

HARZA-EBASCO

Susitna Joint Venture
Document Number

2404

Please Return To
DOCUMENT CONTROL

SUSITNA PROJECT

INVESTIGATION MEMORANDUM

TASK 40 - NEED FOR POWER

March 11, 1983

by Harza/Ebasco

SUSITNA PROJECT
INVESTIGATION MEMORANDUM

TASK 40 - NEED FOR POWER

March 11, 1983

Introduction

A brief six-week review of previous studies on the Susitna Project related to the need for power issue has been completed. The review was conducted in the light of recent changes in economic conditions; specifically, the downturn in the demand for petroleum resulting in price erosion, and its effects on state revenues and future electric power demand. The purpose of the review was to determine if the project as proposed in the FERC License Application remains optimal and economically justifiable. Specifically, the review was directed at the following questions:

1. Are the basic assumptions (including economic parameters) appropriate, the methods of analysis logical, and the conclusions reasonable?
2. What changes, if any, in basic assumptions have taken place since the previous work, and how do they affect the optimization of the project, its economic justification and the ability to finance the project?
3. Should the Susitna Project be developed in the same way as planned, particularly in relation to (a) dam height and installed capacity, (b) sequence of construction, and (c) time table?

One area of review focused on the growth of the electric power market which is strongly influenced by petroleum prices and state revenues. An examination of the structure of the MAP (Man in the Arctic Program) and the RED (Railbelt Electricity Demand) computer models was made to assess the program logic as well as the assumptions and parameters used in driving the computer model to produce electricity forecasts. This review led to the conclusion that the power market forecast could be changed with the use of the present models under the current economic conditions. Also, the models should be improved in certain areas to better simulate the economy and the energy scenarios.

Another area reviewed was the estimated capital costs and the energy productions of the Watana and Devil Canyon developments to determine how the project cost might be reduced by developing a smaller Watana Project, or by developing Devil Canyon first. If the dam were lowered, the project cost could be reduced with a corresponding reduction in energy production. From this brief review it was determined that the unit cost of energy would remain the same if the dam were lowered 85 or 185 feet. Furthermore, the unit cost of energy from the Devil Canyon development appeared to be competitive. Since the proposed Watana development has a very long construction period (nine years) and involves high capital cost, a smaller project

with the same unit cost of energy and lesser construction time might be the optimal choice and could be financially sound.

A third area of interest concerned the transmission system which constituted a significant portion of cost of the initial development of the Susitna Project. With rapid load growth and development of the Watana-Devil Canyon complex within a few years of each other, a solid transmission system would be in order. If the load growth were leveled out, and a smaller initial development were to take place, a scaled-down transmission expansion in tune with the growth of the generation system would be appropriate.

Finally, the present downturn in the petroleum price could lead to a leveling of other forms of energy. Since the Susitna Project was justified largely in comparison with thermal-electric energy production, the economic attractiveness of the Susitna Project could diminish if the outlook in natural gas and coal costs was lower.

The above observations have been made through a review of existing reports, discussions with personnel involved in previous work, consultation with the Power Authority, and brief analysis. None of the above results are conclusive or precise, nor have they been developed from rigorous analysis. However, they do point toward the need for a thorough and complete update of the Need for Power study. The program outlined in this Investigation Program has been designed to accomplish this reevaluation.

Objectives and General Scope

The Need for Power Update Study has two principal objectives:

- Update of the electric power and energy demand of the Railbelt.
- Optimization of the Susitna Project, reviewing its technical feasibility, economic attractiveness, and financial soundness.

The study will encompass all areas of concern relating to the need for power issue which must be resolved. The study will utilize all available information that is in the present FERC License Application and supporting documents together with the ongoing work of Harza-Ebasco Susitna Joint Venture. In addition all recent published studies will be incorporated. A list of these publications is given as Attachment 1.

