tributary to the Mackenzie poses nearly unique characteristics; soils, hydrology, flora and fauna each may require extensive work prior to route selection.

Leaving the Mackenzie River Plain and the Franklin Mountains area the proposed Arctic Gas system route exploits the relatively flat topography and silty, alluvial soils of another river flood plain, the Great Slave (lake) Plain. Stands of evergreen and deciduous trees occur in this area of discontinuous perma-frost and become dense northern forest at the border of Alberta. Any type of construction in densely forested areas does leave a semi-permanent swath across the landscape, but under-canopy can be restored and probably completed in 1 or 2 years. Even in this forested area which extends down into Alberta (Zama) access is difficult; construction could probably not be carried out until roads were constructed.

The entire route from Mackenzie Delta to Zama in Alberta traverses relatively flat, open country. Water crossings are frequent and problematic. The pipeline segments in northern tundra soils could be constructed only in winter, and service and access to the area would be difficult in any season.

Animal life along the proposed Arctic Gas System route is typical of the high arctic grading southward into sub-arctic forest biota. The woodland caribou and its domestic cousin, the reindeer, are special animals, scarce in Alaska, but common in British Columbia and Alberta. The woodland caribou rarely herds up like the more common barren ground caribou and hence does not pose extensive monitoring problems; reindeer, even feral reindeer, are herd animals.

Raptor birds, large mammals, smaller food chain animals and fur bearers are all part of the northern forest ecology which extends north beyond the area around Ft. Norman. North of 60° Lat., the complicated tundra/muskeg ecosystems prevail. Trapping and fishing are important to the scattered residents of interior northern Canada; the human population is, however, quite sparse north of Ft. Norman.

Along the proposed Arctic Gas System route there are few towns, cabins, hospitals, airfields, or other facilities. Certainly construction of the proposed line would provoke extensive urbanization/development of adjacent lands. Many residents of isolated subarctic communities resent the thought of nearby construction.

Estimated Route Mileages

Fairbanks Corridor	*Miles*
Prudhoe Bay	
Atigun Pass	110
Yukon River	345
Fairbanks	450
Delta Junction	545
Scotties Creek	735
Haines Junction	954
Fort Nelson	1,510
Zama	1,650

Arctic gas	
Prudhoe Bay	0
Richards Island (Tununuk Junction)	350
Fort Norman	775
Wrigley	904
Fort Simpson	1,050
Zama	1,251
To lower 48	2,676

2A. ENVIRONMENTAL IMPACTS OF CONSTRUCTION OF FAIRBANKS CORRIDOR LINE

One significant aspect of the proposed Fairbanks corridor is the proposed "common use" of the existing Alyeska Pipeline Corridor. The proposed Fairbanks Corridor line leaves the Alyeska Corridor at Delta Junction (AK.) and thereafter heads southeast to Scotties Creek where it crosses into Canada. This section of the route from Delta Junction to Scotties Creek and into Canada to Haines Jct. would traverse territory where another pipeline corridor exists, the Haines products pipeline. The route in this section also parallels the Alcan Highway up to and and across the Yukon Territory to Ft. Nelson in British Columbia.

The vast experience and documentation of the Alyeska oil pipeline is elegantly applicable to the proposed Fairbanks Corridor line. Both the Alyeska and Haines products pipeline corridors are intact and suitable for this proposed Fairbanks Corridor pipeline. The proposed route from Delta Junction (A K.) to Fort Nelson (B.C.) generally parallel and adjacent to the Alcan Highway, would exploit this existing access road. The Alcan Highway, although built more than 20 years ago, still provides a great deal of preliminary information and experience both of which can be applied to this Fairbanks Corridor project.

In addition to the information and experience which can be applied to the entire Fairbanks Corridor, the entire route as proposed is served by a network of all weather roads, airfields, town, camps, hospital facilities and military installations. Exploiting all the cleared right of way and service roads, the Fairbanks Corridor Pipeline has approximately 700 miles of right-of way clear, and not more than 100 miles of access roads (spurs from existing roadways) to construct. The impact of the construction of this proposed Fairbanks Corridor is fairly well defined, taking advantage of previous data and experience gained on the adjacent liquid pipelines. These impacts of construction are physical/chemical, biotic and socio-economic.

The physical/chemical impacts of construction are merely incremental along most of this proposed pipeline. Alyeska has already constructed the work pad and has developed and tested the proper construction techniques. The Alyeska corridor and work pad will require minimal maintenance. This means that only small amounts of additional land would be used in Alaska, land irrevocably committed to supporting or covering a chilled gas pipeline. To maintain the work pad width would require gravel from borrow pits already well established in Alaska.

Soils and rivers would be compromised as would the sensitive permafrost areas. Again the physical/chemical impacts of construction, using the existing pipeline corridors, is only a fraction of that impacted by the previous pipelines. Subsidence, slump and erosion problems have all been resolved by Alyeska; a mere extension of existing technology and techniques solves the majority of problems for the proposed gas line. The specialized construction methods or materials used by Alyeska will be copied where pertinent and altered where the chilled gas line problems are different than hot oil line problems.

Alyeska has established and had accepted (by various agencies) specific stipulations regarding construction and restoration. These stipulations are eminently suitable for the Fairbanks Corridor line. Certainly back-fill, erosion control, berming, diking, and ditching are all conventional techniques applied equally to both lines. Refrigerated coils, frost plugs, thaw control foundations and floatation techniques, state of the art technology for arctic construction, can all be applied to this proposed construction.

Revegetation, fertilization and even animal supportive stipulations are already established. Raptor nests, migration routes, nesting and hatching sites are defined and identified. Anadromous and catadromous fish streams are enumerated and their sensitivities defined for specific construction time "windows".

With the exception of the approximately 60 mile stretch of Arctic coastal tundra immediately south of Prudhoe Bay, all areas along this proposed pipeline route can be constructed with defined stipulations for wildlife protection. Plans for the coastal plain, limited to early winter construction in areas where there is no visible Alyeska Corridor cannot assure that "under snow" flora and fauna will not be impacted/destroyed. In other areas, the detection of the animals and their nests, etc., coupled with the animals' mobility and escape tactics, provides for maximum survival for 99+% of the animals involved. Undeground animals, moles, shrews, etc. may be undetected and thus injured or destroyed by construction activities in any season. Surface, arboreal and airborne species are readily seen and thus protected. All construction on and along the preformed and existing Alyeska corridor will have negligible impact upon those animal species which can be seen from the right of way.

The young of all species are protected by current stipulations. Limiting construction activities to periods outside the "time window" of whelping or hatching would avoid compromising existing populations. Birds and migratory water fowl are protected by selecting construction seasons in late fall. Game animals are frightened by man's activities, but their sensitive migrations, calving and mating periods are protected by the selection of construction seasons. Small fur bearers are possibly threatened—certainly their habitat is compromised, but again the experience gained from Alyeska has identified individual beaver lodges and fox dens. These animals can be protected.

In summary, the proposed Fairbanks Corridor gas pipeline can have only an incremental impact upon the existing Alyeska and Haines pipeline corridors. There is little or no opportunity for synergistic impacts upon the terrestrial or aquatic environments because the construction periods can be varied over many months to protect the soils, animals, fish and waters.

Actual construction of this proposed gas line could (pending negotiations which seem favorable) employ much of the existing machinery and labor force which has built the Alyeska line. All the other facilities and appurtenances which serviced Alyeska could be utilized for this proposed line. Logistics costs would be drastically reduced and construction totally expedited.

The Alcan Highway from Haines Junction (Y.T.) to Ft. Nelson (B.C.) would serve this proposed Fairbanks Corridor pipeline. New right of way would have to be cut and established near the highway and east from Ft. Nelson to Zama (Alta). Preliminary survey work would align the exact route of the line and also identify historic and archeological sites as well as sensitive biotic areas. This entire route, 706 miles, from Haines Junction to Zama would clear and grade approximately 4,278 acres of permanent and an additional 4,278 acres of temporary right of way based upon 50 feet wide temporary plus 50 feet wide permanent. The loss of such acreage in the northern forest zone may actually increase the net energy flow into the plant biosystems. Removal of tree cover allows forbs and herbaceous species to succeed into the right of way; all herbivores then exploit this "pasture".

