ALASKA STATE LEGISLATURE
HOUSE RESOURCES STANDING COMMITTEE
January 25, 2016
1:06 p.m.

MEMBERS PRESENT

Representative Benjamin Nageak, Co-Chair
Representative David Talerico, Co-Chair
Representative Bob Herron
Representative Craig Johnson
Representative Kurt Olson
Representative Paul Seaton
Representative Andy Josephson
Representative Geran Tarr

MEMBERS ABSENT

Representative Mike Hawker, Vice Chair

COMMITTEE CALENDAR

PRESENTATION(S): ALASKA LIQUEFIED NATURAL GAS (AK LNG) PROJECT BY STEVE BUTT, SENIOR PROJECT MANAGER

- HEARD

PREVIOUS COMMITTEE ACTION

No previous action to record

WITNESS REGISTER

STEVE BUTT, Senior Project Manager
Alaska LNG Project
ExxonMobil Development Company
Houston, Texas
POSITION STATEMENT: Provided a PowerPoint update on the Alaska Liquefied Natural Gas (AK LNG) Project.

ACTION NARRATIVE

1:06:50 PM

CO-CHAIR BENJAMIN NAGEAK called the House Resources Standing Committee meeting to order at 1:06 p.m. Representatives Seaton,

Tarr, Olson, Josephson. Talerico, and Nageak were present at the call to order. Representatives Johnson and Herron arrived as the meeting was in progress. Representative Colver was also present.

CO-CHAIR NAGEAK thanked the Department of Natural Resources (DNR) for assisting in getting the new up-to-date resource maps displayed on the committee room walls.

PRESENTATION(S): Alaska Liquefied Natural Gas (AK LNG) Project by Steve Butt, Senior Project Manager

1:08:24 PM

CO-CHAIR NAGEAK announced that the only order of business is an update on the Alaska Liquefied Natural Gas (AK LNG) Project by Steve Butt, Senior Project Manager.

1:08:33 PM

STEVE BUTT, Senior Project Manager, Alaska LNG Project, ExxonMobil Development Company, noted that today's PowerPoint update on the Alaska Liquefied Natural Gas (AK LNG) Project is the first of three updates in 2016 as required under Senate Bill 138 [passed and signed into law in 2014]. He said he is representing the work of the [four] members of the project team [State of Alaska through the Alaska Gasline Development Corporation (AGDC), BP, ConocoPhillips, and ExxonMobil]. The project team views itself as a project organization evaluating the technical and economic viability of the Alaska LNG Project. When providing these updates the team views legislators as the board of directors for the shareholders, the public who, as owners, help make the decisions around funding and directing the project. He said he will be speaking about what has happened since the last update that was given in September [2015].

1:10:45 PM

MR. BUTT turned to slide 2, "Alaska LNG - Project Overview," explaining that the objective of the Alaska LNG Project is to treat, transport, and liquefy the gas on the North Slope in a manner that can be commercially attractive. This means a way must be found to clean up the gas, move it across the state, make it cold, and ship it to consumers in markets that are in need of energy. As the owner, Alaska is the seller and must think in the construct of what makes sense for the seller. The seller must think about how to deliver gas/energy at a cost that

is competitive with, or less than, all the other projects that are trying to capture the same market.

1:12:14 PM

MR. BUTT said the Alaska LNG Project is anchored by the Prudhoe Bay and Point Thomson fields where it is thought that there are 32-35 trillion cubic feet (TCF) of gas. The project would build a transmission line between Point Thomson and Prudhoe Bay that the Point Thomson owners would carry. A gas treatment plant (GTP) would be built [on the North Slope] to remove carbon dioxide (CO_2) and other impurities. He explained that CO_2 is a by-product of reservoirs, with most reservoirs having about 4 percent CO_2 but Prudhoe Bay having 12 percent CO_2. No other LNG projects in the world today are treating reservoirs with that much CO_2. A huge element of the Alaska LNG Project is to find a way to efficiently treat the gas and put those impurities back in the ground. After treatment the gas would be moved south through an 804-mile-long pipeline from Prudhoe Bay to the lead project site located outside of Nikiski. The pipeline would handle about 3.3-3.5 billion cubic feet of gas [per day] (BCFD). Mr. Butt explained that these numbers move with fuel and in-state demand because more gas is used for heating in the winter than in the summer. The gas would be brought to the liquefaction facility to be cooled to -260 degrees Fahrenheit (F). At -260 degrees F, methane gas turns into a liquid and shrinks by a factor of 600. The cooling is done in order to deliver a certain volume of gas to foreign markets and it is much easier to deliver one cargo of liquid gas than 600 cargos of gas in a vapor phase. In summary, the Alaska LNG Project would treat the gas to remove impurities, transport the gas, provide gas to Alaskans, and cool the gas so it can be exported.