Organization and Personnel

Project Organization

The study will be performed by a Study Team under the overall guidance of the Susitna Management Group with principal office in Anchorage:

Project Manager	R.S. LaRusso
Engineering Operations	A. Zagars
Environmental Operations	G. Lawley
Project Administration and Control Operations	M. Soniker

Study Team

The personnel participating in the Need for Power Study are:

Task Leader	Henry H. Chen
Subtask Leaders:	
Power Market	E.C. (Ned) Lesnick
Project Optimization & Justification	William P. Kohl
Financial Analysis & Model Contract	George V. Volland
Sr. Energy Economist	David Augustine
Economist	William B. Hutchinson
Energy Economist	Bruno Trouille
Energy Economist	David Tillman
Hydro Planner	Nick Pansic
Transmission Planner	Peter J. Donalek
Transmission System Analyst	John Szablya

Assistance From Other Task Members

Assistance in project layouts, cost estimates, and project schedule will be required from Task 3 personnel including A. Zagars, D. Ruotolo, J. Straubergs. In addition, assistance will be needed in the area of cost estimating (R.D. Hilliard), construction planning (S. Hjertberg), electrical and mechanical (J. Quinn, R. Burkhardt), telecommunications and energy management (R. Kuntzendorf), project operation and maintenance (M. Schuchard), geotechnical (N. Tilford, R.C. Acker), and arch dam conceptual design (R.P. Wengler).

Assistance in the environmental assessment of project alternatives will be required from Task 4 personnel under

G. Lawley. W. Kitto and E.F. Dudley will provide interfacing between engineering concerns and environmental input and mitigation with input from other environmental team members.

Subcontracts and Consultants

We expect to engage the services of several consultants under subcontract to Harza-Ebasco Susitna Joint Venture in implementing the study as follows:

- a. Alaska Economics, Inc. (David Reaume) - future economic growth of Alaska.
- b. ISER, University of Alaska (Scott Goldsmith) - improvement of MAP (Man in the Arctic Program) computer model in forecasting future economic/demographic condition of Alaska.
- c. Battelle Pacific Northwest (Mike Scott) - improvement of RED (Railbelt Electricity Demand) computer model in forecasting electric power market.
- d. Erickson & Associates (Gregg Erickson) - forecast of availability and cost of Cook Inlet gas.
- e. Acres American Incorporated (Chuck Debelius, John Hayden, Phil Hoover) - running OGP computer model for generation planning, and general assistance in interfacing between License Application study and the present updating.

Alaska Power Authority

The Power Authority is keenly interested in the timely performance and positive results of every aspect of the study. Subtask Leaders are encouraged to provide informal progress briefings to the Power Authority, and to obtain guidance and policy decisions from the Power Authority. The Power Authority may also direct the Harza-Ebasco Study Team to interact with other state agencies such as the Office of the Governor, Alaska Power Administration, etc. Personnel of the Power Authority having direct responsibility on this task include:

Project Manager	Robert Mohn
-----------------	-------------

Deputy Project Manager	David Wozniak
------------------------	---------------

Other Power Authority personnel who may be consulted on this Task include:

Project Operation, Utility Coordination	Myles Yerkes
--	--------------

Healy-Willow intertie	David Eberle
-----------------------	--------------

Comparative Environ- mental Impacts	Richard Fleming
--	-----------------

Methodology and Schedule

The following descriptions of the methodology and schedule are designed to enhance the present study to the level of a feasibility study within the scheduled time period. However, because the time schedule is compressed in relation to the work scope, it might be necessary to

take short-cuts and make assumptions on certain study items which might have to be confirmed through more detailed analysis at a later point. In any case, the overall quality of the work will not be sacrificed. Also the time schedule is dependent on the consummation of sub-contract agreements and their timely performance. If, for any reason, the time schedule cannot be met, the problem will be taken up first with the Task Leader, then the Project Manager, and finally with the Power Authority.

The methodology has been based upon the information that is available at the present time. Since the study is of a planning nature, the results of each step of analysis might differ from those expected. Consequently, it might be necessary to revise the study approach or to change the level of effort in a commensurate manner.

Deliverables

The following deliverables in the form of reports will be provided to the Power Authority:

- | | | |
|----|------------------------------|----------------------|
| 1. | Investigation Memorandum | March 14, 1983 |
| 2. | Basic Economic Planning | |
| | Criteria | April 8, 1983 |
| 3. | Report Content and Outline | April 15, 1983 |
| 4. | Power Market Report | May 16, 1983 |
| 5. | Summary Comprehensive Report | May 23, 1983 |
| 6. | Appendices | May 31-June 30, 1983 |
| 7. | Supplements | July 1-Aug. 31, 1983 |

This Investigation Memorandum provides the objectives and scope, work program, methodology, organization and personnel, and time schedule.