Restructuring and revegetation can actually enhance the right of way in alpine, lowland, plains and forest areas. As in the Alaskan portion of the line, streams and major rivers, can be crossed during "safe" seasons when fish, soils, water and stream bed are least sensitive. The terrestrial construction will be selected to protect migrations, nesting, mating and whelping of animals. Waterfowl, only transient summer visitors, are best avoided; construction in riparian zones will be in late fall and early winter.

Previously noted by preliminary surveys, raptor nests, dens, hunting ranges, forage sites, and specific species territories will be identified. Identification and subsequent stipulation provides maximum protection for the species concerned.

2B. ENVIRONMENTAL IMPACTS OF CONSTRUCTION OF PROPOSED ARCTIC GAS SYSTEM LINE

The U.S. Department of Interior and the U.S. Federal Power Commission have considered the Arctic Gas Pipeline system "in depth". Several aspects of the Arctic Gas Pipeline project indicate an exacerbated impact on both the Alaskan and the Canadian Arctic environments. The segment from Prudhoe Bay to the Mackenzie Delta proposed to cross the Alaskan Arctic Wildlife Range. This segment, nearly 400 miles, would not only cross a National Wildlife Range, but such a route would also traverse the Arctic coastal tundra which may not be fully restored/reclaimed for the life of the pipeline.

The construction of any pipeline between Prudhoe Bay and the Mackenzie Delta poses very special environmental problems. Such a line must either deviate south and then north again (adding approximately 260 miles) to circumvent the Arctic National Wildlife Range or route directly across the width of this preserve. This route would also traverse "Old Crow Flats", a

Canadian Arctic game preserve lying west of the MacKenzie Delta. The route through these reserves would cross approximately 200 miles of Arctic Coastal tundra in Alaska and 150 miles of such tundra in Canada.

Tundra construction cannot occur in the summer time without elaborate pre-conditioning. The moist surface layer (active layer of perma-frost) is nearly swamp-like. Heavy vehicles cannot find support, water seeps into trenches—even footprints leave a water-filled track. These tundra soils are marginal in their qualities, and only the hardiest plants survive. Revegetation in such areas is difficult and may take several years of attentive work to complete. The summer growing seasons are only 8 to 10 weeks, but average 20 hours of sunlight per day; only rapidly maturing and flowering plants can be used in revegetation.

Vast herds of caribou migrate east and west along this coastal tundra plain. Summertime construction would compromise the feeding, mating and calving of these caribou. These caribou are herbivores but they are an essential basis of the carnivorous food chain. Anything that compromises tundra ecology has secondary and even tertiary effects on the ecosystems of the nearby mountains and streams where raptors, predators and other herbivores live, but range into the tundra. Thus, damage to the tundra has far reaching effects on fish, fowl and animals, for several years to come.

Arctic coastal plain weather probably only allows December, February, and March for construction activities. January temperatures and winds preclude any real accomplishments by man. Construction along the Arctic coastal plain could require more time than estimated. Marine access is limited to approximately 5 weeks in July and August. All material and equipment would have to be delivered along the beaches in that short time. New snow roads would have to be built each year starting in November. Vast amounts of heat are needed to melt the water used in snow road construction. Ponds, streams and near surface aquifers cannot be drained since extensive lowering of water levels endangers both resident and migratory fish. Few, if any areas in the Arctic coastal tundra offer suitable building materials. Gravel, rock and select sands would have to be transported into the area. All these facts tend to slow down construction progress across the Arctic tundra. A chilled gas line is problematic in both winter and summer in such tundra areas. Frost bulbs form around the pipeline buried under streams and also those buried under slip-soils (muck). This can occur winter or summer.

Any chilled gas line can solidly freeze the streams which are normally flowing under the winter ice. Frost heave can occur winter or summer where the line temperature is different than the ground temperature. The variable drainage patterns which are naturally occurring in the tundra may provoke rapid erosion of the pipe cover in some and sedimentary burial of the pipe in other areas.

The much higher (than gas) heat capacity of water, collecting incident radiation 20 hours a day in summer, can create large ponds of 80°F water. The chilled gas line traversing such ponds and streams could be warmed to above freezing and thus subside into the permafrost layer. A 42-inch chilled gas pipeline transporting 23°F gas may have to be laid at least five feet into the permafrost layer below the active surface layer. Thus, a 9 to 12 foot deep trench is required, with stream crossings possibly a depth of 18 feet. All these probable problems require preliminary study and even experimentation, before construction can proceed. The Arctic Gas System line, heading east out of Prudhoe Bay, would cross 20 major rivers and several tributary streams in the Arctic Coastal Region. Literally, the entire Arctic coastal drainage system between Prudhoe Bay and Mackenzie Delta must be traversed by this Arctic Gas System line.

Winter construction may rely heavily on blasting. The so-called Arctic Ditch Digger as used by Alyeska (Alyeska's 10" fuel gas line) cannot trench in frozen alluvial silt. A unique population of animals and a few plant species, thrive under the tundra snow in winter. Escape and evasion for these biota is limited; many would be killed during wintertime construction.

The spring flowering season on the tundra is short-lived and very sensitive to soil and water changes as well as the movement of heavy equipment. Animals start their migrations into the tundra. Mating and nesting is initiated. Fowl migrate into the area. Construction must cease in early May in such sensitive areas. The early fall (September) season is the peak time of southward animal migrations. This is during or shortly after many animals have calved, hatched, or whelped. Intense human activities during the fall season provokes the abandonment of many offspring plus the interference with migrations. Even after the summer heat has dried out some of the tundra, the soil is still moist and easily compressed. Construction should not start until the active soil layer is again frozen.

The route south from Mackenzie Delta as proposed by Arctic Gas System crossed approximately 750 miles of broad alluvial river plains which feature many braided streams, unstable stream banks and moist, acidic, fragile soils. (Approximately 200 miles of the proposed route from Mackenzie Delta to Zama is in the area of continuous perma-frost). Of the remaining route, approximately 700 miles, lies in areas of discontinuous perma-frost. Both zones are problematic; even forested discontinuous perma-frost features ice intrusions. There are a few established sources of rock, select gravel or sand near the proposed route. Such proposed borrow pits in river plains may compromise flood control in the river drainage systems.

There are approximately 50 river crossings classed as navigable between the Mackenzie Delta and the Hay River in Alberta (Zama); about 1150 streams must be crossed. Each water crossing is costly in time and money. Construction across the essentially treeless, muskeg, plains areas would require "double ditching" (top soil is removed first and set aside, ditch is completed, topsoil is then replaced on top of backfill) techniques in an effort to expedite restoration of the area. Approximately 200 more miles of treed muskeg can pose similar construction problems.

Service and access roads would have to be built before the pipeline construction could commence. Approximately 700 miles of roadway must be constructed. Some of the southern roads could be built in the summer months, but several hundred miles of snow roads are required. Winter construction periods, at best only 4 months per year, are demanded along some 500 miles of this proposed route. Both roads and the pipeline, per se, would be restricted to this limited construction scheduled. Because of the very intense chill factors, the Anderson Plain and Arctic Slope areas would probably not permit work in January and early February, therefore three months or less work could be scheduled.

In addition to the primary and long term impacts of construction and the limited construction schedule, there would be secondary construction projects. Approximately 18 docks and pier facilities would have to be constructed to service this pipeline route, all in environmentally sensitive or restricted areas. Piers built on the Beaufort Sea coast would probably be removed after construction terminated. The Skagway to Whitehorse road and rail facilities would probably have to be expanded to aid delivery of material to Fort Nelson. Air strips and helipads necessary for any large construction project, would have to be built or expanded and in the sensitive tundra and other areas, these air strips would require frequent repair and rebuilding. Construction and maintenance of these air strips is a constant environmental threat, especially where building materials must be transported into the area.

In summary, the access to the proposed Arctic Gas System route is not complete. The impact of road, sea, and air facilities which must be constructed on or near the right of way serves only to increment the impact of the pipeline construction.