1:14:50 PM

MR. BUTT stated that the Alaska LNG Project has several advantages. The is being located in Alaska where the weather is cooler and drier relative to other places where LNG is made, which allows the gas to be liquefied much more efficiently. Compared to the Middle East, an LNG plant can be built in Alaska with the same horsepower and same equipment and produce 10-15 percent more LNG. Another advantage is being in the Northern Hemisphere. When it is cold in Alaska it is also cold where the buyers are. Because compression equipment is more efficient when it is cold it makes more LNG when it is cold. Therefore, the project is making more LNG in January and February when everyone wants to buy it. Many of the project's competitors are

in the Southern Hemisphere, so those places have to add a lot of compression and make their plants bigger because it is hot in January in the Southern Hemisphere. To handle the difference between the southern and northern hemispheres those competitors must spend more money than does the Alaska LNG Project. The third and most important advantage is being anchored by the known resources of Prudhoe Bay and Point Thomson. The Prudhoe Bay operator has been maximizing oil production by reinjecting the gas back into the ground. There is no resource risk like many other projects because Prudhoe Bay has produced 7-9 BCFD every day for the last 30-plus years and has put it all back in the ground. The project's federal regulator, the Federal Energy Regulatory Commission (FERC), is pleased that the upstream infrastructure is already developed and that the project is taking advantage of a known resource.

MR. BUTT said these strong advantages offset the challenges of the high CO_2 levels at Prudhoe Bay that require a lot of treating and having to move the gas 800 miles from [the North Slope] to a port that can operate for 12 months out of the year. The Alaska LNG Project must pay for this infrastructure, which is infrastructure that most other projects do not have. While some LNG projects operating in the world have about 400 miles of pipeline, no project has 800 miles.

1:17:10 PM

MR. BUTT addressed slide 3, "Alaska LNG - Status," reporting that the team completed all work in 2015, about a half million hours in the field and in the office, without any incidents. One incident occurred in 2014 and none occurred in 2013 or 2012. The project continues to build a culture of caring where people are aware of their actions and are making safe choices.

MR. BUTT advised that the project spent about $83 million in 2014 and about $293 million in 2015, for a total spending of about $376 million on Pre-Front-End Engineering and Design (Pre-FEED) as of closing the books for 2015. In addition to the Pre-FEED expenditures about $170 million was spent on concept work, for a total expenditure so far of about $480 million. The Alaska Gasline Development Corporation (AGDC) recently provided information in the public domain that the approved 2016 budget is $230 million, although efforts will be made to try not to spend that much. The initial design work that was defined in the June 2014 joint venture agreement (JVA) is about 85 percent complete. However, that does not include the work being done on the 48-inch pipeline; when that is included the work is about

70-75 percent complete. The JVA goes out to the middle of 2017 and when looking at what needs to be done in 2016 the project is on track.

1:20:24 PM

REPRESENTATIVE OLSON asked what the cost is for the 48-inch pipeline study.

MR. BUTT replied that it was scoped at about $30 million but may get done for $26 or $27 million.

1:20:51 PM

MR. BUTT returned to slide 3, explaining that the aforementioned all goes into the execution basis for cost and schedule. One of the most important deliverables in the Pre-FEED phase is a really good estimate of what the project will cost. The range of between $45 and $65 billion has always been used. While the estimate will remain within that range, he said he would like the cost to be at $45 billion, not $65 billion. Progressing the regulatory work done in 2015 will continue in 2016, and this is viewed as critical path because if this slides everything slides with it. The FERC work is viewed as critical path because, until more certainty is had on the regulatory environment and the permit, it is hard for the team to make decisions; for example, labor and logistics hinge on when the permit is received to construct. While the project continues to have great support from FERC, it does not have certainty on when [the permit] will be done. The Alaska LNG Project has received export authorizations for both free-trade and non-free-trade countries, making the project one of just a handful in the U.S. that have the right to export gas. Outside the project domain, the Prudhoe Bay and Point Thomson operators worked with the Alaska Oil and Gas Conservation Commission (AOGCC) to get the right to offtake gas. Prior to that work neither Point Thomson nor Prudhoe Bay had the right to deliver gas to the project; so, from a project perspective this was a big risk given that the project is talking about building a $45-$65 billion project and nobody had right to give the project gas. A step forward like this is called de-risking.

1:23:29 PM

MR. BUTT reported that in 2016 the Alaska LNG Project will continue its Pre-FEED work and its environmental impact statement (EIS), which is the product of the FERC resource

reports. The resource reports inform the EIS, and the completion of the EIS allows the project to secure an authorization to construct. Work on the 48-inch pipeline will be finished in the second quarter and the team will try to make its decision in April 2016 on which size makes more sense. Geotechnical and geophysical work (G&G) will be continued. Field work will continue to finish the resource reports to FERC; FERC wants one set of drafts written in pencil, a second set written in pen, and then a final application. The pencil draft was provided to FERC in first quarter 2014 and many of the components of the pen draft are finished. In 2016 the team will also do a lot with contracting strategy - how to make sure the project will be globally competitive and engage global LNG companies with local Alaskan companies. The team will keep trying to provide owners with information for the Front-End Engineering and Design (FEED) decision.

MR. BUTT pointed out that a strength of this project is that for the first time ever all four parties with a claim to the gas on the North Slope are working together. The three producers bought the right to produce the hydrocarbons from the State. The State receives its share of revenue as a derivative right. All four of those parties have a claim to that resource in different ways, but this is the first time all four parties have tried to come together and work out all the myriad issues associated with making that happen. As a board of directors group for the owners, legislators need information to make this decision that will be coming up later this year or middle of next year, and the legislative updates will provide this information.

