

**02/19/2014
PRESENTATION:
ALASKA
NATURAL GAS
BY BLACK AND
VEATCH**

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ALASKA NATURAL GAS BY BLACK AND
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BUILDING A WORLD OF DIFFERENCE

FEBRUARY 19, 2014

**OBSERVATIONS ON HEADS OF AGREEMENT
PRESENTATION TO SENATE FINANCE COMMITTEE
PREPARED FOR THE STATE OF ALASKA**



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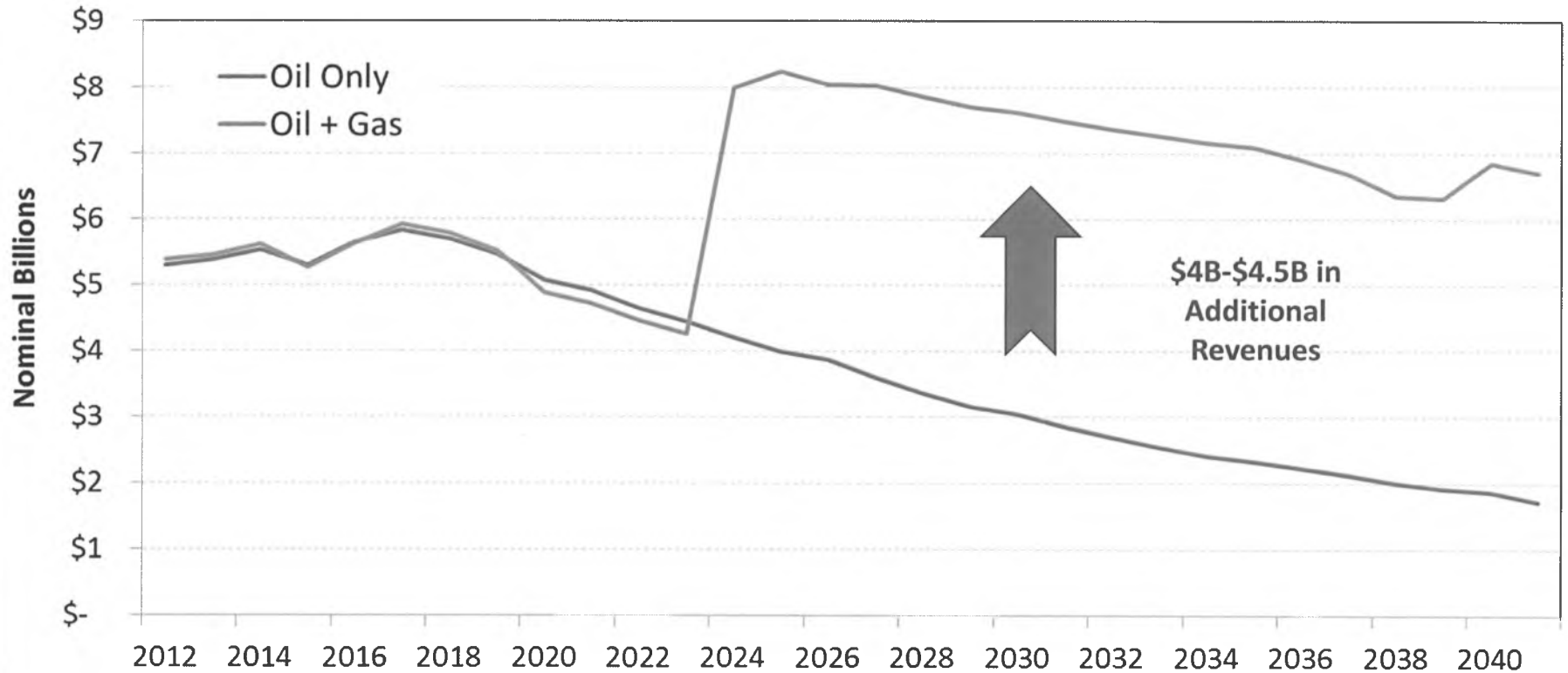
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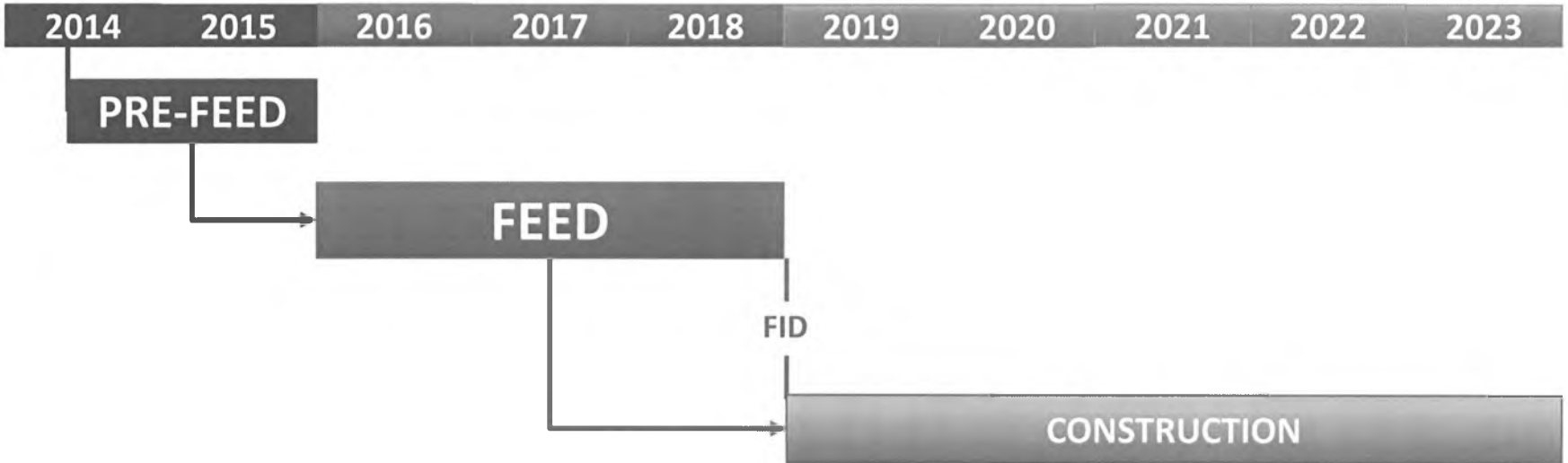
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LONG-TERM NORTH SLOPE OIL & GAS REVENUES ARE DRIVEN BY AKLNG PROJECT SUCCESS