Approximately 1/2 of the anadromous fish and their escapements which occur in the Mackenzie Delta/Beaufort Basin could be jeopardized even by wintertime construction of the Arctic Gas System line between Prudhoe Bay and Fort McPherson. The winter construction season does protect most of the tundra migrators, but fur bearers which provide an income vitally essential to many northern Canadian trappers, would be disturbed and threatened by winter time construction activities, especially south of the Great Bear Plain. The many stream crossings may have a *long term* effect on beaver, as well as marine mammals.

Waterfowl are not jeopardized by winter time construction, but extended construction periods (late April through September) could endanger segments of the vast nesting areas in the river plains of the Yukon Territory. Game animals, moose, bear, caribou, sheep, deer and goats could be protected and preserved during winter construction periods. Spring mating and migrations could be protected, but again extended construction would pose a threat to some species.

Sport fishing in each and every stream or lake crossed in the winter time could be drastically compromised both directly that winter and secondarily the following spring. Winter construction, trenching and ice breaking, could allow streams and ponds to freeze solid. The exclusion of oxygenated water couplied with "total freeze" would kill many larger fish species. The area trenched and restructured would be unstable the following spring. The concomitant changes in turbidity, conductivity, pH and oxygenation, etc. which occur during rapid water run-off over newly constructed stream burials would have drastic effects on spring season nesting and hatching as well as migrations of both catadromous and anadromous fish. The effects on fish could thus be long term and widespread. Small fish species and bottom dwellers are not drastically threatened by wintertime construction activities, but they are compromised by the springtime after-effects of construction. Again spring break-up, occurring simultaneously in many streams which were crossed, has a synergistic effect.

Raptor birds (significant populations exist in the Richardson and Franklin Mountains) can be protected, winter and summer, but only with very conscientious efforts. Raptor nests and a variety of historic and archeological sites would have to be identified before any construction activities could be initiated. This survey work could require more than one full year.

2C. SUMMARY COMPARISON OF ENVIRONMENTAL IMPACTS OF CONSTRUCTION

The single most unique difference between the Fairbanks and the Arctic Gas System proposed trans-Alcan gas line is the existence of the Alyeska oil line along 545 miles of the proposed Fairbanks Corridor. Another pipeline, the Haines products Pipeline, from Fairbanks A K. to Haines A K., provides an existing corridor for the Fairbanks Corridor from Fairbanks or Delta Junction south into Haines Junction Y.T. From there to Ft. Nelson (556 miles) the Fairbanks Corridor proposes to parallel the Alcan Highway. From Ft. Nelson to Zama, 143 miles, access would be along the right-of-way.

Common corridor usage has been advocated and approved by regulatory agencies as well as the industry for many years. Federal Power Commission guidelines published at 18 CFR Section 2.69 provide that in locating proposed facilities, consideration should be given to the utilization, enlargement or extenson of existing rights-of-way belonging to either Applicant or others such as pipelines, electric power lines, highways and railroads. The use of such corridors is economic and expedient.

The six years experience and data collection which defines the Alyeska line can be elegantly applicable to the proposed Fairbanks Corridor. The Alyeska route was constructed only after several years study and negotiations. Besides the experience, there can be a common use of camps, airfields, work spaces and facilities which served the Alyeska line. There need be few environmental impacts from secondary construction. The Fairbanks Corridor route can use *established*, environmentally acceptable *all*-weather roads which serve the entire line. Prudhoe Bay to Ft. Nelson. There exists experienced logistics, transport loading and docking facilities, etc.

Besides the existing labor and personnel to construct the pipeline, there is a reservoir of expertise, both private and governmental, to monitor the engineering and environmental stipulations which define the pipeline. These people, with construction and accessory skills, can work year-round on at least 80% of the proposed Fairbanks line.

In addition to these points, the Fairbanks Corridor line does not cross the Arctic National Wildlife Refuge. It crosses only 60 miles of sensitive Arctic coastal tundra and that will be on the existing Alyeska line work pad.

Construction of the Fairbanks Corridor line is further expedited by the availability and proximity to ideal construction materials, soils, gravel, select sands, etc. Borrow pits are already established and in use.

The Fairbanks Corridor route, as selected, features proximity to established oil and gas fields in the Petroleum 4 reserves and the far western boundaries of potential Alaskan oil/gas fields. (Bering Sea). Proximity to potential gas fields at Copper River, Middle Tanana and Kandik Basins, where small gas "finds" are established, is another feature. "Manned and ready" military installations, available in the event of any emergency, lie all along the Alaskan portion of the Fairbanks Corridor as proposed.

In addition to the experience, equipment, skills and techniques provided by Alyeska, existence of Alyeska's line means that all impacts of construction can be incremental. The proper selection of stipulations (which are now well founded) cite the ideal time, area, temperature, water level, barometric pressure or equipment necessary to provide maximum protection to the environment at hand.

The Fairbanks Corridor Route passes near the Denali Fault, a high seismic risk area. Fairbanks township has sustained seismic shocks of 7 to 8 Richter. The proposed gas line, utilizing established technology, will be built to withstand 8.5 Richter (8.5 Richter is Seismic Resistance of the Alyeska line).

Experience has shown that only a case by case investigation can determine which engineering and construction techniques (burial, surface lay or suspension/elevation) will provide the utmost in safety, reliability and environmental protection for any pipeline. Aesthetics may be compromised where the proposed pipeline is exposed; valve sites, etc. would be exposed. These exposed segments of pipe would be less than that of the Alyeska line, which is already accepted. Therefore, only incremental aesthetic impacts would be expected.

The proposed Arctic Gas System line from Prudhoe Bay to Zama is about 400 miles shorter than the Fairbanks Corridor route. The Arctic Gas System line does not pass near an established fault line or high seismic risk zone. Taking advantage of the flat topography and alluvial soils of the MacKenzie and other river plains, the Arctic Gas route will be reportedly totally buried.

In all other respects, the Fairbanks Corridor gas line, as proposed, affords countless construction advantages which represent important savings in time, effort, and money. The Fairbanks Corridor gas line employs established right of way along most of its route. The in-depth environmental analyses for a large portion of the proposed route is completed, established and stipulated. Supportive systems, camps, airfields, access roads, even men and equipment, are in place and can be used. Environmental impacts for the Fairbanks Corridor line will be incremental to those impacts already established by the Alyeska line.

Environmental impacts of the Arctic Gas System line would be multiple; one for the access and service facilities and one for the pipeline itself.

3A. ENVIRONMENTAL IMPACTS OF OPERATION AND MAINTENANCE OF THE PROPOSED FAIRBANKS CORRIDOR LINE

The entire Fairbanks Corridor route, Prudhoe Bay to Ft. Nelson, is accessible by all weather, heavy duty roadways. In the Canadian segment from Haines Jct. (Y.T.) to Ft. Nelson B.C. (556 miles) the selected route of the pipeline may not be directly alongside the Alcan Highway and accessory roads would be built, but the main roadway (Alcan) has existed for 20 years and is in constant use. Marine access to this roadway system can be established at Haines, Skagway, Prudhoe Bay and even Anchorage or Valdez; Prudhoe Bay is used only in summer. Along the eastern leg from Ft. Nelson to Zama (Alta) access would be along the right of way.

Two large cities, Fairbanks and Whitehorse, lie on the proposed Fairbanks Corridor line and these cities could absorb the influx of supplemental/service businesses which would support the gas pipeline. Fairbanks provides frequent flights to the Anchorage International Airport and two railroads, the Alaska RR and the White Pass and Yukon RR (a narrow gauge road) serve the separate cities of Fairbanks (from Anchorage) and Whitehorse (from Skagway).

Those features of operations and maintenance for the proposed Fairbanks Corridor gas line which differ markedly from those of the Arctic Gas System pipeline, all take advantage of the excellent access to the Fairbanks Corridor route. The presence of the Alyeska hot oil line also provides some distinct operational and maintenance advantages to the Fairbanks Corridor gas line; pending future negotiations, many supportive systems and facilities can be shared with Alyeska.

The unique advantages provided to a chilled gas line which follows the proposed Fairbanks Corridor are enumerated below:

1. Some shared costs and services with Alyeska Pipeline.
2. Availability of industrial groups which can provide assistance in the event of an emergency.

