

Final investment decision: big breakthrough for LNG projects

The decision to break ground on a liquefied natural gas export project is a momentous move for project sponsors, a multibillion-dollar stake on their futures. Reaching what the industry calls a "final investment decision" — the golden milestone signaling that steel can be ordered, workers hired and construction can begin — takes time, money and tight coordination between multiple parties working on different parts of a project.

Sponsors and financial backers want to make sure they've done their due diligence before unleashing a flood of capital. More than 90 percent of project costs — the money for production modules, compressors, pipe, motors, installation and construction — are incurred after the final investment decision.

The FID naturally attracts attention. Aside from signaling the start of real spending, it's a big breakthrough in a multi-year process that's typically fraught with uncertainty and risk.

"It is a public proclamation that the project will go forward. Since these are oil and gas projects and usually high-visibility, with people for and against, the FID will generate lots of interest," Andrew Inkpen, professor of global strategy at the Thunderbird School of Global Management in Glendale, Ariz., wrote in an email interview in February 2014.

ALASKA LNG

The Alaska LNG project's proponents — ExxonMobil, ConocoPhillips, BP and TransCanada — estimate it will take several years before they reach FID.¹ Black & Veatch, an international oil and gas consulting firm advising the state of Alaska on the LNG project, says FID could come as early as 2019.

The state of Alaska is considering whether to join the project as a partner.

A work plan² by proponents of the proposed \$45 billion to \$65 billion Alaska LNG project shows that a positive investment decision hinges on whether they can secure gas buyers, shipping agreements, land-use approvals, financing, permits, engineering, procurement and construction contracts, and as much certainty as possible that the profits will be worth the enormous investment.³ The plan was part of an October 2012 letter to Alaska Gov. Sean Parnell and has appeared in subsequent presentations to the Legislature.

The investment decision also rests on an intensive process, called pre-front-end engineering and design (pre-FEED) and FEED.⁴ That's when project backers attempt to anticipate and solve just about every dimension and challenge of engineering and operations.

These are common prerequisites for coming to a final investment decision, but no one gets there in quite the same way.

"Every company has its own policy for determining when to make the FID and that's tailored by the partners you have and even further tailored by the country where the project is located," said Houston-based energy attorney Bill Garner in a February 2014 phone interview. "It's measureable and tangible, but most of it is very squishy."

Still, an affirmative FID doesn't guarantee a finished or operational project. The decision is rarely legally binding in terms of an absolute construction schedule, giving project owners an escape hatch.

"Things change. The LNG demand market could go poof. The supply commodity costs could ratchet up to an unsustainable level. Or project costs could just get out of control. Or exchange rates could turn on you," Garner said. "Since this is a private decision within a company or among the partner group, it just is wiser to maintain one's flexibility by not having things legally binding."

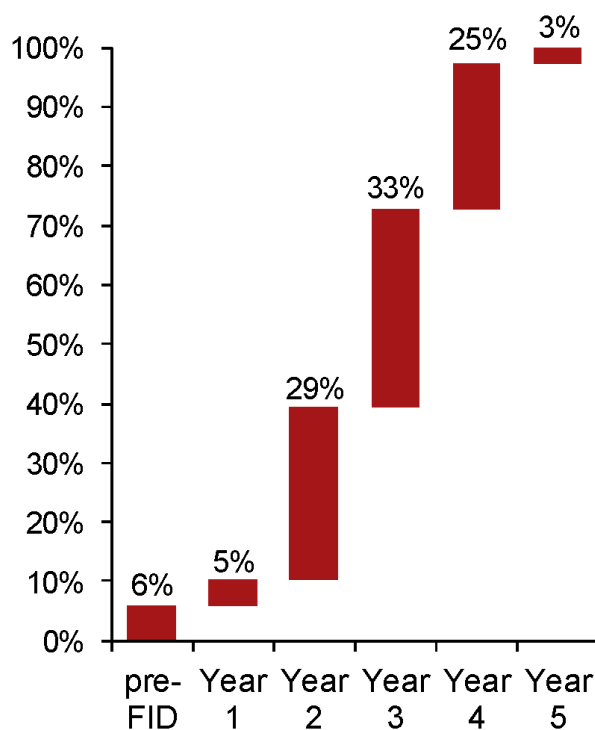
The rise of LNG megaprojects is recent enough that few examples exist of projects that have been postponed and there are no examples of privately sponsored projects that have been abandoned after an investment decision has been made, but it's not unheard of within the greater oil and gas industry.