State of Alaska – North Slope Oil & Gas Annual Revenue Forecast



PUTTING THE HOA WITHIN THE CONTEXT OF AKLNG TIMELINE



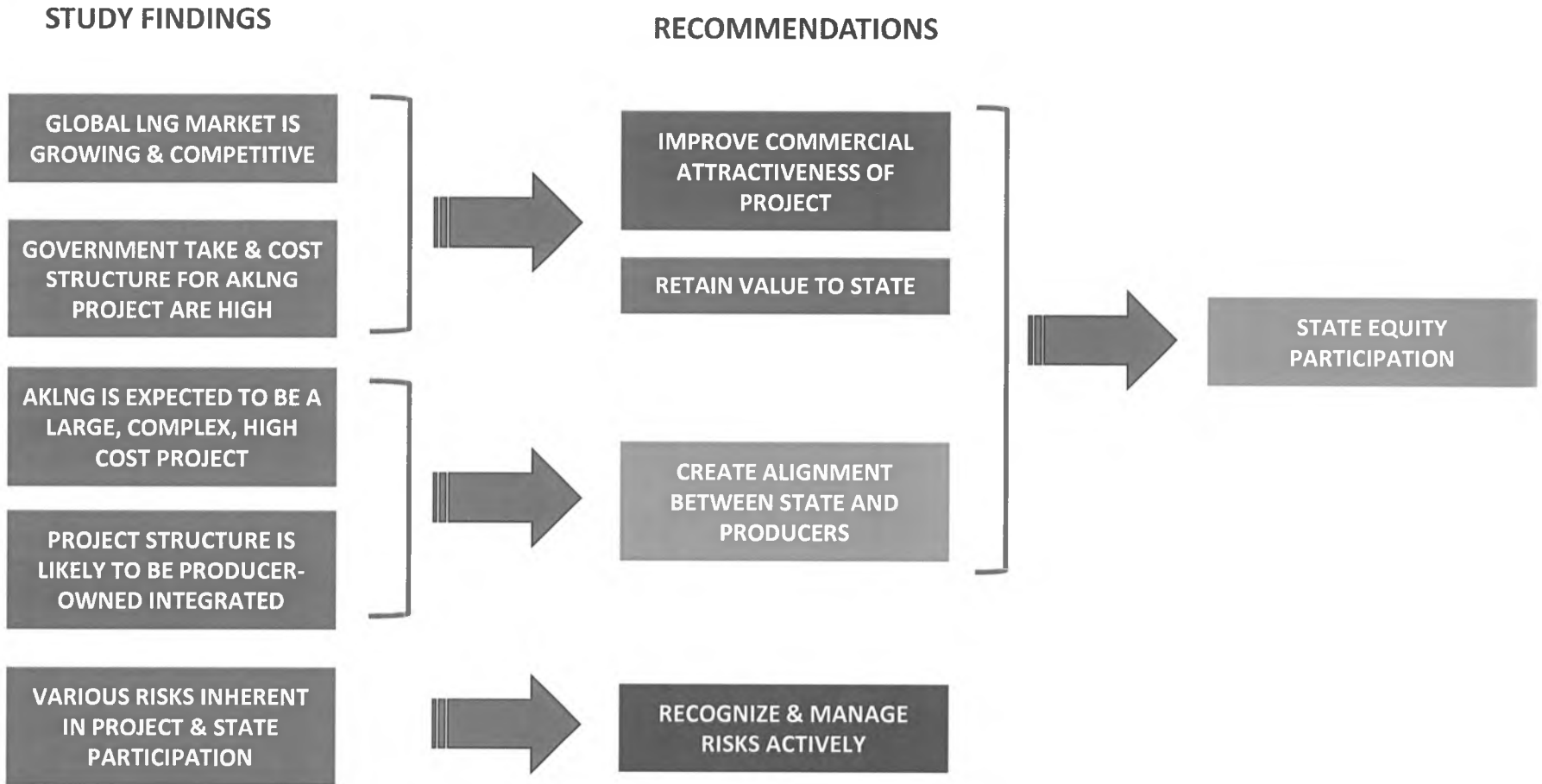
STATE INVESTMENT

<p>\$43 - \$108 million or ~1% of Total Investment</p>	<p>\$180 - \$450 million or ~2%-3% of Total Investment</p>	<p>\$7 - \$13 billion or ~95%-97% of Total Investment</p>
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HOA lays out principles to advance the project to pre-FEED and enter into commercial agreements

ROYALTY STUDY HIGHLIGHTS & RECOMMENDATIONS



CRITERIA APPLIED FOR EVALUATION OF HOA TIE IN TO ROYALTY STUDY RECOMMENDATIONS



HOA – ALIGNMENT THROUGH EQUITY PARTICIPATION

ALIGNMENT



Royalty Gas and Tax as Gas = State Gas Share

State Gas Share = State Equity Share



State Equity Share Impacts State Investment and State Revenues



State Holds Equity Along The Entire Supply Chain

Commitments Made In A Stage-Gated Manner

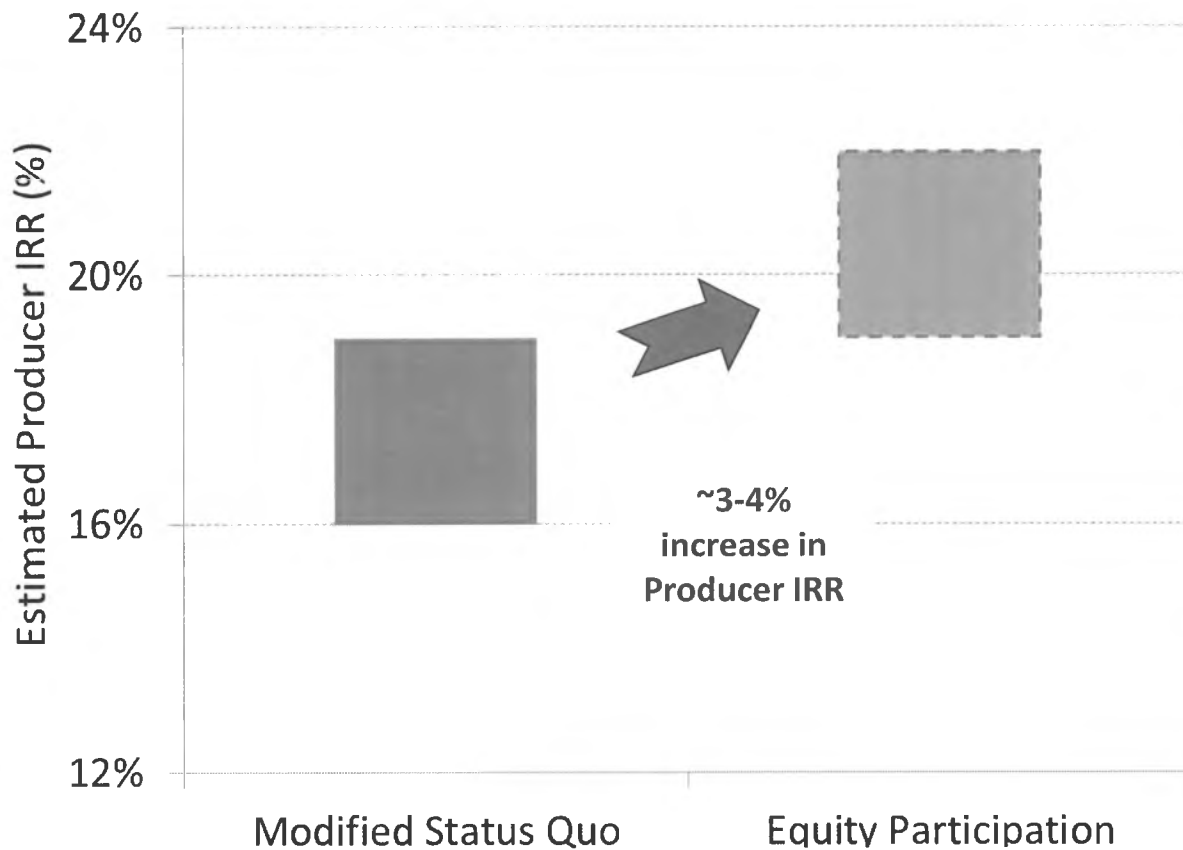
- Current decisions focused on enabling pre-FEED



IMPROVE COMMERCIAL ATTRACTIVENESS OF AKLNG PROJECT



Producer IRR



- Reduces upfront investment by Producers
- Risk is shared with the State
- Potentially reduces valuation disputes if State elects RIK

* Assumes 25% State equity participation

PRESERVE VALUE TO STATE FROM ROYALTY & TAXES

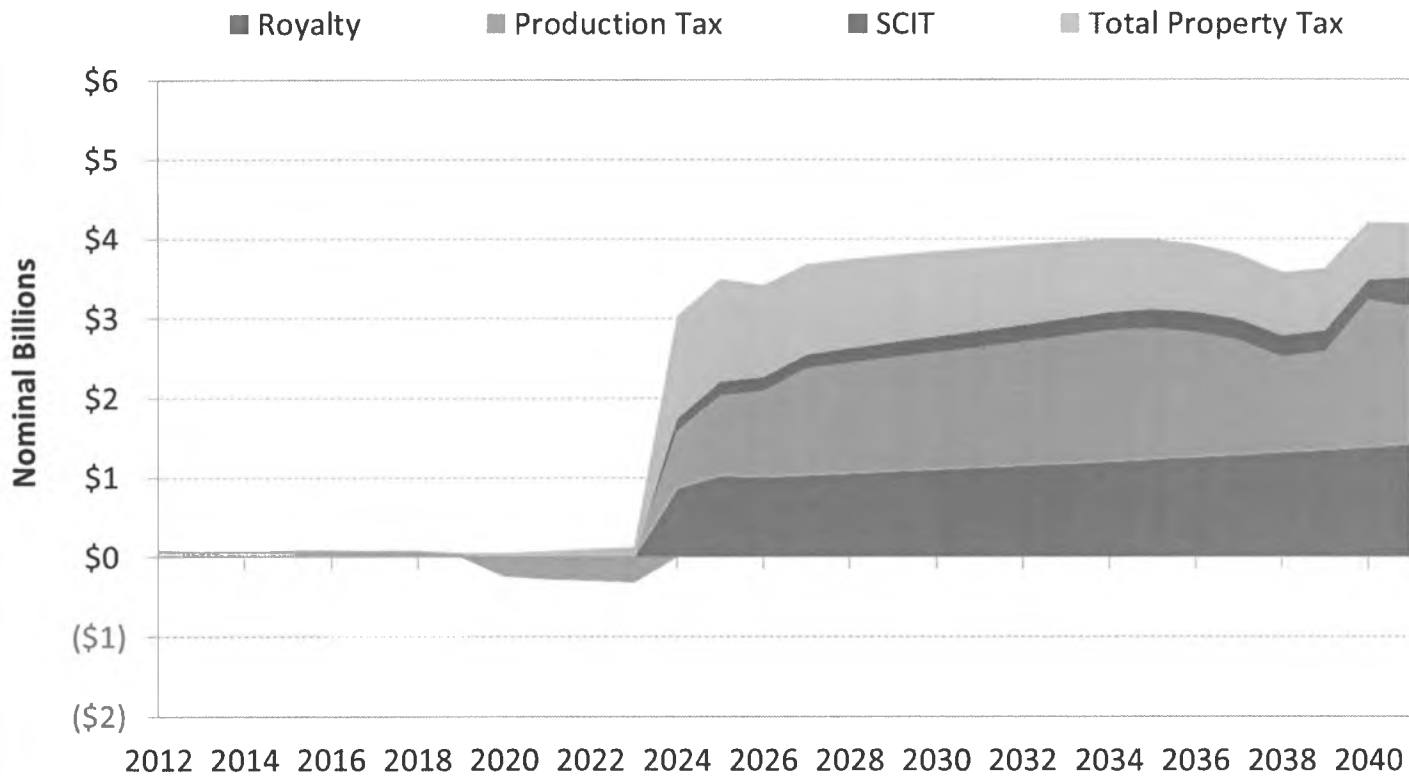


- Obtain value in return for the State's incentives to the project
- Preserve the State's expected revenues from the AKLNG Project relative to an RIV world without State equity participation