1:25:42 PM

MR. BUTT reviewed several key messages. The first, he said, is that the Alaska LNG Project is an integrated LNG project. The plants are really important and are three-quarters of the cost. Without the LNG plant there is not the ability to underpin the economy of scale necessary to make the whole project work because the amount of gas Alaskans use is a fraction of the amount of gas the project will be handling. Alaskans use about 250 million cubic feet of gas a day on average; AGDC's recent study was about 220 million. However, the project will be sending 10 times that amount - about 2.4 billion cubic feet a day to export markets, enough gas to fuel an economy the size of Germany - and the State has enough gas to do that for decades. Having the ability to liquefy that gas and get an export market to underpin the project will attract interest from investors,

lenders, and buyers to make a project like this work. This project cannot be done if it isn't integrated and that comes back to the gas treatment plant. The CO_2 must be taken out of the gas and put back in the ground because CO_2 has no beneficial use and it freezes at [-50] degrees F. In trying to make gas really cold at -260 degrees F and with CO_2 freezing at -50, everything that the CO_2 touches freezes. So, the CO_2 must be removed to prevent damage to the plant and stopping the plant from running. The CO_2 cannot be vented as an alternative to being put back in the ground because it has adverse impacts on the environment, so the project must meet this head on and make sure there is the ability to reinject the gas at Prudhoe Bay.

1:27:23 PM

REPRESENTATIVE OLSON inquired about the CO_2 content at Point Thomson.

MR. BUTT responded that the Point Thomson CO_2 content is about 4 percent, much less than [the 12 percent at] Prudhoe Bay. Most reservoirs are about 4 percent and most LNG projects are in the 2-4 percent range. It is uncommon to liquefy gas with more than 4 percent CO_2 - there is only one, in Western Australia, and it will be coming online sometime in the next 9-12 months. Combining Point Thomson and Prudhoe Bay gas will help because the blended stream has less CO_2 than Prudhoe Bay alone. The gas treatment plant must be built to handle the gas at Prudhoe Bay. Whether for the 10.5 percent blended value of Point Thomson plus Prudhoe Bay or just for Prudhoe Bay, the size of the facility is about the same.

1:28:32 PM

MR. BUTT resumed his discussion of slide 3, stating that another key message is that low cost of supply wins. Everything in the LNG market is about cost. People want the utility value of the gas; it is not Copper River salmon, nobody will pay extra for it. It is very competitive and people will pay just a little bit less than they can get it for from somebody else. The Alaska LNG Project has to be that reliable supplier that can be cost competitive. Today's low oil prices show how important cost is and also show that prices go up and down. What matters in a project world is whether the participants can find enough alignment to work together, that they trust each other so that when markets come up and down they can work through those problems because there are always problems. Can the participants build a system that is resilient enough that when

prices go up and down they can survive the downs? Is there a little bit left over when the market is down so that when the market is up there is the ability to pay everything back? He urged that legislators, as representatives of the owners, think about this as he shares information in this regard.

MR. BUTT advised that low oil price isn't so much about whether the project makes sense at $30 given that the project will not pencil to come online until 2025 or so. Rather, it is about what the price might be in 2025 or, more importantly, what the price might be in 2040 since the Alaska LNG Project has a 25-40 year life. What will make the project work is the ability to resolve the issues so that all parties see a benefit for themselves and can move forward. Low prices just sharpen the participants' focus. He related that one of the biggest projects he was involved in during his 30-plus years of project work was done at an oil price of $9 because the project had the ability to look far ahead.

MR. BUTT stressed it is critical for owners to think about whether the project would be losing money on a unit cost basis. If the project cannot deliver gas cheap enough that there is a margin when the prices are down, the project cannot make up for it on volume. It cannot be offset because it takes so much money up front: $45-$65 billion must be spent to ship the very first molecule of gas and then every molecule after that gets cheaper. This is why the whole life of the project, the cost of supply, must be looked at. The cost of supply is calculated by adding together all the costs to build and operate the facilities and ship the gas and then dividing that by the amount of gas that will be shipped. The critical question for the project's owners is whether the project can supply markets for less than another supplier. Mr. Butt explained that in his project leadership role he must test how to drive down cost of supply: testing how to get more LNG for less cost by changing machinery configurations, design configurations, and material sources. That is what boards of directors - owners - need to hear and that is the message he is bringing to the committee. Mr. Butt further pointed out that risk is the other side of the coin. One risk is the price going down. Another risk was not having gas offtake, but now there is gas offtake so that particular risk is gone.

1:32:36 PM

MR. BUTT moved to slide 4, "Project Design Basis - Update," informing committee members that the integrated design basis is

pretty much finished. He explained that detailed compositional and hydraulic analyses have been done on the gas from Prudhoe Bay and Point Thomson, meaning a look was taken at every single molecule of every single hydrocarbon and non-hydrocarbon element in the gas to see how much is methane, ethane, liquids, propane, and so on, all of which can be used. An integrated system has now been built from these analyses. The system is very interdependent. For example, changing the delivery temperature of the compression facilities at Point Thomson by about 10 degrees results in moving hundreds of barrels a day of condensate across the whole system. This is because instead of stripping it out at the top it moves all the way to the bottom. So, decisions must be made about what is the best way to put the equipment, what is the right temperature, what is the right pressure to drive down cost of supply.

MR. BUTT explained that modeling and analyses are done to ensure the project is fit-for-purpose. Fit-for-purpose is the way of saying at the lowest possible cost without compromising safety, ability to deliver, or reliability. The next thing that is done is called reliability, availability, and maintainability (RAM) modeling. It is detailed modeling over a 40-year period of every piece of equipment to ensure that the maintenance cycles are not conflicting - that when work is needed on the GTP in the north, work can also be done on the LNG plant in the south. This allows the work to be matched up because the different pieces of equipment have different life cycles. All equipment needs maintenance, but some need maintenance every 5,000 hours and some every 10,000 hours. So, machinery selection and design work must be done to ensure that it all syncs up and remains balanced to help drive down costs; for example, there are three gas treatment trains and three LNG trains.