Pulling out of a project post-FID may still trigger penalties, including loss of all project equity paid to date, liquidated damages or expulsion from the partnership. Depending upon how the agreements are drafted, there may be provisions for termination damages built into financing commitments, off-take agreements or engineering, procurement and construction contracts, Garner said.

COSTS BEFORE FID RELATIVELY SMALL

Before FID, spending on a project is typically less than 10 percent of total costs, said Nikos Tsafof of

Indicative CapEx for integrated LNG project



Source: PFC Energy

Pre-construction spending for a typical large LNG project might involve just 6 percent of the overall capital expenditures, with the other 94 percent of spending coming after the final investment decision, or FID, to build the project.

Analytica, a consultant to the Alaska Legislature on the LNG project.

"The call of capital really comes only after you've had an enormous amount of time to spend to study all the permutations of the options in coming up with a schedule and a project structure that is comfortable to all the project partners," Tsafof told the Legislative Budget and Audit Committee in January 2014.⁵

The state of Alaska estimates \$2.4 billion in pre-FEED and FEED expenditures for the entire production and transportation chain, including the gas treatment plant on the North Slope, 800 miles of pipeline and the liquefaction plant and shipping

terminal at Nikiski. That's about 5 percent of the estimated \$45 billion to \$65 billion cost.

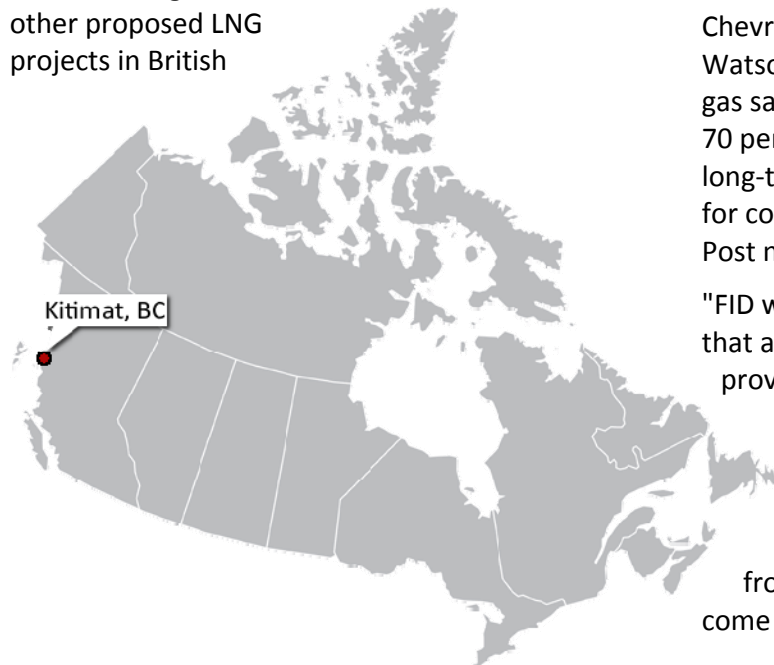
"Before you get to final investment decision, you haven't spent any real money," Tsafos said. Though substantial, "it's not 'real money' in the context of \$65 billion," he added.

The costs of arriving at FID may make up just a small percentage of overall costs, but are still large, even daunting, because LNG projects tend to be very expensive.

Not wishing to fully shoulder the early costs for its proposed Kitimat LNG project in British Columbia, Houston-based oil and gas producer Apache recently announced it would seek additional partners to share the costs of FEED. Chevron and Apache each own a 50 percent stake. Apache faces \$1 billion in prospective costs, in 2014 alone, on work needed to reach a final investment decision.

Apache's CEO Steven Farris told Canada's Globe and Mail newspaper in February 2014 that the company needs to "right-size" and reduce its stake, a decision that isn't unusual for LNG projects. The Kitimat LNG joint venture is looking at adding Asian buyers that would also take on some equity in the project.⁶

Kitimat, along with several other proposed LNG projects in British



Columbia, is a potential competitor for many of the same Asian customers an Alaska LNG project would target.

The terminal plans call for initial production capacity of 5 million metric tons per annum of LNG (averaging about 660 million cubic feet of natural gas per day), with the option to expand to as much as 10 mtpa.

NO FID WITHOUT GAS BUYERS

LNG pricing is extremely important for project sponsors. They're looking at tremendously expensive projects with long lead times and need some certainty that by the time the first cargo is ready to ship, they'll be able to sell the LNG at a price that ensures good returns.

Price certainty is major reason project sponsors nail down sales contracts before making the final investment decision.