PRESERVE VALUE TO STATE FROM ROYALTY & TAXES



State of Alaska Modified Status Quo Annual Cash Flow

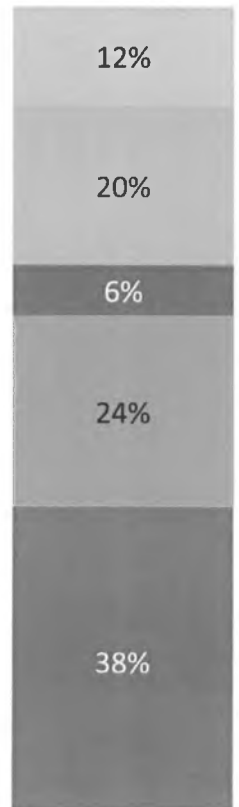
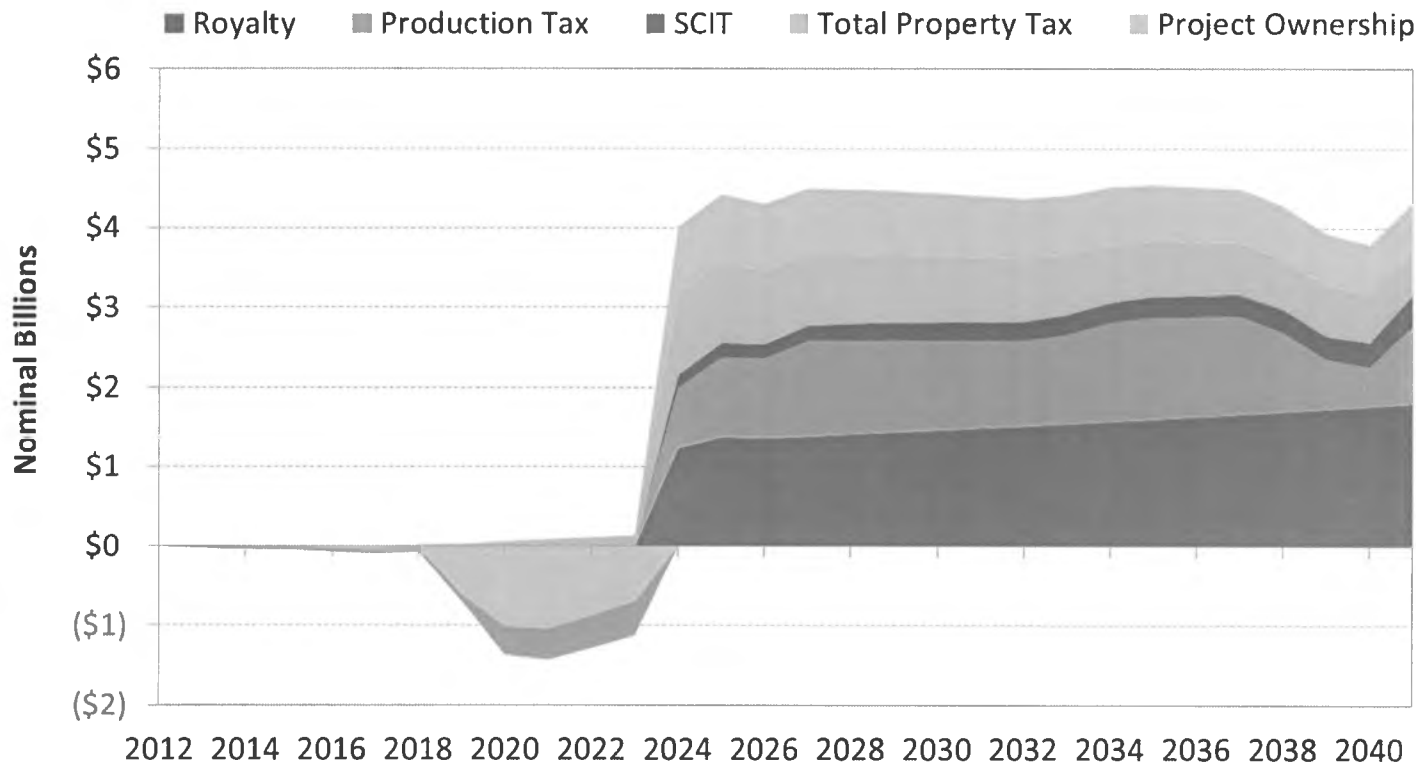


Total Cash Flow (Through 2041) = \$68 Billion

PRESERVE VALUE TO STATE FROM ROYALTY & TAXES



State of Alaska 25% Equity Alternative Annual Cash Flow



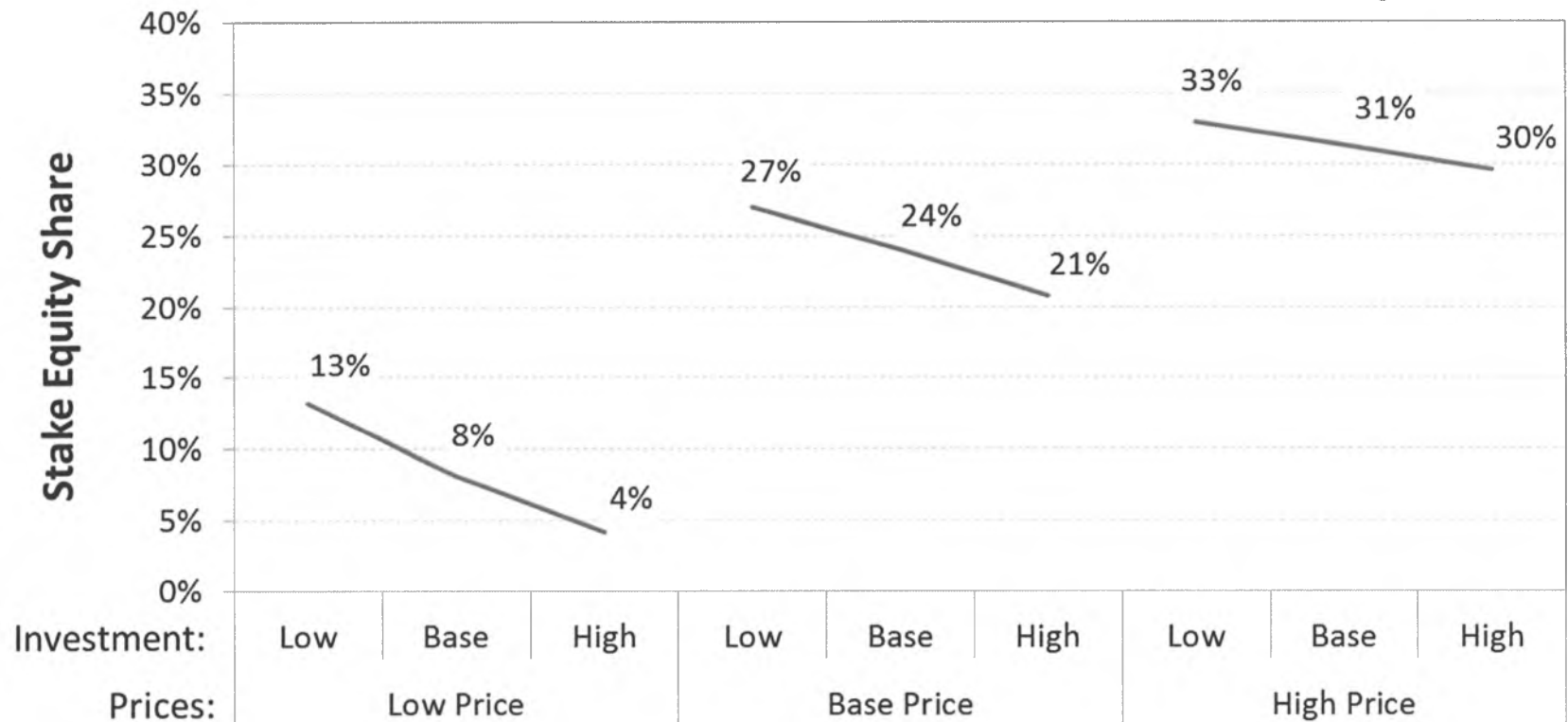
Total Cash Flow (Through 2041) = \$72 Billion