1:35:12 PM

MR. BUTT discussed slide 5, "LNG Plant and Marine Terminal Update," noting that the top right picture shows how a barge (depicted with the red line) would deliver a module (tall structure in the center of the picture) to a roll-on/roll-off (RORO) facility. There is also a lift-on/lift-off (LOLO), which is a crane facility so barges and materials can be loaded from the side. This work is complete and it is now known exactly how to move all the equipment that will be needed to build the facility. The marine design is continuing to be looked at to ensure that costs of the trestle and the size of the footprint are minimized. The geotechnical program was successful with 61 boreholes drilled onshore, 25 boreholes drilled offshore, and 20

monitoring wells drilled to ensure it was understood what was in the soil. It was confirmed that the lead site's geotechnical considerations were as expected - extra money does not need to be put into foundations. The site does not have folding and faulting that would require design for handling earthquakes. There are a lot of significant geotechnical features to the west and to the south of the inlet, as well as down the center of the inlet, so a site was looked for that didn't have those risks. The drillings were to confirm that the aforementioned risks don't exist at the lead site and that fit-for-purpose foundations can be designed for these facilities that can handle any sort of geotechnical or seismic event. Mr. Butt further reported that the LNG facility design layouts have been finished and it is known where all the different pieces will go. This information goes into the resource reports so that the permits can be received to build it. The project has now shifted into optimization where the focus is on cost reduction.

1:37:54 PM

REPRESENTATIVE TARR recounted the [7.1 magnitude earthquake on 1/24/16] that [affected the Kenai Peninsula]. She recounted that road damage occurred fairly near the terminal site and asked whether there was anything from this that was a surprise.

MR. BUTT replied there were no surprises, what was seen was consistent with what was thought. He agreed it was a major seismic event but advised that the design is to seismic load 9.0 and the foundations and so forth are in the right place. He explained that one reason for selecting this site was because the sediments there are relatively soft and do not strongly transfer the energy of a seismic event.

1:38:55 PM

MR. BUTT returned to slide 5 to discuss the optimization studies being done. He reported that how to source the gas turbines and how to make them smaller is being looked at because gas turbines are one of the most expensive things that must be purchased. Given there are several sources of these gas turbines, the project team wants to create a competitive environment for the most efficient turbine possible. Because Alaska is cold and dry and the gas starts out cold a bigger turbine may not be needed. Also being looked at are current limiters, he continued. The project design separates a lot of the big horsepower users between the gas treatment facility in the north and the LNG plant in the south, thereby allowing use of different current

designs to manage this. A half billion to one billion dollars could possibly be saved by redesigning the way the power moves. Modularization improvements are being looked at as well - how to get all the pieces of equipment to come together. Tank technology is being explored. A conventional LNG tank is large, covered with concrete, very thick, and has lots of foam to keep the gas at -260 F. Material selection cannot be compromised because it needs to be safe, but the project team wants to optimize the insulating characteristics and the size as a function of the marine design. Another potential is less LNG storage capacity depending on how efficiently the marine assets can be used. Further, the offloading facility is being looked at to make sure it is sized just right for the modules and it must be able to handle any ice in the inlet.

MR. BUTT played a video of the marine simulation work that has been done with the Alaska Vocational Technical Center (AVTEC) in Seward to design the offloading facility. The simulations are done with Alaskan pilot unions and are like being on a real ship. He explained that modeling and simulation are done to ensure that the materials and different vessels are designed properly for being safely moved in and out of the dock and the area. This simulation is part of the Pre-FEED design phase to make sure everything works and can be done right.

1:42:47 PM

MR. BUTT moved to slide 7, "Pipeline Update," announcing that all of the 42-inch pipeline design work has been completed. All the welding procedure and coating procedure testing is done, as is the capability characteristics of a 42-inch system. He said the 42-inch pipe was sourced from three mills, one in the U.S. and two outside the U.S. The pipe was put into a coating simulator because the pipe gets very hot when being coated, about 2,500 degrees [F], and therefore the post-heat characteristics of the pipe must be tested. Compression and tensile testing of the pipe must also be done with the Pipeline Hazardous Materials Safety Administration (PHMSA). The agency defines characteristics of each test to ensure that the materials selected for the pipe will be safe under a range of conditions at factors far in excess of anything that PHMSA could envision. Tests include stretching and bending under compression, and the 42-inch pipe demonstrated proper characteristics under a range of characteristic far in excess of anything that would be seen in operating. Mr. Butt played a video demonstrating the 42-inch pipe passing a full-scale compressive pipe test.

MR. BUTT noted that hydraulic work has been initiated on the 48-inch pipe, and execution planning is also being done. This pipe will be received in April and similar tests will be done on it in second quarter 2016. A decision, hopefully in April, will be made on the cost and execution differentials between the 42- and 48-inch pipe sizes. The other places where costs are trying to be cut are routing and gravel use in the construction phase, camps, crack arrestor and valve positions, and heater station requirements. Because heater stations are very expensive a look is being taken at whether one or two stations are needed.

1:47:10 PM

REPRESENTATIVE OLSON inquired whether three joints of 48-inch pipe can be handled on a trailer.