"This is a very common, almost necessary step. It is typical for large LNG projects to have the majority of the LNG committed to customers from the start," Deepa Poduval, lead consultant for Black & Veatch, the state's top consulting firm on the proposed Alaska gas project, told the Alaska Journal of Commerce in February 2014.

Chevron chairman and chief executive John Watson recently drove home the importance of gas sales contracts. Chevron wants at least 60 to 70 percent of its Kitimat LNG output sold under long-term agreements before giving the go-ahead for construction, according to Canada's Financial Post newspaper.

"FID will be entirely a function of gas contracts that allow us to develop the opportunity and provide energy to Asian markets at a fair price,"

Watson said during a conference call in January 2014.

Lack of buyers, in part, prevented the Shtokman LNG project in Russia's Arctic from going forward. It had been expected to come onstream between 2013-2015, but

development was postponed in 2010 because of decreased gas demand in Europe and huge gains in U.S. shale gas production.

No investment decision has been made for the Shtokman project, which some analysts estimated would cost \$50 billion. Susan Sakmar in her book "Energy for the 21st Century: Opportunities and

Challenges for Liquefied Natural Gas," writes that "reaching a final investment decision for Shtokman has always been viewed as a difficult aim as the partners weigh uncertainty about demand and prices."

Discovered in the late 1980s, Shtokman is one of the world's largest gas fields, with estimated reserves of 140 trillion cubic feet of gas, but its rather remote location, 340 miles offshore in the Barents Sea, means development will be challenging and costly. Other obstacles include how to transport the gas and the lack of supportive fiscal terms from Moscow.

Kitimat LNG (British Columbia)

DATE	Project milestone announced
2004	Galveston LNG begins planning work for LNG import terminal at Kitimat, B.C.
2005	Apache drills first shale gas test well in Horn River Basin, B.C., supply source for project
December 2008	Provincial environmental certificate issued
January 2009	Province allows gas liquefaction and export plant at site
January 2009	Federal environmental certificate issued
January 2010	Apache acquires 51 percent stake in Kitimat LNG
May 2010	Houston-based EOG purchases Galveston LNG
November 2010	Benefits agreement executed with Haisla First Nation
December 2010	Sponsors apply for export license from Canada's National Energy Board
March 2011	Front-end engineering and design contract awarded to KBR, a global engineering and construction company
April 2011	Encana buys 30 percent stake, leaving Apache (operator) with 40 percent and EOG with 30 percent
October 2011	Export license issued
December 2011	Final investment decision originally expected
December 2012	Chevron acquires 50 percent stake; Encana and EOG leave project
December 2012	Apache and Chevron announce 50-50 joint venture; Chevron takes over as operator
January 2013	Haisla First Nation agrees to new federal regulations, paving the way for LNG facility on its lands
January 2014	Engineering, procurement and construction contract awarded to Fluor and JGC joint venture
2014	Expected final investment decision delayed, with no new date announced

Source: Office of the Federal Coordinator research

DELAYS ALWAYS POSSIBLE

Solid sales and purchase agreements alone can't guarantee a smooth road to the final investment decision.

Proponents of the Alaska project, in their October 2012 work plan, list all sorts of possible challenges in the lead-up to FID, and beyond, including "protracted resolution of fiscal terms, permitting and regulatory delays, legal challenges, changes in commodity market outlook, time to secure long-term LNG contracts, labor shortages, material and equipment availability or weather."

With all their experience in petroleum megaprojects, the companies considering an LNG venture in Alaska know full well that these setbacks are far from rare.

Consider the \$34 billion Ichthys LNG project to develop gas off the northwestern coast of Australia. Operator and lead sponsor, INPEX, Japan's biggest oil and gas explorer, and its next-largest Ichthys partner,

France's Total, ended up scrapping their original plans over objections to the proposed location of the LNG plant and other land-based operations.

In 2006, INPEX and Total were going through the environmental approval process with the Western Australia government for facilities on the undeveloped Maret Islands, about 125 miles southeast of the Ichthys field. But opposition from environmental and aboriginal groups convinced the sponsors to shift their plans to the city of Darwin in the Northern Territory, whose officials were heavily courting the project.

INPEX and Total initially favored the Maret Islands because Darwin, to the northeast, is more than four times the distance to the gas fields.

The decision to move the onshore LNG plant came after the Ichthys sponsors already had conducted extensive studies of the Maret Islands and drafted plans for construction, according to Jiro Okada, vice president of INPEX's Ichthys project division.