3. Maintenance protocols already established and accepted by all monitoring agencies concerned.
4. Established work force of agency experts who can monitor and help with maintenance problems.
5. Established telecommunications systems.
6. Accepted and tested emergency and safety systems which could protect operations of both lines, i.e., seismic episode shut-down.
7. Established roads, airports, etc. which support maintenance procedures.
8. Established and trained security nearby; many military bases are proximal to the line.
9. Established or under construction, port areas which can provide maintenance equipment.
10. Year-round, ready access to almost the entire line. In an emergency, there is no segment of the line that could not be reached by maintenance equipment.
11. Established fish and wildlife jurisdiction and control over sensitive areas "opened" to sportsmen by access and maintenance roads.
12. The "chilled gas" temperature, 23°F, is maintained to protect sensitive perma-frost areas. The Fairbanks Corridor crosses only about 230 miles of continuous perma-frost zone; the Brooks Mountain Range and foothills lie within perma-frost zones, but being founded on bedrock, this is not a fragile frost sensitive area. The maintenance of the selected 23°F temperature and supporting insulation and engineering therefore poses a problem only directly proportional to the amount of perma-frost, nonstable soils traversed. (Arctic Gas System route would cross approximately 550 miles of continuous perma-frost and 700 more miles in discontinuous perma-frost, very fragile sensitive soils).
13. Preventive maintenance, site and road restoration, erosion control, revegatation, restocking and supplementary seeding can all be performed during the entire year, but special emphasis will be on summer time activities, along the Fairbanks Corridor. The summer time efforts permit immediate control of "spring break-up" erosion and slump problems. Summer activities also allow access to water (not ice) for hydrostatic retesting of the pipe segments.
14. The close and parallel route of the two lines, Alyeska and Fairbanks Corridor, could allow a common seismic safety network to be installed and maintained. Though both lines pass through high seismic risk zones and both lines are/can be constructed to resist 8.5 Richter magnitude earthquakes, the installation of vibrosensometers and the "quake warning" radio net (out of Palmer A K.) can afford "state of the art" technological protection to both lines.

3B. ENVIRONMENTAL IMPACTS OF OPERATION AND MAINTENANCE OF THE PROPOSED ARCTIC GAS SYSTEM LINE

A thorough description of the marine and highway access to the proposed Arctic Gas System line can be found in section 2B. This section points out that snow roads are the proposed means of access to that segment of the route which crosses the Arctic tundra. Snow roads cannot be used in the months April through October; emergency access to the line would have to be via plane or helicopter for at least six or seven months per year.

Those segments of the Arctic Gas system pipeline which would be constructed south of the tundra, would presumably be serviced by the roads built during the construction phase of the Arctic Gas System line, approximately 300 miles. These roads could be easily maintained and used year-round, but this implies that only 1/4 of the line is readily accessible year-round on all weather roads.

Summertime access to a pipeline routed thru the tundra or muskeg not only compromises the soils and vegetation of the area but also the animals living in their summertime haunts. Aircraft can easily spook a herd of musk ox or caribou into a stampede which tramples the young and injures adults as well. All terrain vehicles are equally damaging to both the physical and biological environment.

The proposed Arctic Gas System line relies heavily on snow roads, with no system proposed for summertime access. The lack of year-round access is the basic important difference between the Arctic Gas and Fairbanks Corridor lines. A summary of the unique environmental aspects of operation and maintenance of the Arctic Gas System line is listed on the following pages.

1. Only in the winter season (December—April) can all parts of this proposed line be serviced. Access in spring, summer and early fall must be by helicopter or airplane. All terrain vehicles and even pedestrian traffic can be harmful to the tundra and barren muskeg north of the tree line. Summer ranging animals are mating, calving or nesting; they are susceptible to impacts from aircraft and vehicles.

If the applicant or the Canadian government builds an all-weather road from Steen River to Ft. McPherson, then much of the potential damage done by maintenance crews/operations is obviated (The road itself will have a negative impact on the environment). The points below assume no all weather road is constructed.

2. Winter or any season, access to the pipeline will be difficult; the movement of supplies and equipment for emergency work will be problematic and invariably damaging to the environment. Snow roads would have to be rebuilt/restructured each winter. Summer access would probably occur only in the event of a dire emergency, except in those northern forest areas where all weather roads can be built.

3. If the Arctic Gas System pipeline were constructed as proposed, the segment from Prudhoe Bay to MacKenzie Delta would pose nearly insurmountable maintenance and access problems. Access would be in the winter season only, but in the winter season Prudhoe Bay is iced in, limited to helicopter loads only. Material deliveries for emergency repairs would be severely curtailed.

4. The many small streams and rivers traversed by a buried chilled (23°F) pipeline will require constant attention. Frost heave and frost bulbs, as well as slippage in active perma-frost layers, all will demand restructuring and reclamation. Ideally, such work should be after the spring break-up, in early summer. Again, limited summer time access precludes extensive, environmentally acceptable, maintenance activities.

5. Even if a complete gas line access road were built, service sites and facilities, airfields, storage yards, housing and fuel depots would all have to be built and maintained all year long; such secondary construction imposes additional impacts upon the fragile tundra/muskeg lands.

6. Access and maintenance roads which are built may be an impetus to tourism into the Yukon and Northwest Territory. New methods of access to previously isolated areas could attract sportsmen and tourists in general. Such an influx of tourists and hunters especially may be of doubtful value.

7. The areas around Ft. Nelson and Zama have established and accepted plans for compressor stations, monitoring facilities and etc.

8. Arctic Gas Systems has not specifically defined its telecommunication and electrical power facilities. Telecommunications systems are essentially complete throughout northern Canada. Without the availability of a widespread power grid system, electrical power supplies are frequently generated on a local basis.

3C. SUMMARY COMPARISON OF ENVIRONMENTAL IMPACTS OF OPERATION AND MAINTENANCE OF A PROPOSED GAS LINE

The Fairbanks Corridor pipeline will occupy 545 miles of existing Alyeska corridor. In this location, the Fairbanks Corridor can share a large amount of its operation and maintenance systems with Alyeska (some by negotiation, some by governmental directive). Most of the ancillary systems, telecommunication, power, storage and service yards, housing and even skilled labor are presently available to the Alyeska operation and could be shared or transferred to the Fairbanks lines.

The Fairbanks Corridor line does not pass through a National Game Refuge and traverses only about 60 miles of fragile tundra type soils. Even these tundra areas have seasonal road access; thus, excluding the springtime floods, virtually all of the Fairbanks line is accessible by vehicle the year round.

The proposed Arctic Gas System line, in contrast, does not have complete road access. In fact, snow roads are the proposed method of access during construction of most of the Arctic Gas line and presumably, snow roads would furnish access for maintenance and operations.

The Arctic Gas System line, from Prudhoe Bay to Tununuk, crosses more than 400 miles of fragile, frozen, tundra soil, part of which lies within the National (U.S.) Arctic Wildlife Range. No ancillary facilities or systems exist for the operation and maintenance of the proposed line and even wintertime (snow road) access to much of the line is environmentally damaging. Summertime access to the line in the tundra area would be limited to helicopter. The secondary supportive construction which would serve the operations and maintenance of the proposed Arctic Gas System line would definitely compromise the tundra areas and incrementally impact the remaining muskeg and forest areas traversed by this system.

Socio-Economic Aspects of Construction of a Proposed Gas Pipeline

4A. SOCIO-ECONOMIC FEATURES OF THE CONSTRUCTION OF THE PROPOSED FAIRBANKS CORRIDOR LINE

The social and economic impacts would fall primarily on areas already impacted, directly or indirectly, by the Alyeska oil pipeline. With fewer construction workers employed over a shorter period of time than on the oil pipeline, the impacts probably would not be as significant. The impact on Fairbanks and on the remainder of Alaska would not be of the magnitude of the Alyeska impacts since the number of workers would be less than for Alyeska and since services have expanded in the last few years under the pressures generated by Alyeska. Fairbanks would probably continue to be the center of construction activity. Compared with the Arctic Gas system, the longer pipeline needed within Alaska for the Fairbanks Corridor line will require a larger workforce over a longer period of time and will pass through less isolated areas. Thus, property taxes would be greater and worker income would be greater. The Fairbanks Corridor pipeline will be constructed by many of the workers who have been employed in constructing the oil pipeline. There will be some impact on private services, especially in the areas of housing, private health care, utilities, communications, transportation, financial, retail, and leisure services, but the impact should not be significant since these services have been developed in response to the activity on the oil pipeline.