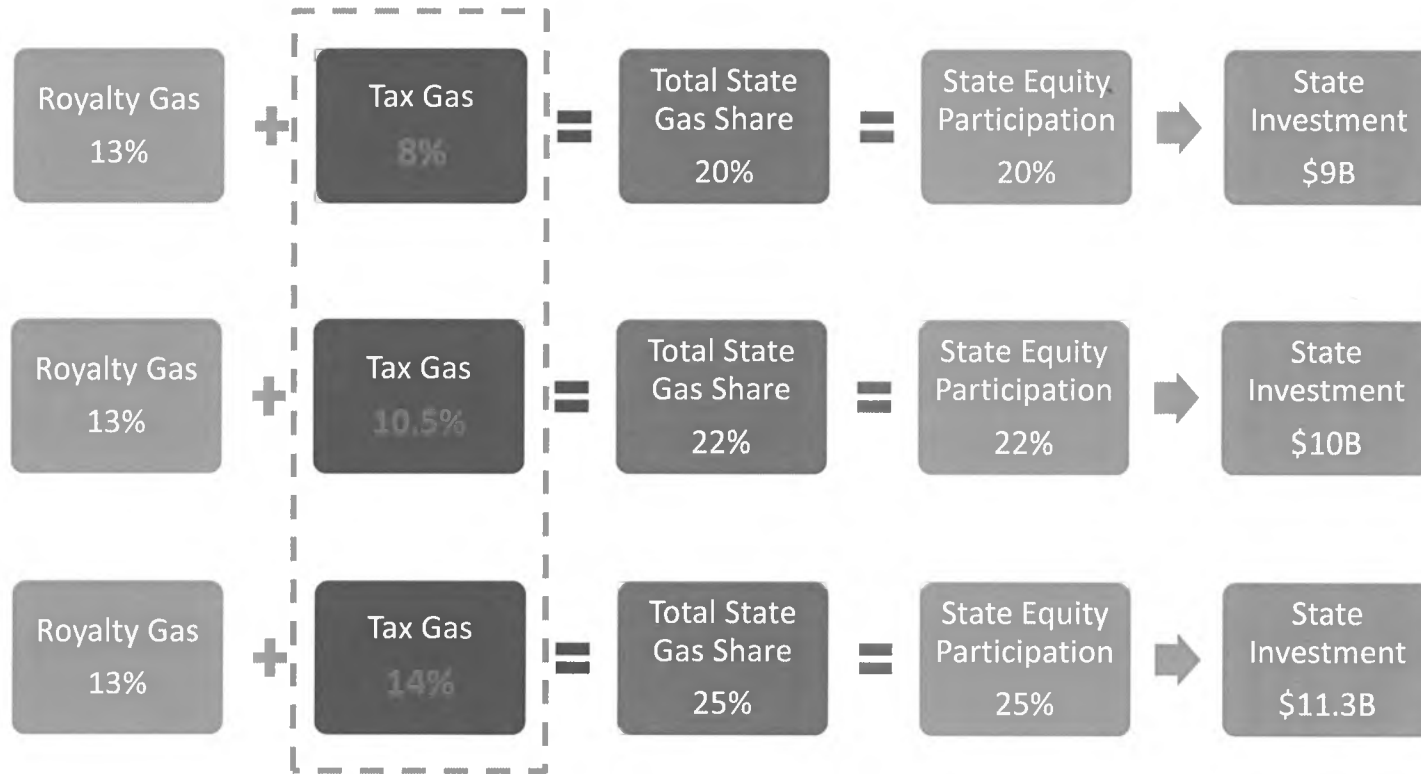
PRESERVE VALUE TO STATE FROM ROYALTY & TAXES



State Equity Investment for Modified Status Quo = Equity Alternative (SOA NPV₀)