MR. BUTT replied no, a truckload of 42-inch pipe is three joints and a truckload of 48-inch pipe is two joints. One of the big differences in execution is that 30-50 percent of capacity must be added for everything - there would be a lot more trucks, a bigger hole must be dug, heavier side booms are needed, and bigger equipment is needed to hold the heavier pipe. The 42-inch pipe is about 5,400 pounds per joint, 48-inch pipe is about 7,500 pounds per joint.

1:47:58 PM

CO-CHAIR TALERICO understood there is a difference between submerging 42-inch versus 48-inch pipe across the bottom of Cook Inlet. He inquired whether testing will be done to [determine whether there is the ability to submerge 48-inch pipe].

MR. BUTT responded that putting 48-inch pipe in the inlet is a little tougher because it is heavy. When placing pipe the pipe's desire to follow gravity and fall must be managed with the ability to move it laterally into the inlet. To do that a large barge is established with very large anchor patterns so that the barge is fixed. Then the pipe is moved from a point that is at or under the shore. How to enter and exit the inlet has yet to be decided because that is difficult. The pipe that is being pulled out is always trying to fall and the challenge with the 48-inch pipe is having the equipment that can move the pipe out far enough and lay it. The thinking is that it can be done with either size of pipe - the 42-inch pipe will be hard, the 48-inch pipe will be harder. The analysis to evaluate the

two systems will look at how much larger a barge will be needed and whether a bigger crane and heavier wench will be needed.

1:49:37 PM

REPRESENTATIVE HERRON asked what the two most critical factors are in the decision besides the aforementioned.

MR. BUTT replied cost and risk are the most critical characteristics. Driving cost is that the additional pipe for 48-inches is much heavier, so a lot more steel must be bought. The flip side, however, is that less compression is needed so fewer compression stations are required. Right now steel is getting cheaper faster than is compression equipment, so a hard look is being taken at 48-inches to try to understand out in the future what that relationship is going to look like. A 42-inch system takes about 1.2 million tons of steel and a 48-inch system takes about 1.8-1.9 million tons. More steel would have to be bought, but less other stuff would have to be bought. Thus, for cost, what is really being looked at is whether enough of the other stuff can be cut to offset the cost of extra steel. For risk, what must be looked at is whether there is a bigger environmental risk because the footprint goes up given that the gravel use goes up, everything gets a little bit bigger and heavier, and the number of trucks moving goes up. It must be determined whether all of this can be done in a manner that the execution risks can be managed. So, for cost it is a tradeoff on cost between steel and equipment, and for risk it is a tradeoff between bigger and smaller.

1:51:25 PM

REPRESENTATIVE JOHNSON inquired whether there could be political risk since no American company manufactures 48-inch pipe and this could potentially cause some opposition in Washington, DC.

MR. BUTT confirmed this is a risk that is being looked at. He said the project team has conversed with about 10 mills in the U.S. and asked whether any of them would be willing to make a 48-inch system. The mills are not as busy today as they were a year ago and now there are more answers of willingness to talk. The large amount of pipe means several years of mill run, he explained. The team is unsure about sourcing it all in one place because it is actually five very different sections of pipes. The section between Point Thomson and Prudhoe Bay is very different than the section between Prudhoe Bay and the top of Atigun Pass, and that section is very different than the

section between Atigun down into the Susitna, which is a discontinuous permafrost area. The section south of Susitna is a conventional system and the pipe in the inlet is different. The only thing in common between these five different sections is that their internal diameter is the same so that the pipe system can be maintained. Therefore it is thought that the pipe sections can be sourced differently and that some of the U.S. mills might be able make some of the conventional sections, whereas a wider net may need to be cast for some of the heavier, more complex sections. Conversations have taken place with federal regulators on how they would view potential import duties should it be chosen to import any of this pipe. In the event that the pipe cannot be sourced in the U.S., is it fair to hit the project with import duties? To date there has been a willingness to have that conversation, but like every risk it is not really done until it is done. He added that the pipe pictured on slide 7 is from a U.S. mill.

1:53:52 PM

REPRESENTATIVE TARR surmised that a 48-inch system would affect the supply of pipe and add time to the timeline. She asked whether this should be of concern.

MR. BUTT replied it is not known whether it really would take longer because it would depend on who agreed to make it and what else that mill is making. The mills not being as busy as they were a year ago is good [for the project] and gives the project some flexibility. However, it isn't real until there is contract. It can be said with great certainty that 48-inch pipe is harder to make. But, if enough of the right resources are procured, the right mill is available, and there is the right contracting structure that requires it in the same timeframe, it might be possible to do it without losing time, which has always been the objective. The project's analysis of comparing cost and execution is being done on the same timeframe for both pipe sizes - which is to say that cost moves, time doesn't.

1:55:22 PM

MR. BUTT returned to his discussion of slide 7, stating that the Alaska LNG Project continues to have good cooperation with the folks at the Alaska Gasline Development Corporation (AGDC) on routing and data sharing.