"It was a very difficult task to convince Tokyo and Paris to go along with the Darwin option because of their attachment to the Maret Islands option," Okada wrote in a report presented at LNG17, held in Houston in April 2013. "It took us almost 5 months to make an internal decision to officially submit the Operator's recommendation to go with the Darwin Option and inform the Western Australia Government."

After scrapping the Maret Islands plan, the Ichthys partners committed in September 2008 to a 560-mile subsea pipeline running to the LNG plant at Blaydin Point in Darwin Harbor, across the water

Ichthys LNG (Australia)

DATE	Project milestone announced
August 1998	INPEX acquires exploration permit for what is now the Ichthys field off the coast of Western Australia
2000-2001	INPEX confirms that the field has "promising resources" of natural gas and condensate
2003-2004	Second drilling campaign
September 2008	Darwin, Australia, announced for onshore LNG plant
January 2009	LNG plant front-end engineering and design contract awarded to JKC joint venture of Houston-based KBR, and Japan's JGC and Chiyoda Corp.
April 2009	FEED contract awarded for offshore gas production facilities to London-based AMEC Engineering
July 2010	Draft environmental impact statement released for public review
November 2010	Invitation to tender for central processing facility
December 2010	Invitation to tender for onshore gas processing facilities
April 2011	Australia and Northern Territory governments receive final environmental impact statement
May 2011	Northern Territory endorses EIS
June 2011	Australian government approves EIS
January 2012	INPEX finalizes sales of total output of LNG plant
January 2012	Final investment decision announced
February 2012	Engineering, procurement and construction contract for onshore plant awarded to JKC joint venture of Houston-based KBR, and Japan's JGC and Chiyoda Corp.
February 2012	Samsung Heavy Industries awarded contract for central processing facilities
May 2012	Official groundbreaking ceremony
December 2012	Project financing arrangements completed
June 2013	Shipping and shipbuilding contracts finalized
2016	Expected first gas shipment

Source: Office of the Federal Coordinator research

from the city proper.

Ichthys sponsors hit additional setbacks that pushed the announced FID date from sometime in 2010 to January 2012. One delay occurred because design work for the offshore facilities, which began in April 2009, was going to take 18 months, or six months longer than initially projected, the company told Reuters.

A second delay, which INPEX acknowledged but did not explain, may have been caused, some analysts believed, by a brief slowdown in global gas demand, which in turn caused INPEX to review the project's cost structure.

As of April 2014, the 8.4 mtpa project (averaging 1.1 billion cubic feet per day of gas) was under construction and expecting to send out its first LNG shipment in 2016.

RUNNING AND RERUNNING THE NUMBERS

Rigorous, obsessive financial analysis of such projects is the norm in the lead-up to FID. Although these and other calculations take time, the project, ideally, should drive the schedule, not the other way around. Missed deadlines during planning are less of a problem than surprise costs during the construction phase.

"Given the magnitudes of capital and risk associated with oil and gas projects, for example a mega-project like Alaska LNG, you can be sure that it will be done with incredible detail, depth, and conservatism," Michael Moffett, co-director of the Thunderbird Center for Global Energy Studies, wrote in a February 2014 email interview. "The depth and sophistication of this analysis is beyond what many people in other businesses of any kind would ever imagine."

Along with signing up buyers for the gas, project developers often seek independent evaluations of various aspects of the project leading up to FID, according to Michael Tusiani, former CEO of energy brokerage and consultancy Poten & Partners, and Gordon Shearer, former CEO at Hess LNG, in their book, "LNG: A Nontechnical Guide."

But even with meticulous plans in place, major snags can slow projects or cause costs to balloon.

"Getting to FID is a very disciplined process. Everyone knows exactly what they're focused on and there's a majordomo (chief steward) pulling all this together and after that, you lose the discipline

in the project implementation," Garner said. "That's when things always go awry."

During a committee hearing Feb. 26, 2014, BP Exploration Alaska's David Van Tuyl assured members of the Alaska Legislature that the four companies backing an Alaska project would do their utmost to avoid cost overruns.

"The one galvanizing fact, I think, for all the companies here is that we want this project to be a success, to compete in the world market and to be delivered at the lowest cost possible," Van Tuyl said in testimony before the Senate Finance Committee.⁷ "That's going to make us relentless about identifying opportunities to reduce costs and minimize the risks."

Sometimes the need to rein in costs leads to dramatic changes best made before construction starts.

Woodside Petroleum, operator of the proposed Browse LNG project in Australia, and its joint-venture partners postponed their final investment decision because of a major switch from an onshore LNG export operation to a floating LNG project.