The report on Basic Economic Planning Criteria will document the basic assumptions about the future economic scenarios that will be used in developing the power market forecast and in performing the economic analysis. Included will be projections of future petroleum prices and state revenue forecasts. Principal economic parameters will also be included, e.g., interest rates, real escalation rates, and discount rates used in economic and financial analysis. The relationship of all such economic parameters with one another, and their effects, either singly or in combination, on such cost components as material, labor, and fuel will be established - to ascertain that consistent assumptions are made in developing costs for a given set of parameters.

The Report Outline will provide a detailed Table of Contents, key words under each heading, list of exhibits, and tables. The Report Outline will provide a list of appendices and supplements which might accompany the summary report.

The Power Market Report will document all study elements which lead to the updated power market forecast including the analysis of basic economic/demographic data, projections of future major developments, projections of

prices of petroleum and state revenues, projections of total energy and electrical energy demand and the use of the computer models in making such projections. The sensitivity of the demand projections will be treated in the report.

The Summary Comprehensive Report will cover all major study areas, study results, conclusions and recommendations. The Summary Report will provide, as a minimum, an overall recommendation as to the specific projects to be built, the plan of development of the Upper Susitna River, estimated costs, economic justification and a possible financing plan. The most competitive non-Susitna alternatives will also be presented and discussed. The results will be presented to reflect how they change with changes in economic parameters.

Each of the appendices will cover a study subject which can be treated separately and serve as a contribution to the Summary Report.

Supplemental Reports may be required in certain areas or prepared upon request for clarification by the Power Authority. These reports will be prepared on an as needed basis.

Work Assignment

Our tentative work assignment is separated into Task 40A Power Market Forecast and Task 40B Project Optimization and Justification and Financial Analysis. The study elements are given below:

	<u>Work Item</u>	<u>Harza/Ebasco</u>	<u>Subcontract</u>
A-1	Review remaining reports, data	All	
A-2	Resolve economic/baseline data	Lesnick Hutchinson	Reaume
A-3	Visit utilities	Lesnick Trouille Volland	
A-4	Visit other agencies for projection purposes	Lesnick Augustine Hutchinson	
A-5	Assess non-electric energy demand	Augustine	Erickson
A-6	Analyze energy conservation	Lesnick Tillman	
A-7	Improve RED model	Lesnick Trouille	Battelle
A-8	Forecast future economic growth	Lesnick Hutchinson	Reaume ISER
A-9	Forecast total energy and electric energy growth	Lesnick Augustine Trouille Tillman	Battelle
A-10	Forecast monthly distribution of electrical peak and energy demand	Trouille	
A-11	Conduct sensitivity analysis	Lesnick Augustine Trouille	ISER Battelle

A-12	Reports on power market forecast	All above	
B-1	Review remaining reports, data	All	
B-2	Utilize computer models	Pansic	
B-3	Delineate economic and technical (generation, transmission) criteria	Chen Lesnick Kohl Volland	
B-4	Analyze cost and availability of fuel	Augustine Tillman	
B-5	Refine thermal alternatives	Augustine	
B-6	Screen Susitna alternatives	Kohl Pansic	
B-7	Optimize selected Susitna alternative	Kohl, Hilliard, Zagars, Ruotolo, Straubergs	
B-8	Delineate other hydro alternatives	Kohl Pansic	
B-9	Delineate transmission system	Donalek Szablya	
B-10	Formulate and analyze expansion programs	Kohl Volland Pansic	
B-11	Perform computer runs (OGP)	Trouille Pansic	Acres
B-12	Perform economic justification	Kohl Volland Trouille	
B-13	Develop model contract	Volland Carter	
B-14	Perform financial analysis	Volland Carter	Acres
B-15	Reports on economic and financial justification	All above	

Work Scope for Task 40A - Power Market

A-1 Review Reports and Available Data

This task represents an on-going activity to update information and data made available after completion of Step 1 (Initial brief review). For example, a final draft version of the DEPD's 1983 Long Term Energy Plan may be issued in a month or so with revised data. Also, numerous reports such as ISER's model documentation report and summary report on their economic development projections will be reviewed.

A-2 Resolve Economic, Demographic, and Energy Baseline Data

The existing data base at the end of Step 1 will be expanded to include 1981 and 1982 data made available during Step 2. For example, ISER will have to update their employment data from the Department of Labor to obtain a complete set of 1982 preliminary monthly data. Also, ISER needs to examine their method of relating employment to population which differs from that used by the Department of Labor before projecting population.