MR. BUTT displayed slide 9, "Gas Treatment Plant Update," and stressed the importance of the GTP for getting rid of 450

million cubic feet of CO_2 every day, which is well over 4 trillion cubic feet of CO_2 over the life of the project. Handling that staggering volume of CO_2 is what drives the size of the gas treatment plant. The design and layout has been figured out. Much work was done with Prudhoe Bay on integration opportunities and making sure everything worked from permitting and operating perspectives. The camp layout was changed and refined to make it smaller and the camp was moved off the pad so less gravel would be used. Gravel is one of the project's biggest costs, so the gravel sourcing has been tested and the ability to get the pit-run gravel that will be needed has been confirmed. Between 6 and 10 million cubic yards of gravel will be needed. For comparison, he noted that the [gravel] mine opened in 1974 for all the facilities has produced 18 million cubic yards of gravel. Because it does not have enough gravel for the Alaska LNG Project, a new gravel source is needed. Also being looked at for cost reduction are module weight and layout optimization for making modules as small and tight as possible, electrical design through different equipment positioning, what machinery will be used and the sources, and utilities such as electricity. Execution is being looked at in regard to whether four sea lifts are required. There will be well in excess of 100 modules, each weighing 6,000-9,000 tons, and the current plans call for getting them all up there over four years, which is four different sea lift windows. A hard look is being taken at whether the first of three sea lifts could bring up the camp facility along with modules, rather than bringing up the camp facility by itself.

1:58:58 PM

REPRESENTATIVE JOSEPHSON inquired where the equipment is made for the aforementioned sea lifts.

MR. BUTT answered that different pieces of equipment are sourced in different places. A lot of it would be in Alaska and some of it would be out-sourced to places that have heavy equipment. The main reactors and re-boilers for the acid gas removal units (AGRUs) are 130 feet tall, 28 feet wide, 6-8 inches thick on the plate, and there are only a few places in the world that can do that. Korea is one place and other places are being looked at in efforts to be as competitive as possible. There is no place in the U.S. right now that can fabricate a vessel that large. The barges that would be used will probably by sourced in a range of places including the U.S. The camp can probably be sourced in Alaska, which is good because then it doesn't have to be moved as far. Everything is being done to ensure marrying up

global LNG expertise with local construction knowledge to drive down the cost of supply. Some of the big turbines will be made in the Lower 48, but there are only a couple of places in the world that make those. Some of the big reactor vessels will be made in Asia; again, only a couple of places in the world make those. The most efficient source for each will be used in order to drive down cost of supply.

REPRESENTATIVE JOSEPHSON asked what gravel source will be used.

MR. BUTT pointed out on slide 9 that there is a gravel source about two and a half miles down the road from the west dock at Prudhoe Bay (depicted in yellow) to the central gas facility. He noted that the picture of gravel on slide 9 shows that it is a good gravel find. Finding the gravel source was progress on de-risking because a year ago it was unknown whether there was gravel, which was a risk. Now the optimization study is needed for getting the costs down.

2:02:04 PM

MR. BUTT turned to slide 10, "Labor Update," advising that the labor study is progressing with the help of large third-party companies to understand how to source the labor. The estimate is still for 9,000-12,000 jobs and it will be hard to source that labor. He drew attention to the graph depicting the projects in the Western U.S. that are currently consuming labor for the next several years. He explained that while the graph shows a tapering off in the amount of labor that will be needed, that is not really the case. Rather, the graph tapers because the forecaster's ability to capture information on those jobs goes away. To show the enormity and the context of 9,000 jobs, he pointed out that this number is equivalent to all the labor working on similar activities in all of the Western U.S. coming to work on one project in one place. So, the challenge is how to source this labor efficiently to maximize use of Alaskans and source the labor that will be needed.

2:04:12 PM

MR. BUTT noted that slide 11, "Logistics Update," is about how to use sea, road, rail, and air to move facilities. He said each of the yellow boxes [shown on the map of the state] has a logistics plan for the facilities that would be required in those places. For example, hundreds of thousands of trucks will be required to move all the facilities and all the pipe across the state. The needs of each individual part of the project

must be considered in relation to the needs of each of the other parts of the project. The needs for the same skill sets must be considered and phased and integrated so as not to compromise each of the other parts. Different ways to execute the project are being looked at in order to be as efficient as possible; for example, whether something could be done by rail instead of truck or how to use as little air transportation as possible because it is the most expensive method.

2:05:55 PM

MR. BUTT drew attention to slide 12, "Contracting Approach," explaining that a contracting model is being put together that is grounded in the philosophy of how to combine global LNG knowledge with local Alaska experience. The two parties don't have a lot of experience with each other, so people are being introduced to each other to build a relationship and create the ability to have capacity to execute this project. Local Alaskans know regulations and communities. Global constructors have large capabilities and experience building these large vessels. The near-term contracting goals are to finish the market engagement with all the primary bidders, conduct business information sessions, get FEED bid information from the main contractors, have networking forums where these groups talk to each other, and complete focus group sessions on execution plans. Mr. Butt noted that over 100 contractors have so far worked on the project.

2:08:25 PM

MR. BUTT addressed slide 13, "Summer Field Season/Regulatory Work," pointing out that everything being done is to inform the resource reports and file for an application for an environmental impact statement. Exhibits A-D are all about the corporate framework or structure of the entity that makes the application. Exhibit E is about the safety and engineering information that underpins it. Exhibit F is what is called the resource reports, which are the 13 reports listed in the left purple box. Draft 1 was submitted last year and was about 10,000 pages. Draft 2 is being prepared now for submission sometime between February and May. Each of the resource reports focuses on one of the thirteen things; for example, Resource Report 7 will be about 2,000 pages reporting everything learned about the different soils in all the different places across the state and why it is thought that a GTP can be built in the north, a pipeline through the center of the state, and an LNG on the eastern side of Cook Inlet. This must be done for all 13

resource reports and those resource reports then trigger the environmental impact statement (EIS) application, which is what FERC uses as the umbrella organization to get all the agencies to work with the project team to progress the EIS.