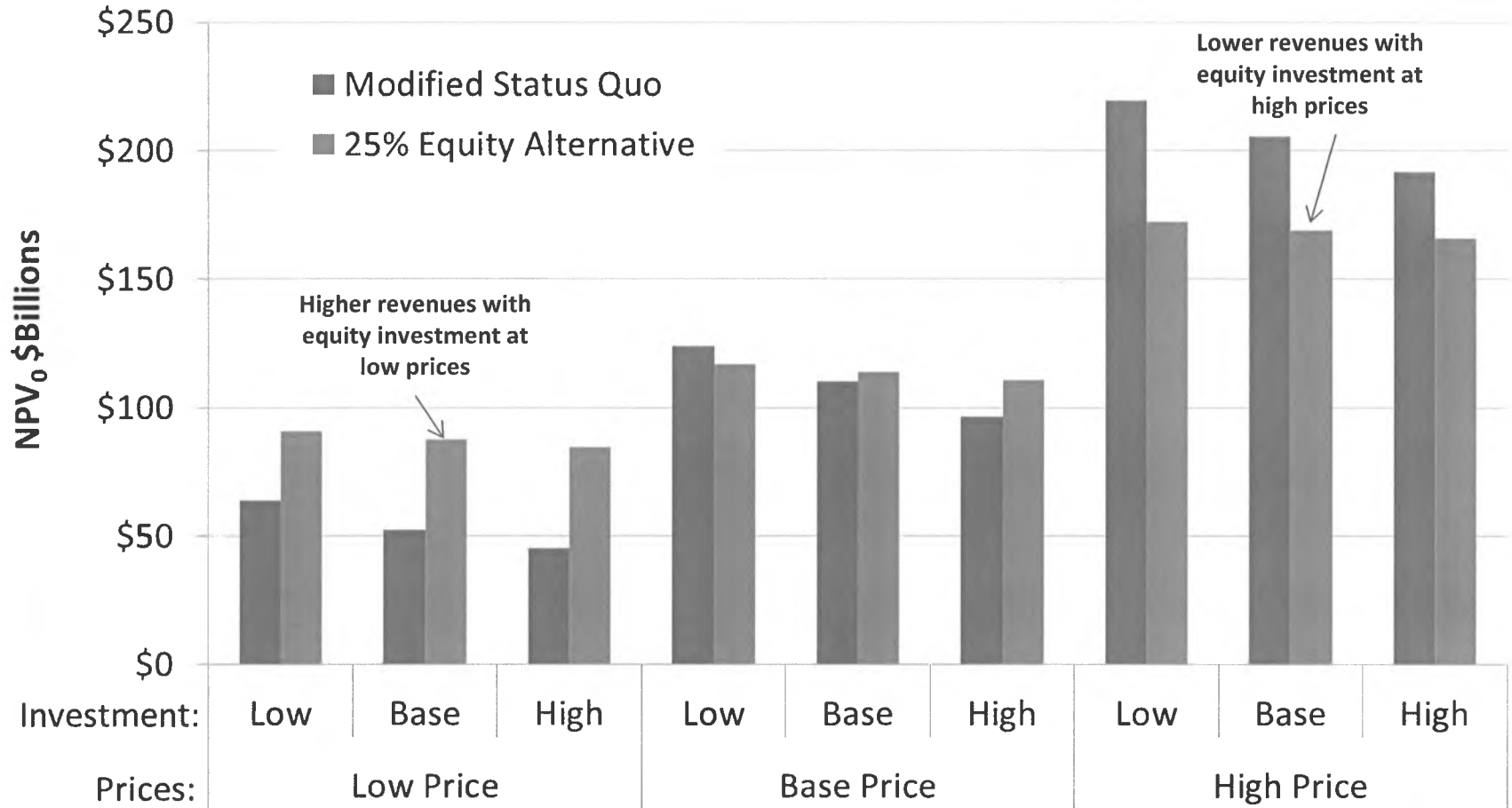
GROSS TAX RATE SETS THE TOTAL STATE GAS SHARE & EQUITY PARTICIPATION



MANAGE RISKS – EQUITY INVESTMENT HELPS TO HEDGE PRICE EXPOSURE



State of Alaska Total NPV₀



MANAGE RISKS – CAPITAL COST EXPOSURE REDUCED THROUGH TC PARTICIPATION

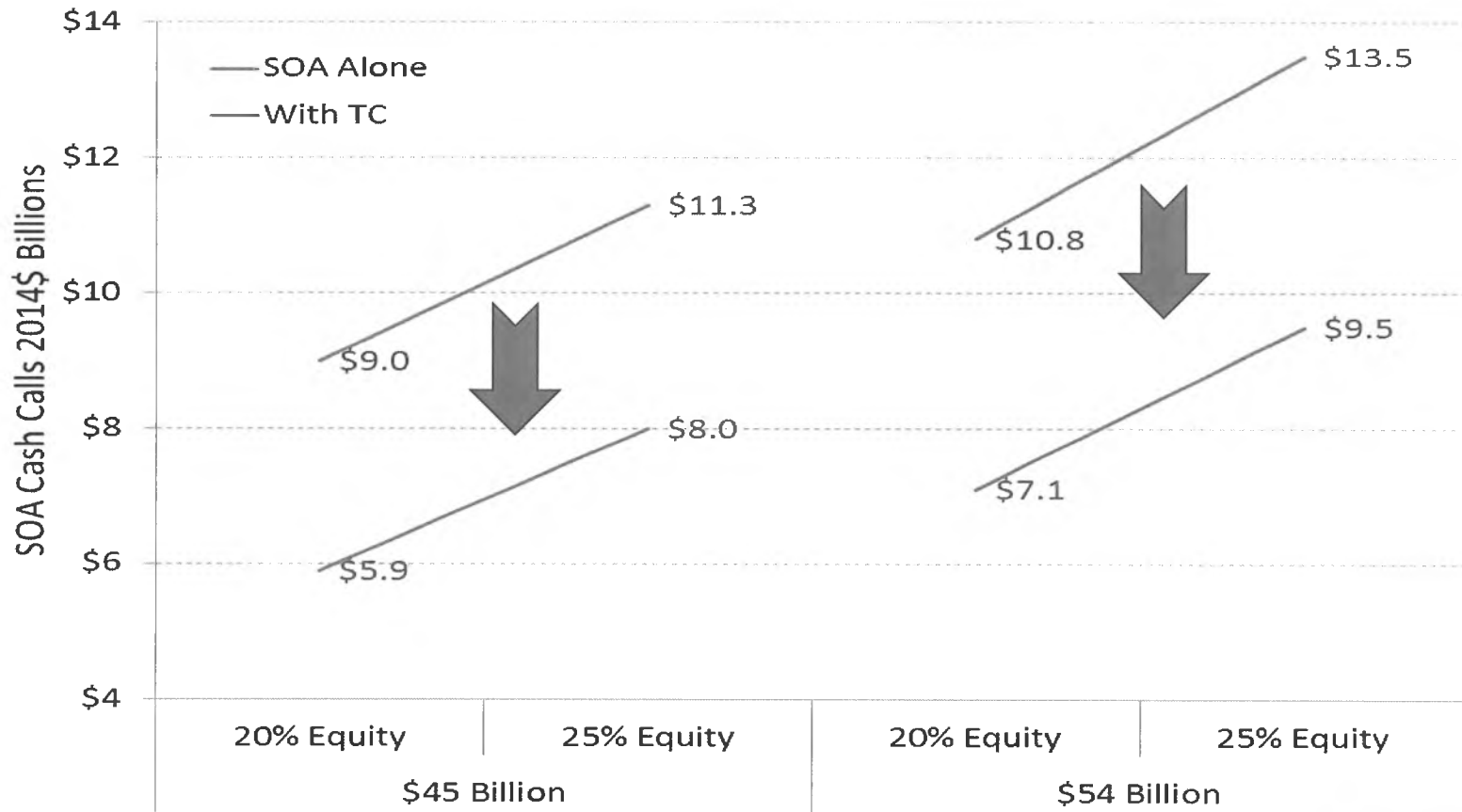


- Highest risk exposure is prior to project start when cash calls are not supported by project revenues
- TransCanada (“TC”) participation allows State to retain 20%-25% of gas share while being responsible for only 13%-18% of the upfront costs
- This is especially important if cost overruns occur on project

MANAGE RISKS – CAPITAL COST EXPOSURE REDUCED THROUGH TC PARTICIPATION



TC Participation Reduces Upfront Cash Calls on SOA by ~40%



* Assumes State exercises 30%-40% equity buy back with TransCanada

MANAGE RISKS – REDUCE POTENTIAL LOSS OF VALUE THROUGH RIK



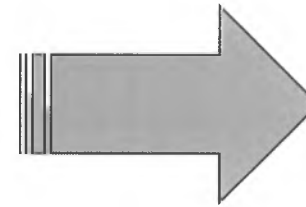
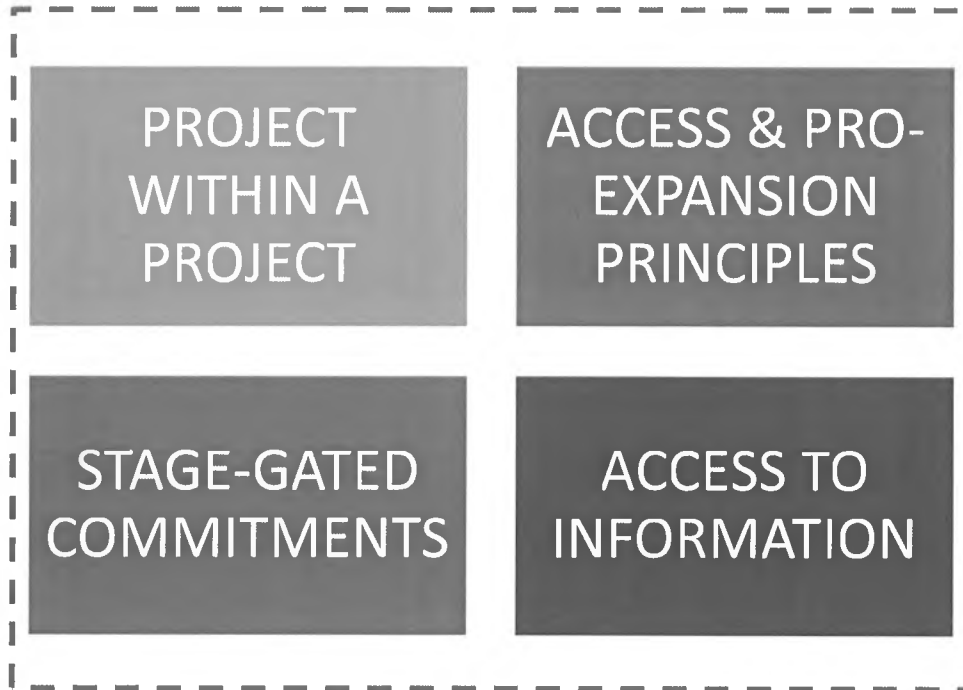
- HOA includes intent of Producers to offer to negotiate separately to market State’s share of gas – proportional to each Producer’s share of producer capacity
- SOA to only obligated to elect RIK if the Producers make “satisfactory arrangements for disposition of the State’s share of LNG”
- SOA would benefit from Producers marketing expertise rather than competing with them
 - Could recreate marketing benefit of RIV

MANAGE RISKS – STRUCTURE OF PARTICIPATION



SENATE FINANCE COMMITTEE – OBSERVATIONS ON HOA

HOA ELEMENTS



HOA SCORE CARD RELATIVE TO CRITERIA

Royalty Study Recommendations	How HOA Addresses Recommendation
Alignment Through Equity	Equity Participation Along Supply Chain; Royalty and tax as share of gas
Improve Commercial Attractiveness	Increases Producer IRR Shares/Reduces Producer Risk
Preserve Value to the State	State could be Cash Flow Neutral relative to status quo depending on final equity share
Manage Risks	
Price Exposure	Equity Participation in midstream dampens exposure to prices
Capital Costs	TC participation lowers State's cash calls prior to commercial operation
RIK Marketing	HOA reflects intent of Producers to negotiate to market State's share of gas
Structure of Participation	Project within a project, Stage gated commitments, Access & pro-expansion principles, Access to information

THANK YOU



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In conducting our analysis, Black & Veatch has made certain assumptions with respect to conditions, events, and circumstances that may occur in the future. The methodologies we utilize in performing the analysis and making these projections follow generally accepted industry practices. While we believe that such assumptions and methodologies as summarized in this report are reasonable and appropriate for the purpose for which they are used; depending upon conditions, events, and circumstances that actually occur but are unknown at this time, actual results may materially differ from those projected.

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Testimony for Senate Finance Committee – Feb. 19, 2014

By Larry Persily, Federal Coordinator

Office of the Federal Coordinator for Alaska Natural Gas Transportation Projects

For the record, I am Larry Persily, head of the federal Alaska gas line project office.

Thank you for the opportunity to testify today. I hope my comments are useful for your deliberations and answer some of your questions.

I'd like to explain why this time may turn out differently than all the other attempts at a North Slope gas line.

But first, I have two examples of Washington taking notice of what's happening in Alaska.

I know normally Alaskans don't like to hear that the federal government is watching our resource development — but trust me, this time it's OK.

I presented an update on the Alaska LNG project last week at the Department of Interior, speaking to the Alaska Interagency Working Group which created by presidential executive order almost three years ago to track and help coordinate the work of federal agencies for onshore and offshore energy projects in Alaska.

As I started talking about the Alaska gas line, people actually paid attention and asked good questions. They've heard about Alaska gas many times before. And their agencies have spent a lot of time on the many false starts in years past.

But they had heard and read that this time might be different — and they were eager to know what was happening.

They had heard that all of the players are working together on the same project and spending serious money to determine if Alaska's time finally has come.

Between budget cuts, retirements and other staffing reductions, however, federal resource management and regulatory agencies don't have any spare time for another false start — like they went through a few years ago with a proposed pipeline from Alaska to serve North American markets.

Though sponsors of that project tried in good faith to make it work, shale gas put an end to it — but not before federal agencies had spent a lot of time on permitting issues, rights of way, scoping meetings and reviewing draft resource reports for an environmental impact statement.

The Federal Energy Regulatory Commission, Department of Energy, Bureau of Land Management, Army Corps of Engineers and others have more than enough files on their desks without the Alaska gas line.

FERC alone has several Lower 48 LNG export terminals on its work list for environmental review.

The Department of Energy has two dozen LNG export applications waiting for review, including applications from the existing ConocoPhillips plant at Nikiski.

Federal agencies are the same as Alaskans — they don't want another false start.

But every one of those agencies is ready to work on the Alaska LNG project just as soon as an application hits their desk. They would just like to know that this time it has a real shot at making it.

I told them last week what I am going to tell you -- and this is coming from someone who is generally very cynical and skeptical.

This time very well may be different. If the markets perform as expected, if the companies and the state can keep the costs down, if the financial terms look good to all parties, you could see gas flowing in the 2020s.