Energy balances for the two major load centers to be served by the Susitna Project will be refined based on additional information made available during Step 2. A review and analysis will be made of more recent data on daily, monthly, and annual load curves for each load

center. Load shapes of electric demand will be developed. The responsiveness of loads to weather, time-of-use characteristics and other parameters will be identified and analyzed. Load and net generation data for 1982 and updated forecasts will be obtained from the Alaska Power Administration or Alaska Coordinating Council.

A-3 Visit With Electric Utilities

Visits with Railbelt electric utilities are needed to obtain utility load and energy profile data; generation and transmission system data; existing tariffs and rate schedules; power purchase agreements; conservation and load management efforts; and fuel contract information. Because some of the data are available from the Alaska Public Utilities Commission (APUC), the APUC will be contacted first to avoid duplication of effort on the part of the electric utilities. Because some utilities such as Fairbanks Municipal Utility Systems are not regulated by APUC, personal visits are essential. It might be necessary to make several visits to the Railbelt utilities to deal with different aspects of the study.

As a part of the Subtasks for Economic Justifications and Financial Analysis, Railbelt utilities will be contacted with respect to their views how power from Susitna plants can be integrated with other plants in their systems and more specifically, the approach of dispatching

the generating plants for base load, peaking operation and spinning reserve purposes. Discussions will be held and data collected to assess the present operation and use of the existing plants, their conditions, and statistics on the performance of the power plants. Discussions will be held as to the specific design criteria which should be imposed on the Susitna or other power plants.

A-4 Visits With Other Agencies For Projection Purposes

A number of visits to public and private agencies are necessary to obtain information for performing economic projections or to obtain alternative projections for purposes of comparison. In addition to data acquisition, these meetings will provide a forum to gather the opinions of key individuals and to incorporate their ideas, opinions and insights to the extent possible. Visits with the Department of Revenue, Department of Energy and Power Development, Department of Natural Resources, Office of Management and Budget, and other Federal and State agencies will be made. Also, energy developers in the private sector will be contacted such as Enstar Natural Gas Co., Placer Amex, Inc., Diamond Shamrock, etc. In addition, the Alaska Oil and Gas Association and other industry related affiliates will be visited.

A-5 Assess Non-Electric Energy Demand

An assessment of the demand for natural gas, coal and oil in Alaska will be made taking into consideration prospective fuel prices, resource availability, inter-fuel substitutability, changing technology, financial requirements, market penetration, and other constraints such as infra-structure or environmental requirements. The assessment will include an examination of foreign demand for Alaskan coal, oil and gas based on available data and studies. A model will be developed to estimate gas prices in Cook Inlet as a function of usage over time. Also, an estimate of North Slope gas prices will be made.

A-6 Analyze Energy Conservation

The purpose of this task is to ensure that all available data and information about conservation of energy programs sponsored by utilities or state agencies or trends in consumer preferences for energy saving appliances have been collected, analyzed and factored into the electric demand forecasts. Battelle Pacific Northwest Laboratories will be used as a sub-consultant to assist us in this effort which may result in improvements to the RED model as covered in Task A-7. The data collected from utility visits concerning conservation potential will be assessed. This data would include not only specific utility sponsored energy conservation programs in the home

and businesses but the effect of electricity rates and structure on electric power requirements of customers. In this effort, recently available information on the building stock and energy efficiency of appliances will be gathered and factored into the analysis.

A-7 Improve RED Model

Before the Railbelt Electric Demand (RED) model is used to forecast electric loads and energy, a number of concerns about the RED model will be addressed. More specifically, the task includes: (1) clarification about certain areas of model documentation and use of model components; (2) reasonableness of certain parameters and model assumptions as well as results (for instance, the appropriateness of the adopted price elasticities); and (3) enhancements or refinements to RED model (such as inclusion of improvements in energy efficiencies of appliances and energy conservation). To achieve the task goals, Battelle will be requested to serve as a subconsultant for Harza-Ebasco Susitna Joint Venture.