The Fairbanks Corridor route could have more serious effects on those areas outside the oil pipeline corridor, that is, from Delta Junction southeast to the Canadian border. While the towns along the Alcan Highway escaped the direct impacts of Alyeska—such as happened in Valdez or Fairbanks—they did experience increased demands on services due to those people moving into Alaska along the highway. As a result, towns such as Tetlin Junction experienced some economic expansion that would tend to absorb to some degree the impacts generated by the proposed Fairbanks Corridor route. The major revenue impacts of the gas pipeline on the State of Alaska would result from personal income taxes, certain excise taxes, gas production tax revenues, royalty payments to the state, and state property taxation of the pipeline. Construction of this gas transmission system would have a multi-faceted impact on the socio-economic environment of the State of Alaska. It would produce jobs for existing workers completing the Alyeska line, maintain state and local revenues, and further stimulate the Alaskan economy. This in turn would extend the current demand for social services, schools, housing, health care, and public safety. The proposed pipeline will pass approximately 200 miles from Talkeetna, which is one of the suggested sites for a proposed new capital of Alaska. (The other proposed sites are Fairbanks and Anchorage). Thus, with the addition of a smaller diameter spur-line, the proposed pipeline could furnish a natural gas supply to the new capital.

Gas pipeline construction might have a minimal direct adverse impact on the sport fishing industry and minimal impact on the forest industry. Mining could be expected to grow somewhat because of the improved access to mineral rich areas. Agriculture would continue to diminish in importance in relation to the entire economy, but tourism could be expected to grow. Construction of a gas pipeline would extend the demand for transportation services associated with Alyeska and thus provide additional revenues on existing capital investment in Alaska. The construction effort would utilize the barging, trucking, and aircraft resources of the state. The construction of this pipeline system could have a significant influence on Alaskan Natives. The growing demand for material goods has had obvious impacts. This is a major feature that has resulted from the exposure of the Natives to a non-Native culture. Since these goods must be bought, the Natives have become increasingly dependent upon a cash economy. This in turn, has resulted in a decline in the harvesting of subsistence resources and alterations in the nature and significance of the social institutions derived from that activity. The potential pipeline-related causes of interference with the subsistence resources utilized by the Natives consist of disruptions to the habitat of fish and game as the result of construction or operational activities, and increased competition from the non-Native population for the limited available resources.

4B. SOCIO-ECONOMIC FEATURES OF CONSTRUCTION OF THE ARCTIC GAS SYSTEM LINE

It is estimated that a lesser number of workers will be employed in Alaska on the Arctic Gas pipeline. Approximately 2,400 workers will be required during the peak winter construction period. The gas pipeline would provide approximately 20% of the number of jobs created by the oil pipeline. Therefore, the total impact of employment and personal income will be small, but beneficial. Since there is virtually no housing available, mobile construction camps will be required.

During construction, state and local governments along the pipeline will benefit from motor fuel taxes, and personal and corporate income taxes. However, production would be destroyed in agricultural and forest lands throughout much of the route. Some of the land would be out of production for only a short time, but other lands would be out of production for the life of the project. There would be some adverse impacts because of short-term surges of demand for housing, demand for federal, state and community services; and and increased competition for recreation, education transportation, and entertainment. Subsistence trapping would be interrupted during construction of the system.

4C. SUMMARY COMPARISON OF SOCIO-ECONOMIC FEATURES OF CONSTRUCTION

Construction of the proposed Fairbanks Corridor line through Alaska is scheduled to begin in 1979. The rate of growth in employment is expected to slow down in 1977 after construction of the oil pipeline is completed. Construction on the Alyeska project will begin to taper off in 1977 when the system is scheduled to begin operations. Thus, construction of the proposed gas line could provide continued employment for some workers engaged in constructing the oil pipeline. The gas pipeline will provide continued benefits to the business economy of Alaska from the requirements for supplies, materials and equipment. The existing work camps currently being used in constructing the oil pipeline can be used in constructing the gas line; thus, there will be no impact from construction of a large number of work camps. Existing highway and utility systems will provide required services. No large expenditure of capital funds will be required for providing these services and there will be no requirements for large scale use of scarce resources.

Construction and support workers, choosing to stay in the areas along the Alyeska line will be able to find jobs. Additional tax dollars will not be required to support these people.

Contrasting with the utilization of existing housing, transportation facilities, medical facilities, recreational facilities, etc., producing additional profits on existing capital investments, the Gas Arctic route would require all new facilities. New capital investments based on short-term payout will result in additional inflation in the areas affected.

Socio-Economic Aspects of the Operation and Maintenance of a Proposed Gas Pipeline

5A. SOCIO-ECONOMIC ASPECTS OF THE OPERATION AND MAINTENANCE OF THE PROPOSED FAIRBANKS CORRIDOR LINE

Since the Fairbanks Corridor routing is 1650 miles in length and passes near areas of potential development, it would make possible the future use of considerably more natural gas in Alaska than would the Arctic Gas route.

These potential users would be fuel users such as utilities and residential and commercial users in the Fairbanks area, and an iron ore processing facility. In addition, revenues from the state property tax would be large because of the greater length of pipeline in Alaska and the consequent increase in property subject to tax.

Permanent revenues derived from the completed pipeline and pipeline operations would soften the impact of lost construction revenues on completion of the Alyeska line. Construction of the gas pipeline would maintain some of the available jobs for those workers choosing to stay in the area, thus keeping them off welfare rolls.

One of the purposes of this route is to provide natural gas to the Fairbanks area. The availability of an assured gas supply in Fairbanks will increase the potential for development. In addition, this routing will pass closer to the proposed sites for the new capital of Alaska. Regardless of the site which is finally chosen, this pipeline will be available to furnish gas to the proposed capital site. Both the Fairbanks Corridor line and the Arctic Gas line will require a compressor station and/or operation and maintenance facility at Prudhoe Bay. It is estimated that approximately 40 workers will be employed to operate the station.

5B. SOCIO-ECONOMIC ASPECTS OF THE OPERATION AND MAINTENANCE OF THE ARCTIC GAS SYSTEM LINE

The Arctic Gas System will be approximately 195 miles in length in Alaska. This system will transport gas through a relatively underdeveloped portion of the state of Alaska. This pipeline would not furnish gas to any of the larger cities in Alaska.

The airstrips and helicopter landing sites required for operation of the system would create a continuing impact on the fragile Arctic tundra. Because of the unstable soil conditions, periodic reconstruction may be required. It is estimated that 18 docks and piers will be required to facilitate marine delivery of materials to Skagway, Prudhoe Bay, and Mackenzie Delta. The increased traffic at the Mackenzie port may result in interference and delay in delivery of supplies to the Arctic islands. In addition, the existing railroad from Skagway to Whitehorse would probably require expansion and additional maintenance.

5C. SUMMARY COMPARISON OF SOCIO-ECONOMIC ASPECTS OF THE OPERATION AND MAINTENANCE OF THE PROPOSED FAIRBANKS CORRIDOR LINE

The proposed Fairbanks Corridor line will provide permanent benefits to the Prudhoe Bay area, to Fairbanks and to Alaska. The Prudhoe Bay area will benefit from the additional workers required to maintain and operate the compressor station. The Fairbanks area will benefit from the availability of an assured supply of natural gas. The State of Alaska will benefit from the increased tax revenue derived from the greater length of gas pipeline in the State, and also benefit from the reduced number of potential welfare claimants.

Selected Environment Impacts

Some of the impacts on the environment of the proposed Fairbanks Corridor line and the Arctic Gas line, based on the Final Environmental Impact Statement issued by the Department of the Interior, may be summarized as follows:

(a) Climate

Fairbanks Corridor—Alaska.—The construction, operation or repair of the pipeline will have little, if any, impact on climate. It will not affect regional temperatures, winds or precipitation. Avaiable information indicated that micrometerological changes will result from compressor station emissions. Ice fog conditions may occur in the villages or camps along the route.