The latest non-skeptic in Washington is Adam Sieminski, head of the Energy Information Administration at the Department of Energy.

“We think the economics ultimately will favor construction of an LNG facility in Alaska,” Sieminski said in an energy newsletter interview this week.

So why this time?

Global LNG demand is the strongest growth industry for energy. Between nuclear plant shutdowns in Japan and Korea; choking coal pollution in China; population and economic growth in India, China and elsewhere in Southeast Asia; high oil prices that can make LNG look affordable by comparison — they all add up to strong demand build for LNG in the Asian market.

The International Energy Agency predicts global demand for natural gas to grow more than twice as fast as oil over the next 20 years. Others predict even stronger growth rates for gas.

Most of the world's gas trade is by pipeline, but LNG is building. And building at an even faster pace than pipeline deliveries.

Many analysts talk of a 5% to 6% annual growth rate for LNG demand through 2020, then slowing down to the 2% to 3% range through 2035.

That would mean the equivalent of a new, good-sized LNG export terminal will need to start up almost every year to meet that demand growth.

And in addition to market growth, older LNG supply contracts are expiring — and some of those older export plants are running low on reserves.

Just this week Egypt, an LNG exporter since 2005, announced it will need to import LNG for the next several years as gas production has fallen short of domestic demand.

All of which means export project developers are chasing not only new demand but replacement contracts for declining reserves.

Someone is going to win that new business. It will be the lowest-cost, stable, predictable suppliers.

The potential competitors to Alaska LNG have their own strengths and weaknesses, as does Alaska.

Australia?

Seven LNG export projects are under construction and set to open over the next three years. But a majority of that gas is already sold on long-term contracts. Those projects are not Alaska's competition for deliveries to start in the 2020s.

New terminals or expansions in Australia face tough hurdles. Cost overruns on the current projects have got companies worried about repeating history.

Domestic consumers are seeing price increases for natural gas, which is being drawn from the local market to higher-priced export markets.

Dow Chemical claims it cannot get the new gas supply contracts it needs for investments in Australia.

Some local jurisdictions have imposed drilling restrictions on coal-bed gas reserves, which feed three of the export terminals under construction.

Russia?

The country has just one operating export plant, but there's talk of expanding it. Russia has another plant under construction, and thoughts of two more.

The expansion talk at Sakhalin-2, led by Gazprom with partner Shell, is dependent on sufficient gas reserves to justify the work.

Gazprom is also talking about building an LNG terminal at Vladivostok.

Yes, a good location for marketing – it's a short tanker trip from there to Japan, Korea, China or Taiwan – four of the biggest LNG buyers.

But it will take a 2,500-mile pipeline to move the gas from Russia's interior to the coast. The field development costs and pipeline are estimated at \$40 billion — not counting the LNG terminal.

To really make the economics work, Russia will need to extend the pipeline and sell gas to China.

The two countries have agreed on everything but the price for the gas. You could say that about a lot of hopeful projects.

Separately, Rosneft and ExxonMobil are doing their due diligence for an LNG plant called Sakhalin-I. They have issued a contract for initial FEED work.

In Russia's distant Arctic, a terminal under construction is called Yamal LNG. It's about halfway between Iceland and Nome.

Estimated at \$27 billion, the sponsors talk of making their first deliveries in three or four years.

The tricky part for Yamal is that the Northern Sea Route to Asia will be passable for LNG tankers only a few months each year, and even then only with government-funded nuclear-powered icebreakers as escorts.

The rest of the year, the plan is to ship the LNG aboard ice-class tankers to European ports, where the LNG would be transferred to less expensive standard tankers for the long voyage down the European coast, across the Mediterranean Sea, through the Suez Canal, across the Indian Ocean and into Asia.

Look at the map and you see the economic challenges Yamal faces. Plus its main sponsor, Novatek, has never built or operated an LNG terminal.

Canada?

There are multiple proposals; none have all their government authorizations or a final investment decision.

None have cleared the consultation process with every First Nation in the area and along the pipeline route.

The developers that are talking about price are emphatic that they need oil-linked LNG pricing or something comparable to cover their sizable development costs.

There is no Prudhoe Bay production facility in British Columbia's Horn River and Montney shale gas plays that would feed the LNG terminals at Kitimat and Prince Rupert. They have to build it. Gas has to pay for it.

The pipelines that would move that gas to the coast are as long as 525 miles and must go through two mountain ranges.

One possible route into Prince Rupert takes the pipeline offshore for up to 75 miles and across either an old mine tailings disposal site or mollusk bed important to First Nations people.

Meanwhile, the British Columbia government is negotiating a new LNG export tax with project sponsors. The legislation been delayed until fall, with companies saying no project decisions until they know the tax.

Tanzania and Mozambique?

An awful lot of gas but minimal infrastructure; still developing their oil and gas laws and fiscal regimes; and local poverty could become an issue for developers and political leaders.

Closer to home, the U.S. Lower 48 states?

It's a tough political battle, pitting oversupply and low prices at home vs. the free market and exports to trade partners.

The Department of Energy has approved six export licenses, totaling 8.5 bcf a day. That's equal to almost 12% of current U.S. gas production.

The unknown is if and when and under what conditions the department might start to close down or further delay its export approvals.

And regardless of what government does, the only terminals to be built will be the ones that have buyers and can get financing. Just one is under construction so far, in Louisiana.

Other issues for Lower 48 exports include cost overruns at the Panama Canal expansion, which is essential for getting tankers out of the Gulf Coast and into the Pacific.

One of the Gulf Coast project sponsors said this week that Asian buyers are putting off new long-term contracts for U.S. gas because of the delay in knowing just how much it will cost to use the expanded Panama Canal.

Local opposition over environmental and safety concerns is not very noticeable for Gulf Coast terminals but is extremely visible for terminals proposed for the Oregon and Maryland coasts.

My point is: Like Alaska, every proposed project, has its own problems, its own disadvantages, its own issues to solve.

The winners, the terminals that get built will be the ones that solve the problems, hold down costs, and convince buyers that they will start up on time with competitive prices.

The pre-FEED and FEED work — front-end engineering and design — is a key part of that effort. The more you do up front, the better the odds of avoiding surprises during construction.

And in a brief advertisement for our office's work, we issued a report today on just what are pre-FEED and FEED and why they are so important. It's available on our website arcticgas.gov.

ALASKA LNG ADVANTAGES

These are substantial and meaningful.

Shorter tanker run from Nikiski to Japan; one week vs. three weeks from the Gulf Coast

- Tanker charter rates are running \$75,000 to \$100,000 a day. Time is money. Big money at those rates.
- Or less capital tied up in fewer ships if owner-operated tankers.

Proven gas reserves already being produced. It's important to buyers to know that the gas they're committing to buy for 15 or 20 or 25 years actually exists.

Low production costs compared to greenfield projects in B.C., Australia, East Africa.

Oil will carry the infrastructure costs.

Almost 40 years experience producing on the North Slope.

Liquefaction compressors run much more efficiently at cold temperatures.

- Up to 15% more efficient (less gas consumed) than in warm-climate LNG sites

ALASKA LNG DISADVANTAGES

These also are substantial and meaningful.

High construction costs in Alaska.

Seasonal construction limitations (pipeline trenching during the winter only).

Summer-only sealifts of material to the North Slope.

Environmental considerations (wetlands, air quality standards, mitigation expenses).

The cost of an 800-mile pipeline to tidewater that competing LNG projects don't have.

And the need for fiscal certainty is a hard sell in the world of Alaska oil and gas politics.

The federal government is ready for the permitting work, but making the finances work is up to the project sponsors and the state.

The rewards to the state of a successful project include public revenues, the lowest cost to move gas to Alaskans, and an industry commitment to keep North Slope gas and oil flowing for decades.

The risks of state investment are cost overruns that require more cash during years of budget deficits, and the possibility that the project will not make as much money as projected or as people want.

I can't help you there, other than to say the LNG world is a competitive market. But it's not an impossible market.



Early planning, design, engineering key to LNG project success



By:

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Release Date:

February 19, 2014

Well before big money gets committed to construct a liquefied natural gas export project, sponsors typically spend years studying such questions as: Should this project get built? Does it make business sense? And, as the analysis progresses: Does this project continue to make sense? The proposed \$45 billion to \$65 billion Alaska LNG export project is going through that process now.

It's the up-front planning that is critical to megaproject success.

When done well, this pre-construction work can be the reason a project gets built on time and on budget, and creates the kind of cash flow the board of directors was told to expect.

The work goes by different names in different industries. For Alaska LNG, the current work is called pre-FEED — or pre-front-end engineering and design — which will be followed by a more intense FEED phase if the project continues.

During these stages, the project team selects the technology to be used in the production units. It chooses sites for facilities and does initial layouts. Utilities are plotted. Labor needs, particularly skilled-labor needs, get problem solved. Pipeline routing and the related issues — soils, vegetation, river and wetlands crossings — get documented and the best solutions determined. Needed licenses, authorizations and environmental permits are identified and many might even be secured. Markets are assessed and reassessed. A financing plan is defined.