Floating LNG, a new concept in the industry, involves building a massive ship with gas production, liquefaction and storage all squeezed into and on top of the vessel. LNG tankers pull up alongside and fill up for their delivery runs. Proponents argue the all-in-one behemoths can park and operate above an offshore gas field at a lower cost than building onshore facilities.

The instigator of the Browse project change was money. Land-based LNG development costs in Australia are escalating in leaps and bounds. The original project was supposed to cost \$45 billion, but Woodside told financial news outlet Platts in December 2013 that the land-based plan in reality would have cost at least \$80 billion and "could have threatened the company's existence."

Early cost estimates for the Browse floating LNG project should be available in the first or second



Source: Shell

Woodside Petroleum and its partner in the Browse development, Shell, have switched from an onshore LNG project to a floating liquefaction and storage ship, similar to a Shell design proposal above.

quarter of 2014, Woodside CEO Peter Coleman told Platts.

Woodside, Australia's largest independent oil and gas developer, earlier had pegged Dec. 31, 2013, as the date for its final investment decision on Browse, but has pushed the date back to 2015, according to The Australian newspaper.

NO GUARANTEES

FID may seem to put to rest years, often decades, of speculation, but a positive investment decision is no guarantee that an oil or gas project ultimately will be built. And even if it is built, it may not open for business on time, on budget, or at all.

"Once the FID is made, the project is handed over

to the development team and project execution begins. During the execution phase there will be regular reviews, questions asked, and occasionally, projects in mid-development will be shut down or postponed," Inkpen and Moffett noted in their book, "The Global Oil & Gas Industry: Management, Strategy and Finance."

The steep drop in oil prices in 2008 and 2009 derailed many oil and gas projects — mostly oil — that had been approved for construction, according to an International Energy Agency report in 2009. In that short period, more than 20 planned large-scale upstream oil and gas projects, involving about 2 million barrels per day of oil production capacity, with a total value of more than \$170 billion were deferred indefinitely or cancelled.

The LNG import terminals rimming the U.S. Gulf Coast are the best example within the industry of projects whose status today is very different from what was planned.⁸

During the early-to-mid 2000s, the growth of LNG imports into North America seemed certain as U.S. domestic consumption grew while production fell. Over the course of a decade, two mothballed import terminals restarted and expanded and eight new terminals were built in the United States, plus one in Canada and two in Mexico.

Then, the market shifted. The shale gas boom hit the United States, rendering most of the terminals obsolete as import facilities. At least six of them didn't bring in any LNG in 2013. Many of the owners are now pushing to transform their LNG import terminals into export facilities. It's too early to know how many of the LNG export projects proposed for the U.S. Gulf Coast, East and West coasts will proceed to FID.

At the Feb. 26, 2014, Alaska Senate Finance Committee hearings, company executives testifying alongside BP's Van Tuyl were optimistic about the possibility of exporting North Slope LNG:

"There's no guarantee that this project will succeed, but we are highly encouraged," said Tony Palmer, an executive with pipeline builder TransCanada.

"We think we've got a really good shot at this market. We do think (the project) can be competitive," ConocoPhillips' Pat Flood said.

"ExxonMobil is extremely excited about this project," executive Bill McMahon told the senators. "We believe this project has good fundamentals."

Notes

¹ Office of the Federal Coordinator, "Alaska LNG Project," <http://www.arcticgas.gov/alaska-lng-project>.

² Alaska LNG, "Project Work Plan," <http://www.arcticgas.gov/sites/default/files/documents/alaska-lng-project-october-2012-attachments.pdf>.

³ Jeannette Lee, "Financing strategies for LNG export projects," <http://www.arcticgas.gov/financing-strategies-lng-export-projects>.

⁴ Bill White, "Early planning, design, engineering key to LNG project success," <http://www.arcticgas.gov/early-planning-design-engineering-key-lng-project-success>.

⁵ State of Alaska, "Legislative Budget & Audit Committee - Jan.

28, 2014," http://www.360north.org/gavel-archives/?event_id=2147483647_2014011122.

⁶ Jeannette Lee, "Japan's utilities increasingly invest in LNG projects," <http://www.arcticgas.gov/japan-utilities-increasingly-invest-lng-projects>.

⁷ State of Alaska, "Senate Finance Committee- Feb. 26, 2014," http://www.360north.org/gavel-archives/?event_id=2147483647_2014021557

⁸ Bill White, "North American LNG industry looks for survival through exports," <http://www.arcticgas.gov/north-american-lng-industry-looks-survival-through-exports>.

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