A-8 Forecast Future Economic Growth

We will first review previous assumptions made on future economic growth and major capital intensive projects such as the Alaska Highway gas pipeline, the Pac Alaska LNG project, and future exploration and development

of the outer continental shelf. The possibility of a major decline in oil revenues and the direct effects such a decline would have on the Alaska economy will be analyzed. The quantitative effects of the actual and projected changes in state and private spending will also directly affect overall growth of the Alaskan economy as well as socio-demographic change. The assumptions made in the previous reports will be reviewed, updated, and used in the selected models. The Department of Revenue will be requested to assist in developing revenue forecasts under specific scenarios in oil price projections.

The forecast of future economic growth will be based on the results of Task A-2. Task A-8 will require the efforts of ISER, Alaska Economics, Inc. and Harza-Ebasco Susitna Joint Venture.

A-9 Forecast Total Energy and Electric Energy Growth

As a result of the review and update of the economic projections and the costs of various forms of energy, the economic end-use models will be used to forecast the total energy and electric energy consumption, for each of the major load centers. Because it requires assumptions as to what type of energy development plan will be eventually adopted, each energy forecast will adopt a specific set of assumptions.

The forecast of total energy will reflect the results of Task A-5. Battelle will assist us in running the RED model to forecast electric energy and demand growth in the Railbelt.

A-10 Forecast Monthly Distribution of Peak and Energy Demand

The assumptions and methodologies used in previous studies will be reviewed. Based on this evaluation, we will recommend, if necessary, alternative methods to evaluate monthly distribution of peak and energy demand for each load center. The sub-regional energy demands will then be aggregated to derive regional demands. Pertinent factors such as diversity and load factors on regional bases will be developed.

A-11 Conduct Sensitivity Analysis

Both the relationships between causal factors and their impacts on energy consumption and also the projections into the future of the causal factors themselves are subject to uncertainty. The relationships between causal factors and electricity consumption, and the factors influencing projections of causal factors, will be analyzed by producing a range of forecasts based on varying combinations of alternative levels of major causal factors.

The methodologies used in previous studies will be reviewed, and, if necessary, other procedures will be proposed. The set of possible forecasts based on alternative levels of the major causal factors could be produced using decision analysis and judgment with respect to the assignment of probabilities of the alternative levels of the causal factors. The results of the analysis would be combined with the base forecasts to produce a reference forecast and an entire set of alternative forecasts with associated probabilities.

These analyses will involve computer simulations using MAP and RED models. As a consequence, ISER and Battelle will be asked to assist as a part of their scope as sub-consultants.

A-12 Reports

A final report will be prepared to document the studies under Task 40-A. In addition, separate memoranda will be prepared in advance of the final report to cover each subtask or combination of subtasks and to meet deliverables.

B-1 Review Previous Studies

A review of the final FERC License Application and other supporting documents will be undertaken specifically for the purpose of:

1. Identification of alternative hydroelectric projects, and for each project, review of the selection of reservoir elevation in the feasibility study.
2. Optimum sequencing of projects.
3. Consideration for staged development.
4. Alternative thermal generation plans.
5. Power market forecast for use in study of alternative generation expansion plans.
6. Estimated costs for power development alternatives.

The basic alternative schemes for the development of the Susitna basin will be delineated. Those alternatives which have been eliminated because of some overriding external factors, such as environmental or geotechnical considerations, will not be included. Site layouts and cost estimates will be extracted from previous reports. Alternatives which appear to be favorable will be carried through for more rigorous analysis.

B-2 Utilization of Computer Models

We will use a reservoir operation model to determine firm and average energy of the hydro system. Then a hydro dispatch model will be used. The results will be used to drive General Electric's Optimum Generation Planning (OGP6) model. This model will be used to determine energy availability at each reservoir for the various staging alternatives. The model will also be improved to provide information required for environmental assessment.

The OGP6 model will be used in the various expansion plans, relying on data generated from the simulation models.

Analyses using the generation expansion model will result in a list of the most feasible expansion plans. It may be necessary to employ a production cost model which examines the operation of the hydro-thermal system in greater detail. The program will operate the generation system for various time periods (hourly, daily, monthly) and will have the capability of operating the hydroelectric plants recognizing the effects of streamflow regulation and reservoir drawdown, and thermal generation mix.

B-3 Delineate Economic and Technical Criteria and Power Market Forecast

The evaluation of alternative future electric generation plans is largely based on forecasts of project costs

and electric power demand. These elements can be predicted with some degree of accuracy for the near term, but are less than certain for the long term planning horizon.