Fairbanks Corridor—Canada.—The short-term effects of construction and operation of the proposed pipeline on climate will be minimal. Local and transitory ice fog, the only impact, will not be deleterious to the climate. If airstrips are not sited at elevations higher than equipment such as compressors, ice fog could interfere with aircraft movement for a few hours before wind disperses it.

Arctic Gas.—There will be no significant impact on regional climate; however, climate will have a major impact on the construction and operation of the pipeline in the arctic and the subarctic. The cold air temperature, combined with winds and the long winter darkness, will cause extreme stresses on personnel, materials, equipment, and machines.

(b) Topography, Geology and Soils

Fairbanks Corridor—Alaska.—Some landscape changes in topography will be caused by borrow areas, ditch mounds, and buildings. A major portion of this route is located in forested, rolling topography and is associated with a major existing transportation system (the Alcan Highway). Therefore, it is believed that the overall impact on topography will be slight.

This route will serve the Prudhoe Bay oil and gas fields, the Kandik Basin, the Middle Tanana Basin and the Copper River Basin.

Construction and operation of a gas pipeline will have little, if any, impact on the development of hardrock minerals and energy producing minerals except for oil, gas, sand and gravel. The 735 mile segment of the Fairbanks Corridor in Alaska will not affect the overall distribution or abundance of perma-frost in Aaska. Perma-frost will affect the pipeline. The route crosses approximately 230 miles of continuous perma-frost and approximately 505 miles of discontinuous perma-frost. In perma-frost terrain, disturbance or removal of the plant cover and peat layer causes thawing of the perma-frost and deepening of the active thaw layer. The impact on soil along the route can be minimized by avoiding disturbance to the vegetation protecting those soils.

Fairbanks Corridor—Canada.—Topographic impacts of the proposed pipeline constructed along 915 miles of right of way in Canada are considered to be minor. Most of these impacts would be secondary manifestations of more serious geologic impacts such as thermokarst development, gullying and stream siltation, and accelerated mass wasting.

Constructing of a pipeline and ancilliary structures will require great quantities of sand and gravel or crushed rock for such purposes as pad foundations, backfill in trenches, and roadways. Suitable materials sources are generally abundant along the corridor, but are relatively scarce in some segments. Other than the consumptive use of construction materials, the construction and operation of a gas pipeline will have no impact on metallic or non-metallic resources and their extraction. Trenching and other pipeline construction activities would impact topsoils to a variable degree ranging from complete destruction to partial burial. This routing will not cross major areas of agricultural lands; thus, there is little potential for major impact on agricultural uses of soils.

Arctic Gas.—The major unavoidable effect on topography would be the excavation of at least 108 borrow pits averaging about 14 acres each. In addition, plans call for a nearly continuous berm of soil (several feet high and about 5 feet wide) directly over the pipe. (DOI Final EIS, Canada, March, 1976, p. 321).

A buried chilled pipeline poses special geologic problems such as heaving of the pipe and disruption of shallow ground-water movement. It has not been demonstrated that the integrity of the pipeline can be maintained everywhere in the perma-frost area. Thawing of ice-rich, fine-grained permafrost materials could locally result in serious impacts such as soils liquefaction, slope instability, differential settlement of the ground surface, disruption of drainage, and accelerated erosion along as much as 800 miles of the route north of Ft. Norman on the Main Line and on the supply line laterals. Approximately 30 million cubic yards of construction material from borrow pits and quarries will be required for construction of the pipeline system.

Adverse effects on agricultural soils would be minor except on the right-of-way of the proposed pipeline, permanent roads, temporary access roads, and other graded or filled areas. These effects would be significant only in areas of agricultural development, mostly south of Ft. Simpson on the Main Line and on the delivery lines in southern Canada.

(c) Water Resources

Fairbanks Corridor—Alaska.—Construction of the pipeline will affect surface drainage patterns. Impacts associated with the pipeline, ditch, frost bulb, and mound will be long term and will result in wet conditions on upslope sides and dry conditions on downslope sides. Airfield, future compressor station and communication sites are considered to have no significant impact on surface drainage patterns. None of the streams along the route are utilized as municipal supply sources either through reservoirs or through other bodies of water connected to the streams.

Fairbanks Corridor—Canada.—The degree of potential impact at stream crossings would depend upon the design and the measures taken during construction to minimize the impact. Four areas of concern are: (1) channel erosion, (2) icings, (3) depletion of streamflow during construction, and (4) drainage disruption.

The primary impact on ground water by the pipeline would be the disturbance of the shallow active layer overlying perma-frost during pipeline construction and operation. Disturbance of the thermal regime in the active layer would create new ground-water flow patterns, possibly resulting in aufeis, accelerated thermal degradation, accelerated erosion, frost heaving, and potentially explosive icing mounds. Another potential for impact on ground water would be the discharge of liquid wastes and leaching of sanitary landfills.

Arctic Gas.—Excavation of materials and the placement of fill during construction of the proposed pipeline will alter numerous natural drainage channels. Erosion could be accelerated because of the potential for increased velocities and concentrated flows, steepened terrain slopes, soil disturbances and vegetation modification. Changes in the subsurface drainage caused by pipeline construction, soil compaction, or the frozen annulus around a chilled pipe could result in conversion of subsurface flow to surface flow and thus increase erosion. Changes in the form of drainage could alter the freeze-thaw, wet-dry, liquefaction, or other characteristics of soils leading to new or accelerated mass movement. A principal potential impact of such soil movements would be the disfiguration of the landscape and a decrease in the quality of water.

The proposed pipeline alignment would cross numerous streams and flood plains. Where the pipeline is buried at stream crossings, scour might expose the pipe and cause damage. Along the northern (Prudhoe Bay to Tununuk) one-third of the route, the formation of river icings (aufeis) could affect the integrity of aboveground structures as well as cause unpredictable effects on depths of riverbed scour.

The natural quality of water in streams or lakes would be impaired where construction-related activities, including the removal of vegetation, sand and gravel mining, and grading and filling for roads or camp buildings would add particulate matter. Adverse effects of sedimentation could largely be controlled during the life of the project, but would be unavoidable during construction.

Contamination of streams and lakes by deliberate or accidental discharge of toxic chemicals would be a long-term, continuing threat to water quality and plant and animal populations both in freshwater and marine environments. The effects could be critical along major waterways but cannot be quantified as they would depend for the most part on the incidence of accidental spillage and leakage of fuel oil and other toxic materials.

(d) Vegetation

Fairbanks Corridor—Alaska.—Some existing underbrush and forest will be destroyed by the construction of permanent access roads, compressor station sites, borrow pits and other structures. A few temporary work pads will be required along the Alyeska portion of the route and an additional number will be required in the portion along the Alcan Highway. Any merchantable timber stands that are cut will occur at scattered locations so that their loss would not be economically significant. Local stands would have value to nearby users and could be salvaged for local use. The right-of-way clearing will leave a rather straight line across the landscape. The percentage of land that will be affected is quite small when compared with the total width of right-of-way. No known plant species are threatened with total extinction on this route.

Fairbanks Corridor—Canada.—In the portion of the route following the Alcan Highway, discontinuous perma-frost is present, although not widespread southeast of Whitehorse. The principal impact on vegetation would result from clearing of the right-of-way in the open, parkland forests of spruce and mixed woods and the permanent occupancy of land for compressor stations and other facilities.

Arctic Gas.—Unavoidable effects of the proposed pipeline on vegetation would be relatively insignificant in terms of the total resource of plant communities.

Losses of vegetation would occur on all land areas occupied by permanent roads, airstrips, compressor stations, wharves, stockpiles, borrow pits and other facilities. On the pipeline right-of-way, clearing of trees would cause a loss of forest productivity. In the long term, following abandonment of the proposed project, all vegetation should recover, although scars would be visible for many decades.

Throughout the lifetime of the proposed project, an apparently intratable problem in perma-frost zones would be unscheduled maintenance operations requiring movement of heavy machinery over land. Such operations could cause more damage to vegetation and terrain than would the initial construction of a pipeline. The adverse effects would be especially severe in the Arctic Coastal tundra where soils are ice-rich, recovery of stable terrain and vegetable is slow, and scars on the landscape are highly visible and long enduring.