MR. BUTT said the project continues to have great support from the Alaska Delegation and the doors are always open to the project when going to talk to the federal regulators. It is a huge amount of work and it won't really be known what federal regulators are thinking until the application is filed and they come back under the EIS and tell the team how the project looks. Until that happens it is still a regulatory risk - anything done without that permit in hand may be frustrated. A quality job must be done on filing the resource reports as part of the application so the permit risk can be de-risked. That is a multi-year process and underpins everything the project is doing in Pre-FEED.

2:11:25 PM

MR. BUTT moved to slide 14, "Forward Plans," to discuss how Pre-FEED fits into the bigger puzzle. First, a concept is selected and a determination made on what the project will look like and how to build it. Concept work was done in 2012 through early 2014 to decide where the different pieces would go and how they would be sized. Then, in Pre-FEED it is made sure that the concept is right via integrated hydraulic modeling and composition modeling. Pre-FEED is moving everything needed for the permit and it is all the cost and schedule estimates. This information is then used to decide whether to go into the FEED phase. In FEED the spending is ramped up and the regulatory machine continues to be fed. Once the EIS is filed the amount of work goes up, not down.

2:12:19 PM

REPRESENTATIVE HERRON posed a scenario in which a break is taken between Pre-FEED and FEED, and asked how long the pause could be between the two phases before a "stale date" is reached.

MR. BUTT replied that discussions have been held with FERC on this topic and the answer is yes, a lot of the work would have to be redone. Geotechnical and geophysical soil borings do not expire; however, cultural heritage, socio-economic, design, and emissions data do expire. Also, while not always the case, regulations tend to get more difficult with time. So, in addition to having an expiration date on large pieces of the

project's work, the hurdles that must be cleared to permit a project of this magnitude tend to get larger, not smaller.

REPRESENTATIVE HERRON inquired as to how long that period of time might be.

MR. BUTT responded that after a year things start to get really difficult because FERC must be given a reason to keep working with the project owner. If FERC was to be told that the project will be pausing for a while, a path forward would have to be painted because the agency has built a team and worked to help the Alaska LNG Project instead of the dozens of other projects that are vying for the agency's time. So, FERC doesn't receive that information well given it is trying to do everything it can to meet its mandate as the umbrella organization to get the right energy mix for the country and this project has been represented as a part of that puzzle. The project has had great support all the way up through the current federal administration.

2:16:06 PM

REPRESENTATIVE JOSEPHSON related that some Alaskans are concerned and cynical because they believe this effort is to save face, is impractical, and won't happen. Also heard is that this is an effort to just preserve the lease so there is no litigation. Qualifying that he himself doesn't see it this way because he can see Mr. Butt's and the contractors' passion for the project, he asked what Mr. Butt would say to these Alaskans.

MR. BUTT answered he has heard the cynicism when talking with people at community meetings and it is fair because monetizing North Slope resources has been looked at many times. Every time folks try to monetize the gas resources they might spin something up but then they stand it down. He said the analogy he likes to use is from the old Peanuts cartoon in which Charlie Brown tries to kick the football and every time Lucy moves it. Different folks have different ideas on whether they are Charlie Brown or somebody else is Lucy. The cynicism is fair because the project has started and stopped and people have never seen all four parties try to do the project together or do the project together successfully. So until that happens the cynicism is well rooted. Mr. Butt pointed out this project has made a lot more progress than any others and cautioned that philosophies can become self-fulfilling. If people don't think it is going to work and don't try to help it work, they are probably going to be right. However, if people do think it will

work and are willing to help make it work, then they are probably right. That is why he is talking to legislators, the board of directors representing the owners who are skeptical. If it is thought that today's market environment is never going to change, then the project probably shouldn't be done. But, if it is thought that today's market environment will change, and the four parties can establish enough alignment to deliver product at the lowest possible cost, then this work is well founded. The FERC work must be kept going in order to keep the option going for continuing the project. When the parties are aligned they have trust in each other and that is the confidence that is needed to go into FEED.

2:20:56 PM

MR. BUTT returned to slide 14, reiterating that confidence is what it takes to move from Pre-FEED to the next phase. Moving along there is a chance to stop the project if that is what all the parties choose to do, but under the joint venture agreement the parties have agreed to finish the work scopes in 2016. Those work scopes include completion of [Pre-FEED]. What happens in 2017 is wide open because there is no budget in 2017. Really big decisions will have to be made in 2017 about ramping up the risk, that there is the confidence that FERC will keep going and the necessary permits will be received and that the four parties can work with each other. When one of the four parties has a problem, he specified, then he has a problem and he must find a way to bridge across that because every party has to be moving through the gate together or nobody moves through the gate. And it must be done in a way that there is enough confidence for the parties to want to go execute this project at $45-$65 billion and spent in a way that gets LNG cost of supply low enough that the project can deliver gas to buyers for a long enough time below what the buyers could get it for from anybody else and there is still money left over to make Alaskans, who are the investors, happy. He said the cost of the concept selection stage was $30 million a year for a total of $107 million over two and a half years. During the current Pre-FEED stage the cost has been $30 million a month, for a total of $376 million spent over the last 18 months. In FEED the amount of work goes through the roof, with expenditures being $30 million a week. In execution expenditures will be $30 million a day.