Source: *Alaska LNG Project*

Part of the Alaska LNG Project gas-pipeline route. The line would feed an LNG plant and export terminal at Nikiski. (Click to enlarge.)

For Alaska, the remote location creates logistical challenges that need detailed planning: Winter-only burial of the 800-mile pipeline because that's when the tundra is frozen; summer-only delivery of massive gas treatment plant modules to the North Slope because that's when Arctic sea ice is absent.

"The definition of a project, from the formation of the core team until full-funds authorization is achieved, is what we call the FEL [front-end loading] process," wrote development guru Edward Merrow in his 2011 book "Industrial Megaprojects: Concepts, Strategies, and Practices for Success."

"FEL is the single most important predictive indicator of project success. There are very few project professionals in the process industries who do not agree with the basic principle that definition and planning drive success, and those who don't should probably be in some other line of work."

Merrow is founder and president of Independent Project Analysis Inc., a major consultancy whose client list includes some of the biggest companies in the world. IPA conducted a megaprojects seminar for Alaska lawmakers in 2011.

"Megaprojects are the most important projects in any industrial company's portfolio," Merrow said in his book.

"When they succeed, the company is strengthened for the long term. When they fail, massive amounts of shareholder wealth can be made to evaporate in a single project."

Even though good up-front planning means better project results, half of all megaprojects in his company's vast database fail to meet that standard, and their failure rate is high. LNG projects do a little better than this average "but not systematically so," he said.

For Alaska LNG, Steve Butt is the man charged with making sure the up-front planning is excellent. He's a career ExxonMobil manager and the senior project manager for this project, having worked stints with ExxonMobil on its big LNG projects in Africa and most recently in Qatar.

"Megaprojects are often defined as projects over \$1 billion," Butt told an Alaska Senate Resources Committee on Feb. 3. "In today's world they're sometimes defined as projects over \$10 billion. By any metric this is one of the largest megaprojects ever, and in some ways it's really five megaprojects, each one working with each other. ...

"No one has ever permitted a project this large. No one has ever permitted an 800-mile pipeline in the NEPA (environmental impact statement) era in the U.S. No one has ever done an LNG plant this big or a gas treatment plant this big. We'll have to do all three."

HUNDRED-MILLION-DOLLAR QUESTIONS

"Ignorance is the mother of research."

- Laurence J. Peter, founder of the Peter Principle

ExxonMobil owns the largest proportion of North Slope gas that would be produced for the Alaska LNG project, and it is leading the technical team among the four companies scoping the project — North Slope producers BP and ConocoPhillips as well as pipeline company TransCanada are the other three.

ExxonMobil has a reputation for tightly controlling its LNG projects, such as the massive Qatar plants built during the first decade of the 2000s. Its Papua New Guinea project is over budget due to unfavorable currency exchange rates, landowner protests, labor work stoppages and bad weather, but it's still on schedule to start production this year.

"Before we make the first cut with a saw, we re-measure five times instead of one," an ExxonMobil executive said in The Wall Street Journal last month of the company's megaproject planning.

Butt talked with the Alaska Senate Resources Committee about the challenges of the project he is overseeing, including planning a megaproject that needs labor, resources and equipment that can handle Alaska's extreme environment.

"It's so big it creates its own weather, and if we're not careful it competes with itself, because we don't want to have challenges with welders on Part A working at odds or at issues with Part B. So we have to plan this very carefully so we level-load this work, we make sure we get the resources we need for the right craft skills and we don't compete with ourselves. That's very important."

The project is "so big it creates its own weather, and if we're not careful it competes with itself. . . so we have to plan this very carefully."

- Steve Butt, senior project manager, Alaska LNG

The team he oversees is looking at every detail, to narrow the estimated \$45 billion to \$65 billion price range and pin it as low in that range as possible.

"We go from really big questions — multibillion-dollar questions — and we just keep grinding it down: Hundred-million-dollar questions, ten-million-dollar questions, million-dollar questions, until we get to such a high level of certainty you move to a place where the investors are ready to make a decision," he said. "They want to know that you've resolved all those uncertainties." He cited some examples.

The steel for the 800-mile, 42-inch-diameter pipeline would be what's known as X80 — extra-strength steel that, if you extracted a plug from it and strained the plug, could withstand 80,000 pounds of pressure per square inch. Ultra high-end stuff.

"We're looking real hard at the materials," Butt said. "The type of material is really important because it defines the amount of steel in the line and the type of steel in the line, and that tells you who can make it, how many mills can you get it from and what it's going to cost. So one of things we have to study in pre-FEED is the material on that pipeline design. ... Can you go to X70? There's little questions that drive huge value, because this system is so big, any little change you make is hundreds of millions of dollars."

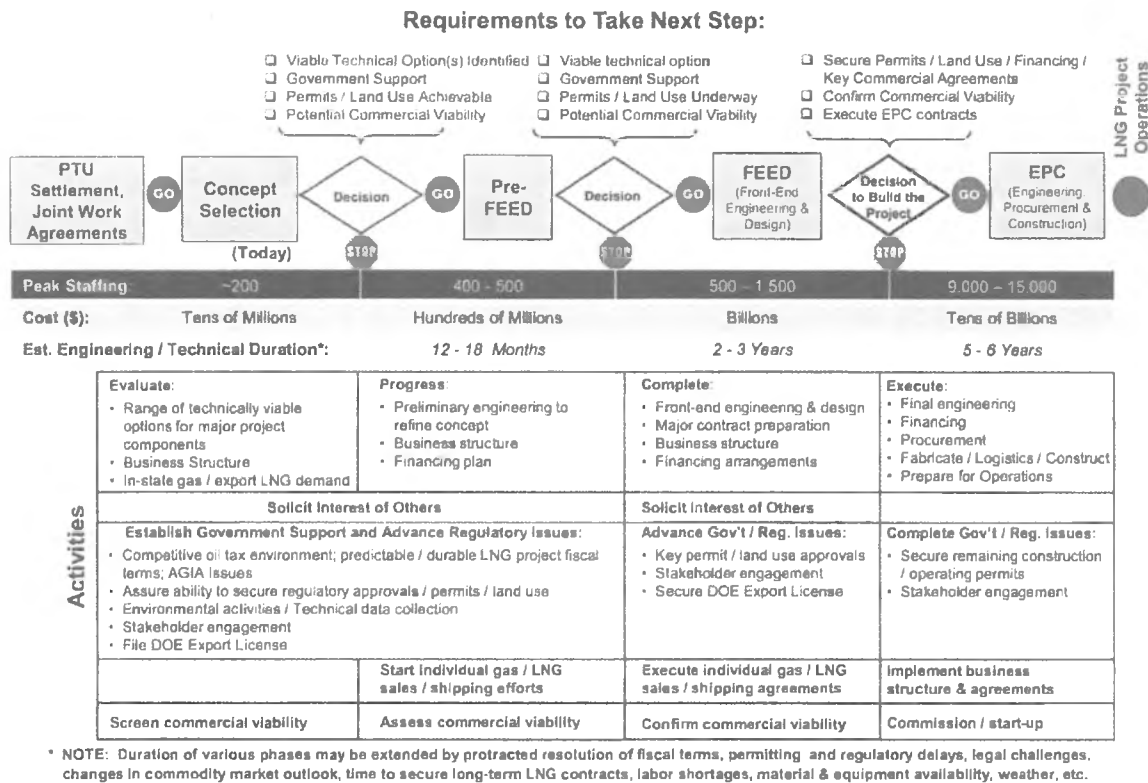
The natural gas produced at Prudhoe Bay — the main field that will feed Alaska LNG — is tainted with about 12 percent carbon dioxide. The project is planning a multibillion-dollar gas treatment plant to extract the CO₂ because it would corrode steel pipe, doesn't burn and LNG buyers don't want it in their gas. Recently Butt's team reconceived the gas treatment plant, streamlining it from an earlier design and syncing it with design of the liquefaction plant to be built 800 miles to the south.

"That's a lot of money we saved," Butt told the committee. "But more importantly, it means the system in the north — with three trains for treating — is now balanced with the system in the south — with three trains for liquefaction. For operations and maintenance over the next 35 years

it a much better balanced system. So this is a pretty big achievement for us that we've been working on over the last several months. It's a huge cost savings and risk reduction."

PRE-FEED, FEED PUSH PROJECT AHEAD

Southcentral Alaska LNG – Work Plans / Key Decision Points



Source: Alaska LNG Project

Graphic from October 2012 outlining the stages and decision points anticipated for the Alaska LNG export project. The project is in the pre-FEED stage currently. (Click to enlarge.)

Officially, people involved with Alaska LNG, including state of Alaska officials, dub the phase the project is currently in as pre-FEED, or pre-front-end engineering and design.

This phase is a precursor to a more formal — and expensive — stage called FEED, which in turn leads up to a final investment decision, or FID, on whether or not to construct the project. One thing to know about FEED in particular is that this is a term commonly used in the LNG industry but isn't all that universal within the engineering world. Other words cover the same scope of project work — Merrow in a passage quoted above spoke of front-end loading, or FEL, a more common term.