The proposed work plan includes a careful review of the criteria such as discount rates, real escalation rates and period of analysis. The economic criteria to be incorporated in this study will be based on current guidelines of the Power Authority, acceptable industry standards, after consultation with the Power Authority and other appropriate agencies.

Power generation and transmission requirements will be analyzed taking into consideration the location of load centers and alternative interconnection plans. Generation reserve and transmission system reliability will be tested in terms of costs and performance criteria and a standard will then be established for planning purposes.

Electrical power demand forecasts may also be affected by the price of energy which in turn is dependent upon the power generation resource plan. Therefore, it may be necessary to vary the demand forecast according to the generation plan under consideration.

Criteria will be established for use in the analysis of various expansion plans and staging of alternatives. A set of criteria will be delineated for use in baseline comparison of all alternatives. Additionally, certain parameters will vary by specified amounts to test the sensitivity of the results to various changing economic conditions.

B-4 Analyze Cost and Availability of Fuel

This work item will address the extent of existing supplier's resources, costs and existing supply contracts. Reserves in the Railbelt region, and future development and supply costs will be assessed. The costs of development of new coal fields will be analyzed and factored into estimates of the cost of the fuel. Finally, fuel costs for use in the analysis will be specified in terms of high, low and most likely values, as a function of demand.

Specifically, the price and availability of Cook-Inlet Gas will be addressed based on available data on gas reserves, proven and otherwise, and information obtained through gas producers, transmission, and distribution companies. Existing and potential future sources of demand will be assessed in relation to competing fuel resources. Further, the probable price range of North Slope gas will be determined based on an analysis of the demands for such gas and development constraints. Current utility negotiation for Beluga gas will be factored into the analysis. A model will be developed to forecast Cook Inlet gas usage by utilities and other customers, and the resulting blended fuel costs to the utilities. Also, old gas contracts will be reviewed and the implication of extension provisions, if any, assessed.

In addition, gas, oil and coal demands in Alaska and for export will be examined in order to determine relative fuel prices in future periods given the limitation of the data. Developers of such resources will be contacted for information and to incorporate their opinion about potential developments and prices. World oil prices will be monitored to contrast with assumptions made for project analyses.

B-5 Refine Thermal Alternatives

The Step 1 study identified coal-fired steam, natural-gas fueled combined cycle plants and simple cycle combustion turbines to be the most attractive thermal option for the Railbelt system. These plants will be studied further and the present cost estimates will be reviewed and refined if necessary to recognize location, air pollution abatement and other factors.

B-6 Screen Susitna Alternatives

A review of the previous studies on the identification, screening, and comparison of alternative Susitna schemes will be conducted. The review will be directed towards confirming whether or not the Devil Canyon - Watana developments still remains the most favorable scheme when compared with other Susitna alternative dam sites. The review effort will therefore be an update process, but will recognize the merits of a smaller development.

A review will be given to the High Devil Canyon and Vee developments which appeared from previous studies to be attractive. In this screening process, choice of site, layouts, cost estimates, environmental considerations and energy generating capabilities will be checked and updated.

The environmental implications of alternative Susitna development schemes will be evaluated. Optimization or modification of the project arrangement as presented in the FERC license application may result in changes in anticipated project impacts. Relative impacts of each alternative scheme will be compared.

Potential effects of the alternative schemes on project licensing and permitting schedules will also be considered.

B-7 Optimize Selected Susitna Alternative

It is assumed that the previous task will lead to the selection of the Watana and Devil Canyon developments as most favorable. To save time, refined work on the two developments will be performed concurrently. This will involve alternative layouts, cost estimates, and schedules of the following:

		<u>Units</u>
Watana El. 2185	(Fill Dam, Arch Dam)	4
Watana El. 2100	(Fill Dam, Arch Dam)	4
Watana El. 2000	(Fill Dam, Arch Dam)	4
Devil Canyon El. 1455	(Arch Dam)	4

For the low dam Watana schemes, studies will be made to determine if the dam could be designed to be raised in the future. (This study will not, however, take priority in terms of the deliverables before June 30, 1983 if such work cannot be done conveniently.)

Reservoir drawdown levels and rating of units will be established from operation studies.

A critical review of the present cost estimates will be done, as the basis for the development of new cost estimates.