(e) Wildlife

Fairbanks Corridor—Alaska.—The construction of this pipeline system will affect wildlife populations in the following ways: (1) direct and indirect harassment or project-caused disturbance during critical periods of an animal's life cycle; (2) increased harassment and/or destruction of wildlife because of better access to area; (3) the introduction of pollutants to the ecosystem; (4) the inability of certain species of wildlife to adapt to man's presence; and (5) the direct or indirect destruction of wildlife habitats. Because most of this alternative route closely parallels the trans-Aaska oil pipeline system, many of the impacts, e.g., noise and pollutants from gas compressor sites added to noise and pollutants from oil pump stations, will be cumulative. However, because there is no precedent for this combination of pipeline transportation system, the additive effects, while based on best judgment, are mainly tentative.

Fairbanks Corridor—Canada.—There is insufficient background material available to permit evaluation of impact of the use of this routing on fish and fish habitats. Since a large portion of the route has already been affected by highways, there would be less affect on wilderness areas when compared to other possible routings. The segment paralleling the Alcan Highway would be disturbed, but most of the area would eventually be revegetated. Construction of the pipeline would represent a temporary loss of habitat for small mammals in contrast to the permanent habitat loss that accompanied construction of the highway. Thus, the impact to animals along the highway would be less than the impact to animals in previously undisturbed areas.

Arctic Gas.—The pipeline along the proposed route should have only a few unavoidable adverse effects on fish populations, if known and planned mitigating measures are successfully employed.

Most mammal species should be little affected along the proposed route if planned mitigative measures are employed. Winter construction would avoid contact with the Porcupine caribou herd if construction were halted in advance of the spring migration and no barriers to movement were left. Control of fire-arms and prohibition of hunting would remove a principal threat to game animals in the Arctic and Subarctic. Planned right-of-way alignments avoiding denning sites of wolves, foxes and grizzly bears along northern parts of the route will remove some of the principal threats to these species.

Adverse effects would be expected on such vulnerable species as wolverine, grizzly bear, and polar bear and to tundra populations of wolf in the Yukon and Northwest Territories. Although most potential adverse effects would be avoidable, noise disturbance by aircraft, harassment, and increased hunting pressure by hunters who benefited by increased accessibility of the area would be continuing threats to game animals and to the subsistence of Native peoples.

Use of the proposed route would adversely affect bird habitats on the right-of-way and in areas occupied by permanent facilities but the areas would be small relative to the total habitat resource.

Disturbances to migrating, nesting, feeding, molting and staging waterfowl and shorebirds and disruptions to the habitats used for these functions would be potential adverse effects at one time or another over essentially the full length of the proposed route. Especially critical habitat occurs along the MacKenzie River, in its delta, and along the shores, estuaries, lagoons and barrier beaches of the Yukon coast. Local summer construction of facilities, summer marine, river and air transportation, and noise of all kinds present throughout the operational period of pipeline, would be disruptive to waterfowl and shorebirds.

(*f*) *Economic Factors*

Fairbanks Corridor—Alaska.—The economic impacts of the Fairbanks-Alaska alternative route as developed by the University of Alaska econometric model (Scott, 1975) include: a property tax of $44 million, construction employment of 6,845, a capital value (pipe and compressors) of $2.2 billion, an increase in gross state product of $249.7 million, a total state employment effect of 23,900, an increase in real wages and salaries of $199.6 million, population growth of 33,400, an addition to personal income statewide of $572.7 million with an increase in per capita income of $463, and a total addition to state revenues of $156.5 million. All figures are projected to 1980. The concentration of pipeline construction supervisory and logistical function in Fairbanks should result in an increase in the average income level. The incomes of local natives will be bolstered by continued pipeline construction.

Fairbanks Corridor—Canada.—Construction of a pipeline would generate a relatively small overall net increase in population. Tourism, sport fishing and hunting and mining would probably have a greater impact on population than the proposed pipeline. Construction and operation of the pipeline will contribute significantly to the established communities diremctly along the corridor. The infrastructure already existing along the Alcan Highway would be, in varying degrees, already able to support additional activities, and it is probable that upgrading and expansion of existing facilities could be accomplished easily. Increased economic activity should work to the advantage of any existing businesses that currently might be marginal. Without this proposed pipeline, further growth would be dependent on the level of activity in the government, tourism, and mining and mineral exploration.

Arctic Gas.—The proposed project would in some degree have an adverse effect on the desire and/or ability of the Native local residents to follow their traditional hunting-trapping-fishing land-based economy. A trend away from the land-related pursuits toward a wage economy, however, has already been established in many parts of the proposed route region. Therefore, in general, the proposed project could not be regarded as an initial cause, but it might be a potent factor in augmenting and accelerating this trend.

Some adverse effect, due to unemployment, might result in the post-construction phase of the proposed pipeline project when the labor force required would be only a small fraction of that needed during the peak years of construction. Other secondary activities in gas and oil exploration and development in the MacKenzie region might materialize and provide continuing employment for those displaced from jobs following the projected peak construction period.

(*g*) *Sociological Factors*

Fairbanks Corridor—Alaska.—Sociological impacts will range from beneficial impacts such as cultural opportunities because of greater demand, to such adverse impacts as increased in crime, lower standards of housing, greater traffic problems, and an accelerated rate of decline of Native culture. Sociological impacts along the Fairbanks Corridor may be considered less disruptive than other alternative pipeline routes, because few communities not already affected by the Alyeska pipeline will be involved. Fairbanks currently serves as a major regional center for health care.

Fairbanks Corridor—Canada.—The approximately 12,500 population along the Fairbanks Corridor in Canada was distributed in 1972-1973 as follows: Whitehorse 11,100, Watson Lake 555, Teslin 340, Haines Jct. 190, Carcross 190, Beaver Creek 120, Burwash Landing 65, Destruction Bay 80. It is reasonable to assume that, if the proposed pipeline were built in this corridor, there would be a moderate population increase, at least temporarily, in addition to that which could be projected in the absence of any major new project. This would be generated by increased demands for services and recreation. The continuing need for an operational staff for the proposed pipeline could result in increased employment for the local residents or a migration of people from other areas seeking jobs, or both.

The impact of the project on housing and secondary service facilities is difficult to assess in the absence of a survey of existing facilities. The quantity and quality of existing housing in this region is probably no more than adequate for present needs, and more housing would be needed to accommodate even a small population increase. The need for more or better service facilities would vary depending on the communities and particular business. Expansion of at least some facilities would be needed in many of the communities.

Arctic Gas.—To some degree the various activities directly and indirectly associated with the proposed pipeline project would be likely to result in significant relocation and concentration changes in the population of the northern regions, as well as in the net total increase. Depending upon how these situations were handled, what the attitudes of the local residents would be at that time, and what one's opinion is of such a change, these changes might or might not have an adverse impact.

(h) Land Use

Fairbanks Corridor—Alaska.—There is no comprehensive land use plan for lands traversed by the Fairbanks Corridor route. Since it is located within an area already dedicated to transportation, it can be assumed that construction, operation and repair of the Fairbanks Corridor pipeline system will not change land use in the immediate area. The entire length of the route from Prudhoe Bay to the United States-Canada border is accessible by road. No existing national park, forest, wildlife refuge, or wild and scenic river areas are involved. Approximately 10 miles of the route near the Canadian Border is within the proposed Wrangell Mountains National Forest; the route would also traverse a proposed waterfowl refuge near Tetlin. No other proposed forest, national parks, refuges, or wild and scenic rivers are known at this time. No areas of potential wilderness are involved.

The approximate land ownership on the route is shown on the following table:

Ownership	Miles	Percent
Federal Utility Corridor [1]	360	49
Proposed Wrangell Mountains National Forest	10	1
Military and other Federal	89	12
State	[2] 252	35
Native	24	3
Total	735	100

[1] Occupied by Trans-Alaska Oil Pipeline System.
[2] Much of area has been transferred to private ownership.

Throughout the state, substantial portions of land are being transferred to the State of Alaska under the provisions of the Alaska Statehood Act. Similarly the Alaska Native Claims Settlement Act provides for transfer of land and minerals to Alaska Native Regional and Village Corporations. Both land transfer programs are still in their infancy. Any additional right-of-way required for the proposed pipeline will be acquired in accordance with these statutes, or as provided by the established procedures of the Bureau of Land Management.