Pre-FEED is starting to get used more widely to describe the LNG project-related activities that occur before FEED — there can be many such activities, so a term for them can be handy. In the case of the Alaska LNG project, FEED would include:

- Enough engineering of the project so that contracts can be let for final engineering, procurement and construction (called EPC). EPC contracts are where the BIG money gets spent and the project is built.
- Crafting a plan for supplying, commissioning and starting up the Alaska LNG infrastructure — the gas treatment plant, gas pipeline, LNG plant and all related facilities.
- An estimate of the capital costs itemized in sufficient detail that corporate directors charged with making the yes-no final investment decisions are comfortable with their choice.
- A final assessment of environmental, social and health impacts.
- Action on procuring anything for the project that requires long lead times.

These are standard activities during FEED.

Pre-FEED would involve engineering, design, technical and other work needed to prepare for FEED. This includes conducting enough environmental field work and designing the project in enough detail to support applications to the Federal Energy Regulatory Commission for authority to build and operate the project. At a minimum, FERC would oversee the LNG plant construction and possibly the pipeline and gas treatment plant. The commission would produce an environment impact statement as part of its review.

At the end of the pre-FEED stage, each company sponsoring the project would decide if it wants to continue to FEED based on the information gathered so far.

"The purpose of Pre-FEED is to progress technical work that would provide each of the Alaska LNG Parties with sufficient information for evaluating the technical, cost and schedule aspects of the Alaska LNG Project," says the January 2014 Heads of Agreement signed by the state, the three major North Slope producers and TransCanada.

The pre-FEED, combined with other commercial, legal, economic, financial and marketing information, will help all of the parties decide whether to spend billions of dollars on FEED, the HOA says.

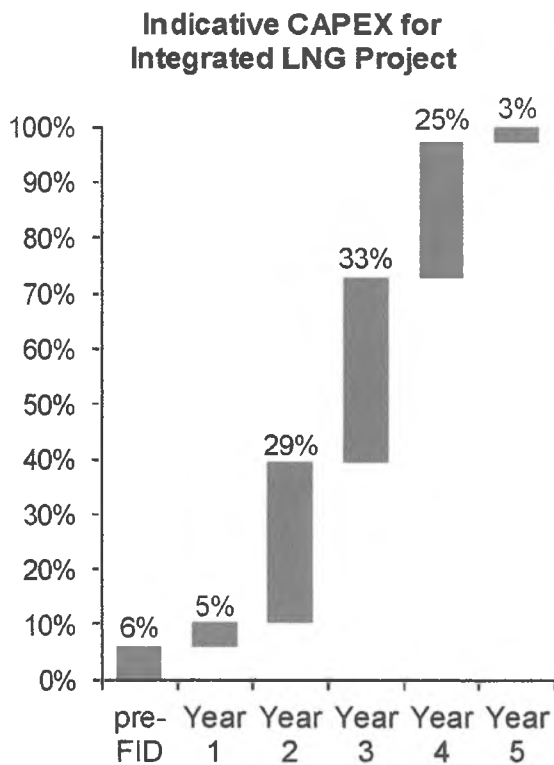
Joe Balash, Alaska commissioner of Natural Resources, and Michael Pawlowski, Alaska deputy commissioner of Revenue, told the Senate Resources Committee on Feb. 7 the pre-FEED phase should last up to 18 months and involve about \$435 million in spending. Pending Alaska Legislature action before it adjourns in April, the parties committed in the HOA to ramping up pre-FEED in 2014.

The agreement says the FEED decision would occur within three years after pre-FEED ramp-up begins — that could put it at late 2016 or early 2017. Balash and Pawlowski told the Senate committee the more intense FEED stage would span two to three years and roughly estimated it would involve about \$1.8 billion in spending. The HOA says FEED would cost "billions of dollars."

IS THAT BIG MONEY?

Now, \$2.4 billion in pre-FEED and FEED expenditures that the state of Alaska estimates might sound like BIG money, and it is.

But for a \$45 billion to \$65 billion project, it's only about 5 percent of the total. It'd be like saying a 10-story building is tall — perhaps in some cities, but not in Manhattan. Five percent CapEx spending through FEED is about normal for megaprojects, according to Merrow and others.



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. ([Click to enlarge.](#))

For LNG projects, figure 6 percent, said Nikos Tsafos of Analytica Inc., a consultant to the Alaska Legislature on the LNG project, in November 2013. The other 94 percent gets spent after the final investment decision to build. This encompasses all the final engineering, purchase of materials and construction spending. In January, Tsafos loosened his estimate to "less than 10 percent" before FID.

"Before you get to final investment decision, you haven't spent any real money," Tsafos told the Legislative Budget and Audit Committee Jan. 28. "It's not 'real money' in the context of \$65 billion.

"The reason this matters (the pre-FEED and FEED spending) is because by the time you get to FID, you haven't resolved but you have found an answer to most of the things you are worried about.

"So it's not the type of project where you put in \$65 billion and as you're putting the money down you're thinking, 'Well, how should we do this? Who should we market it to? How should we finance it?' It doesn't work that way.

"By the time the large bulk of that investment takes place, all these things will have been sorted out. Maybe not to a 100 percent. You may not have signed every single deal with everyone. But you'll have a pretty precise idea about what each one of these things (upstream, midstream, liquefaction, shipping, marketing, finance, permitting) are going to look like," Tsafos said.

"So, yes it's a big project, it's a massive project. But 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."

WHAT CAN GO WRONG?

"It ain't what you don't know that gets you into trouble. It's what you know for sure that just ain't so."

- Mark Twain (some say)

One needn't look hard to find megaprojects that became big messes. Way over budget. Way behind schedule. That didn't work as planned.

Take Denver International Airport, a favorite case study in the annals of project management disasters.

It opened in 1995, 16 months behind schedule and 80 percent — \$2 billion — over budget. Its much-touted automated baggage-handling system "became famous for its ability to mangle or misplace a good portion of everything that wandered into its path," as the New York Times put it. The airport scrapped it in 2005, replacing it with humans. A triumph of man over machine. The textbooks call Denver's failure a classic case of inadequate pre-FID work, of reliance on untested technologies, of "optimism bias." And, a flaw that sometimes infects big-ticket public works projects that politicians really want. It's called "strategic misrepresentation" — the cloaking of true costs from the public for fear they would rebel.

Other favorite examples: Boston's Big Dig tunnel — original budget \$2.8 billion, ultimate cost \$22 billion — and the Chunnel connecting England and France — 20 percent late; 80 percent more expensive than forecast.

Among LNG projects, the Chevron-led Gorgon project under way off Australia's west coast is more than 40 percent over budget as the sponsors endure a trickier environment, and costlier labor and materials than expected, as well as an unfavorable exchange rate and some acutely nasty cyclones. These are all issues that developers try to foresee and address during pre-FEED and FEED.

Angola LNG was supposed to start up in 2012. It finally shipped its first load in July 2013, more than a year behind schedule. Chevron is a partner here, too, and the CEO said Jan. 31, 2014,

"we have had some technical issues on the front end of that plant." Likely the plant will operate at just half capacity in 2014 and ideally will hit full capacity sometime in 2015, he said.

MONEY WELL SPENT



Source: Alaska LNG Project

An Alaska LNG field crew working in northern Alaska along the proposed gas pipeline route during the 2013 summer.

In his book, Merrow said a project with severe and continuing production problems in its initial years is a failure by definition.

After spending billions or tens of billions upfront on megaprojects, the corporate board wants its payoff, and that starts the moment the plant gets switched on. A late start or a slow start mean a lot less cash inflow than the directors were told to expect.

"The early years' production are the most valuable the project will ever have," Merrow said. When lost, they're lost for good.

Although there are no ironclad laws about these things, there are some general rules of thumbs circulating in the industry's literature about what constitutes a problem project besides start-up production problems: big cost overruns or big schedule slips — say 25 percent beyond what they should be.

"Megaproject results are frequently seriously short of the expectations of the sponsor-investors," Merrow wrote. "Their cost overruns are often so significant that the whole project becomes NPV negative."

Negative NPV — or net present value — does not mean unprofitable, it should be noted, but rather that the return on investment is below the investor's requirements.

"The real question is whether the investment you made up-front is optimal or not, or whether having put that money elsewhere would have generated a better return. So it's not really usually about losing money. It's about the optimal use of money," Tsafos explained to the Alaska Legislative Budget and Audit Committee in January 2014.

Megaprojects whose pre-FEED and FEED are well done — Merrow calls these stages FEL-1 through FEL-3 — have good track records for producing plants that operate as expected, according to his company's database.

Megaprojects are headed for trouble if the partners' interests are out of sync, if they skimp on pre-FEED and FEED staffing, if they're under such schedule pressure that corners get cut, if they short-change upfront planning because it can be expensive.

"We hear things like, 'Why should it cost so much money? I once front-end loaded a big project on a napkin over a beer.' If you are the project director, now would be a good time to post your resume," Merrow said in his book.

"Doing a thorough job defining and planning an industrial megaproject takes 3 to 5 percent of eventual total capital cost. Let's be clear; on a megaproject that is a lot of money. The cost, however, of not spending the money is much, much more."

-By Bill White, Researcher/Writer for the OFC. bwhite@arcticgas.gov

<http://www.arcticgas.gov/early-planning-design-engineering-key-lng-project-success>