Project schedules will be established.

The level of effort of this work will be to develop reliable layouts and cost estimates for project optimization purposes. Definite project layouts and preliminary design of selected project layout will be scheduled later, beyond June 30, 1983.

The layouts of Watana and Devil Canyon will be adjusted to reflect which project will be built first.

B-8 Delineate Other Hydro Alternatives

Other hydro alternatives not in the Susitna Basin will be included in the study. Estimates of power and energy potential with the corresponding capital cost estimates given in existing reports will be reviewed, modified where necessary, and updated for use in the study. Data from the more promising alternatives will be included in the system expansion studies (possibly Chakachanna).

B-9 Delineate Transmission System

The existing transmission system will be reviewed. Transmission performance criteria will be established for planning purposes based in part on the cost of providing redundancy.

New transmission connections will be developed to bring power from generation alternatives to the load centers. These transmission connections will be utilized to develop rational expansion plans for the entire interconnected system, based on the preferred generation expansion plans developed in previous studies.

This work will be done concurrently and following B-10 generation expansion, as additional favorable expansion plans are developed.

B-10 Formulate and Analyze System Expansion Plans

The system expansion plans will be developed along the following major lines:

- Susitna Plan
- Non-susitna Plan

Under each basic plan, it may be necessary to consider integration of alternating types of generation. For instance, thermal plants will be added to the Susitna plan, and the non-Susitna plan may consider non-Susitna hydros.

B-11 Perform Computer Runs and Analyses

The computer models referred to in B-2 will be activated to formulate and analyze alternative system expansion plans with the basic plans given above. This will probably require two separate levels of analysis.

As the more favorable expansion plans are developed from a larger set of alternatives, the preferred alternatives will be subjected to more study, adjustment, and refinement, including the testing of transmission system configuration, and different levels of reliability.

Once the most feasible expansion plans have been identified, it will be necessary to carry out a detailed simulation of system operation. The expansion model does not have the capability to take into consideration fluctuations in hydroplant capacity with changes in reservoir elevation during the drawdown period, and for this reason, a simulation of system operation is necessary. The simulation will address the subject of daily and hourly operation and demonstrate the system's capability to meet loads on a hourly basis. The detailed simulation of system operation will enable accurate calculation of system operating costs.

The analysis will address the question of interconnection between the regions. The Susitna development alternatives or the thermal alternatives involving large capacity plants would necessarily require interconnection to utilize the capacity in the early years of project operation.

The results of the analysis will be tested for various changes in basic parameters, such as the changes in construction cost, fuel cost, discount rate and load forecast. The proposed work plan includes an analysis of the generation expansion plans under various scenarios of cost, load growth and discount rates.

B-12 Perform Economic Justification

The foregoing analysis leads to the evolution of the most competitive expansion plans. The first major project under the single most competitive expansion plan should be the project to be recommended. For purpose of discussion, it is assumed that the analysis will lead to the identification of the Susitna Project as that project.

This Susitna Project will then be tested and further optimized as to configuration, timing, and sequence using the best non-Susitna plan as the basis for this test, and the "medium" or most-probable load forecast as the base power market forecast.

The selected plan will be tested against a selected set of changes in basic parameters including:

- changes in power market
- changes in cost of fuel
- changes in real interest rates and discount rates

The above tests will determine how the selected plan and project might be revised in case of any changes in the future to remain economically viable.

B-13 Develop Model Contract

A model power sales contract will be developed after consultation with the utilities. The sales contract will recognize the sale of capacity and energy under various water supply conditions of the Susitna Project, utilities' own generating capability in relation to demand, and its operation and fuel costs.

The contract will be established to promote maximum benefits to the interconnected system by providing necessary incentive to the utilities to take the power and energy while maximizing revenues to the Power Authority.

B-14 Perform Financial Analysis

An existing financial forecasting model will be utilized to perform the analysis. The analysis will be done in 1983 dollars as well as in current dollars.

Capital requirements and Cash Expenditures. First the construction schedule and the timing of major contracts will be established to develop cash flow expenditure tables. Inflation rates that were used in the previous studies will be reevaluated in accordance with the Alaska Power Authority guidelines and responsible projections. The study will be done on a year-by-year basis over a 20 to 35 year time period as appropriate.