Fairbanks Corridor—Canada.—General land-use patterns would be little changed if a gas pipeline were to be constructed in the Fairbanks Corridor. The major impact during the life of the project would be the dedication of sites for compressor stations, some borrow pits, and communications facilities to pipeline-related uses for the duration of the project. Impacts during construction would include withdrawal of the right-of-way from other uses as well as the use of borrow pits and quarries that would not be needed for maintenance. Additional possible impacts during construction would be crowding of existing highways by additional traffic and changes in breeding and foraging habits of game animals, both of which might affect tourism.

Arctic Gas.—Most of the 43,060 acres that would be used during the construction and operation of a gas pipeline is not under extensive development. Should the proposed project be adopted, the right-of-way (120 feet wide), the land occupied by borrow pits and quarries and by road that served only the project, and the land occupied by compressor stations, communications sites, material marshalling areas, wharves, and the like, would be committed during the construction phase of the project. After construction has been completed, much of the right-of-way and all temporary facilities, including borrow pits not needed for maintenance, would be available for nonpipeline-related use.

Prior to the construction and operation of any pipeline in Canada, it will be necessary to submit an application for "grants of interests in territorial lands" to the Department of Indian and Northern Development of the Government of Canada.

(i) Archeological and Historical Factors

Fairbanks Corridor—Alaska.—Remnants of Alaska's early history are scattered along the route. The locations of many of these sites are well known and protected. Some of the sites in the Fairbanks vicinity have been entered in the National Register of Historic Places. The adverse impacts of the proposed pipeline on these sites could be negligible if minor route alignment changes are made. Several, still visible, old trails would be crossed. Although only short segments of such trails would be disturbed, the visual and aesthetic impact to people using the trails could be adverse. The exact locations of some former trading posts and old villages are unknown. If studies presently being made fail to find these, the areas would need monitoring during clearing and construction for the pipeline. As workers and others move north of the Yukon, vandalism and artifact hunting probably will increase in old mining areas such as Wiseman. This could cause a significant impact if old buildings or artifacts were destroyed or removed.

Some archeological sites have been identified near the route. In general, however, the extent of impact on the archeological and paleontological resources along the route is not known and cannot be assessed until a right-of-way survey is completed.

Surface surveys along the trans-Alaska oil pipeline already show that many sites exist and that the country is quite rich in both archeological and paleontological sites. For example, in the section between Livengood and Prudhoe Bay, 189 sites are listed.

Potential impacts of the system on prospectively valuable archeological areas include: destruction of sites without scientific investigation; destruction with partially completed scientific investigation; vandalism of unexcavated, partially excavated, or accidentally opened sites, and removal of artifacts (surface finds are often of great significance in the Arctic).

Archeological values may have an adverse impact on the completion of the system. Provisions of the National Historic Preservation Act of 1966, Executed Order 11593. and the Archeological and Historic Preservation Act (P.L. 93-291) require archeological values to be identified and protected. Thus, it is possible that the pipeline may be rerouted within the approved corridors to comply with this Act.

Fairbanks Corridor—Canada.—Because so little information on archeological aspects of the Fairbanks Corridor is available, it is difficult to predict the impact of pipeline construction on the archeological resources of the region. Of course, all phases of construction involving land use could cause loss of, or damage to, archeological and historical resources. Construction of ancillary features such as compressor stations, borrow pits, stockpile sites, and wharves, as well as the excavation of a pipeline trench itself, could destroy potential archeological and historic sites.

Construction of a pipeline along this corridor would not appreciably increase the accessibility of archeological and historic sites because the proposed corridor roughly parallels for most of its length, existing roadways such as the Alaska Highway.

While construction of a pipeline could destroy potential archeological sites, it may also uncover some sites, which could be salvaged by professionals. Any new information thus obtained would probably contribute greatly to knowledge of the prehistoric inhabitants of the region.

Arctic Gas.—The proposed pipeline would traverse the area through which early man is believed to have traveled after crossing the Bering land bridge into North America. Adverse effects on archeological resources along the proposed route would be inversely proportional to the extent and effectiveness of the archeological survey and salvage program. Some unidentified sites would very likely be damaged or destroyed, but their number and value cannot be estimated. Because of the limited knowledge of archeological sites in the Arctic and Subarctic, the potential loss of sites is especially critical.

(j) Recreation and Aesthetic Factors

Fairbanks Corridor—Alaska.—During construction, there would be moderate recreational use of areas along the pipeline by workers. The proposed route will parallel either existing roads or other utilities. It parallels the trans-Alaska oil pipeline from Prudhoe Bay to Delta Junction. Thus, the aesthetic impacts should be considered in terms of adding another pipeline (or utility) to an area already partly disturbed by man (i.e., it is not comparable, to building a pipeline across any area currently undisturbed by man). Because of the existing development along most of this route, the addition of another pipeline will have only minor impacts on the aesthetic values. The Alyeska pipeline already provides private access to the vast area between the Yukon River and Prudhoe Bay. Public access is considered of doubtful benefit. The area north of the Yukon River is so vast that the impact of another pipeline on the total landscape will be small.

Fairbanks Corridor—Canada.—Since the routing is roughly parallel to existing or planned roads for nearly all of its length, pipeline construction in it would have a visual impact on highway travelers. Proper restoration after construction could minimize the impact on tourism, in such areas as Kluane National Park.

Arctic Gas.—In the regions traversed by the proposed pipeline north of 60° N latitude, the main adverse effect on recreation resources would be in the form of landscape scarring from construction of the pipeline and related roads, borrow pits, airstrips, compressor stations, communication sites, wharves, etc. Other landscape scars would result if underlying perma-frost were to be thawed, causing settling and erosion.

The proposed project by itself would have adverse effects on some wilderness areas, notably the arctic coastal region. Of greater importance would be the major invasion of wilderness areas set off by the proposed project. By its roads and right-of-way it would make the land more accessible to those who would come later. It would also stimulate related development in transportation, recreation and industry, as does any large project.

(k) Air Quality

Fairbanks Corridor—Alaska.—With three categoric exceptions air quality along the Fairbanks Corridor route from Prudhoe to the United States-Canada border via the Alaska highway is considered to be very high. Exceptions are as follows:

(1) Prudhoe Bay oil and gas field.

(2) Small towns and population enclaves along the highway between Fairbanks and the border.

(3) Fairbanks with its particular combination of air related circumstances.

Fairbanks Corridor—Canada.—There are highways in practically the whole length of the Fairbanks Corridor. Because of exhaust emissions from mobile and stationary internal combustion engines, air quality is probably lower than in more remote areas in the region traversed and in areas in similar latitudes along the proposed route.

Arctic Gas.—Air quality along the pipeline route will be impacted during construction and subsequently at compressor station locations during operation of the pipeline. Factors which will have an impact are: exhaust emissions from construction equipment engines, dust produced by construction activities and release or escape of gas from the pipeline.

(l) Environmental Noise

Fairbanks Corridor—Alaska.—Data on environmental noise associated with the Fairbanks alternative route are not available. North of the Yukon River the route is closely associated with a transportation corridor for the trans-Alaska oil pipeline and an access road. Adjacent areas, however, are undeveloped and are expected to have little environmental noise other than that produced by nature. South of the Yukon River the route is near an established highway. In Fairbanks noise levels are expected to be typical of a community of comparable size except that Fairbanks has a very high proportion of aircraft use because of its location as a major air center. From Fairbanks southeast to the Canadian border, the route is closely associated with an established highway. Noise associated with construction will be transitory.

Fairbanks Corridor—Canada.—Ambient sound levels are slightly higher than along the Arctic Gas route. Since this routing follows existing highways almost all of its length, existing noise levels are higher along a greater proportion of this corridor than for any of the other corridors and routes. The addition of construction noise to existing highway noise constitute less of an impact than on alternative routes.

Arctic Gas. The construction noise will be short-term and widespread and will produce both indirect and direct noise. The indirect noise impact will be due to the road traffic generated by the project and the direct will be the construction site noise. During operation of the system, the compressor stations will produce continuous and fixed noises which will be long-term and more localized.

O