Source and Applications of Funds. A range of financial options has already been considered and analyzed in

the feasibility report and other financial documents. These options will be reviewed with the Alaska Power Authority's financial advisers. Based on the results of this review, we will develop various financial plans that are feasible and suitable to meet the financial requirements of any plan. Tables will summarize the sources and applications of funds. Among these plans we will assess:

- Appropriations by the State of Alaska;
- Tax exempt revenue bonds, and the legal aspects related to compliance with the IRS Code;
- General obligation bonds and other revenue bonds;
- Suppliers' credit;
- Revenue from sales of power and energy.

The Power Authority will provide guidelines in terms of the probable range of funding from each source. We will optimize the utilization of these funds to arrive at reasonable costs to the customer. This optimization will be subject to the various constraints that apply to each source of funds. Detailed tables will summarize the year-by-year analysis through the construction and operating periods of each development (Watana and Devil Canyon).

Balance Sheets. Balance sheets for each development and the total project will be developed. A breakdown of the equities and liabilities will be presented. Financial ratios such as debt service ratios, profit and loss ratios, and internal cash generation ratios will be computed and analyzed.

B-15 Reports on Economic and Financial Justification

A summary report documenting the major study results, findings, conclusions and recommendations will be prepared. The report will include a recommendation on the most favorable Upper Susitna Project, sequence and timing, economics and financial implications. Recommendations on further work including definite project feasibility studies will be outlined.

Appendices documenting in detail each separable study task with supporting data suitable for independent review will be prepared following the preparation of the summary report.

PARTIAL LIST OF REFERENCES

The following is a partial list of references relevant to the current study. Reviewers of the Investigation Memorandum are requested to submit any other recent relevant documents for review and analysis by the study team.

Acres American Incorporated. Task II Report: Financing Options, Susitna Hydroelectric Project, January 1983

Alaska State Legislature House of Representatives Research Agency. Memorandum to Representative Brian Rogers regarding: Status of Susitna Project Studies Financing and Power Sales Proposals Research Request 82-157, January 5, 1983

Bechtel Civil & Minerals, Inc. Chakachamna Hydroelectric Project Interim Feasibility Assessment Report, February 1983

Department of Commerce and Economics Development, 1983 Long-Term Energy Plan (Working Draft), 1983

Ebasco Services, Incorporated. Draft Final Report Feasibility Level Assessment. Use of North Slope Gas for Heat and Electricity in the Railbelt, January 1983.

FERC. Letter to Mr. Eric P. Yould (APA) regarding "Pre-filing review of draft application for license for the Susitna Hydroelectric Project and deviciencies list", January 11, 1983

Gas Purchase Contract, Marathon Oil Company and Alaska Pipeline Company, December 16, 1982

Governor's Economic Committee on North Sope Natural Gas Report Trans Alaska Gas System: Economics of an Alternative for North Slope Natural Gas, January 1983

R.W. Beck and Associates, Inc. Supplement Report - Kenai Peninsula Power Supply and Transmission Study, December 1982

State of Alaska, Department of Natural Resources, Memorandum to State of Alaska Task Force on Alternative Uses for North Slope Natural Gas regarding: Phase I Report, Evaluation of Alternatives for Transportation and Utilization of Alaskan North Slope Gas, November 1982

State of Alaska, Memorandum regarding: Gas Prices in the Cook Inlet Area, January 12, 1983

STEP 2 - UPDATE NEED FOR POWER SCHEDULE

A. Power Market Forecast

[illegible]

STEP 2 - UPDATE NEED FOR POWER SCHEDULE

B. Optimization And Justification

Week Ending		March		April					May				June			
		19	26	2	9	16	23	30	7	14	21	28	4	11	18	25
B-1	Review Remaining Reports															
B-2	Utilize Computer Models															
B-3	Delineate Economic, Technical Criteria															
B-4	Analyze Cost and Availability of Fuel															
B-5	Refine Thermal Alternatives															
B-6	Screen Susitna Alternatives															
B-7	Optimize Selected Susitna Alternative															
B-8	Delineate Other Hydro Alternatives															
B-9	Delineate Transmission System															
B-10	Formulate and Analyze Expansion Programs															
B-11	Perform Computer Runs															
B-12	Perform Economic Justification															
B-13	Develop Model Contract															
B-14	Perform Financial Analysis															
B-15	Report Outline & Summary Appendices															

Deliverables ▼