MR. BUTT urged that the four [stages] depicted on slide 14 not be looked at as just abstractions. Rather, it is a process to ask whether the cost has been driven down enough to be ready to invest that kind of resource - to go from $30 million a year to

$30 million a month to $30 million a week to $30 million a day. So, how to do that? The pipeline size will be figured out in April and work will be done with AGDC to identify and define exactly where the interconnection points, the offtakes, will be located. The authorizing legislation states up to five interconnection points, but the project team is open to some flexibility and would like to see the number around five. The integrated model will be completed so that all the pieces can be known. Once all the pieces are known, all the other things can be done, such as checking the maintainability and the availability, making sure that everything works, getting the deliverables done, and driving down cost.

2:24:23 PM

REPRESENTATIVE TARR inquired as to how much more confidence there will be in the budget numbers, and reducing the size of the range between $45 and $65 billion, once the pivot point between Pre-FEED and FEED is reached.

MR. BUTT replied that coming out of Pre-FEED the cost and schedule will absolutely be defined to a much tighter range. The pieces will be broken down to show what is needed and what is contingency. The costs will be broken into three buckets: 1) premise - what it takes to build this; 2) contingency - the extra that will be held for uncertainty since it will be several years before the start of construction during which time things can change; and 3) owner's cost - those monies needed to execute that project. Effort will be made to drive all three of those down, but the focus will be on premise and premise is driven by the equipment, steel, machinery, and so forth that is bought.

REPRESENTATIVE TARR recalled that in his State of the State address, Governor Walker said he hoped to have commercial contracts for legislators to consider during this legislative session. She offered her understanding that Governor Walker is interested in the project financing model and asked how those two are going to intersect at that stage.

MR. BUTT suggested this question be directed to the four party representatives who will be before the committee on 1/27/16. He explained that from a project perspective, his role is to make sure the work gets done in the right way and all the pieces are kept together. He allowed there are some significant commercial challenges and the questions are whether the parties want to work past them and can they work past them.

2:27:17 PM

REPRESENTATIVE SEATON offered his appreciation for Mr. Butt's work and for Mr. Butt directing his talk to committee members as the board of directors of an owner of the project. As an owner, he noted, the State has a 12.5 percent royalty and a 12.5 percent production tax, both of which are taken as gas and thereby make the State a 25 percent owner. Expressing his concern about the State's current fiscal condition, he noted that the State is paying 35 percent of the upstream costs via development credits while the State's midstream ownership is 25 percent. He asked how Mr. Butt sees the influence of that issue on the Alaska LNG Project.

MR. BUTT deferred to each of the four parties that will be before the committee on 1/27/16. Offering a unifying thought, however, he said investors, whether direct participants or lenders, want to understand how their capital is at risk and what it will take to get that capital returned in a safe manner. Whether it is investment tax credits or any other element of a tax structure, which in Alaska is a royalty structure, they want to understand how that influences the different flows of capital. He added that he thinks that the tax credit is a little bit different than an investment.

2:30:26 PM

REPRESENTATIVE JOSEPHSON related that some of his constituents have said legislators were wrong in voting last November to invest another $150 million and that instead consultants should be paid to go back three years and look at ideas such as having tankers off the North Slope and depositing excess in the Aleutian Islands until such time as the market is ready and then have tankers go west from there. He asked whether there has been discussion of options that do not require a pipeline.

MR. BUTT responded that the task in the concept stage is to look at everything that can be thought of; for example, even submarines under ice was looked at. The main challenge moving LNG in the Arctic is that it is the wrong time. Buyers want absolute certainty in January and February because those buyers have put their whole economy at risk in the hands of the company from which they are buying their energy. If the LNG project doesn't make a delivery, that economy goes down when the lights and power are lost. It is a big deal to deliver reliably. The parties in this venture have the ability to demonstrate success in a wide range of solutions and build confidence in buyers.

The costs for long-term seasonal storage of LNG are off the chart, he advised, because the LNG is so cold that very specialized materials must be used to store it. The metals and insulation are ridiculously expensive. The foundations are dozens of feet thick depending on location because every molecule in that tank must be kept at -260 degrees F. Storing LNG for anything more than a period of days is extremely difficult and requires continuous energy because in comparison to LNG the world is on fire and LNG is constantly trying to return to a gaseous state. In the LNG business everything is done to get LNG storage to nothing - in a perfect world it would be liquefied and immediately put on a transport ship.

MR. BUTT shared that another way to do this is to use icebreaking tankers. A project called Yamal decided to do this across the Arctic, but is having tremendous difficulty; the reliability in winter is really challenged and the project is having a very hard time getting finances. He added that in 2012 and 2013 he was often asked why not have the project do gas to liquids (GTL). The reason, he explained, is that LNG is 95 percent efficient - 95 percent of the amount of energy that goes into the system is delivered to the customer. However, the efficiency for GTL is 60-65 percent because so much energy is used to convert the gas to a wax to break it to a liquid. Additionally, in the Arctic, GTL takes tremendous amounts of water and there is not that water. Plus, with GTL a pipeline would not be built and so the benefit of delivering gas to Alaskans would go away.

CO-CHAIR NAGEAK remarked that things have changed since the 1970s when it was a whole lot colder. There is now flooding and earthquakes in Barrow and things are much more costly due to the changes. He thanked Mr. Butt for the presentation.

2:38:14 PM

ADJOURNMENT

There being no further business before the committee, the House Resources Standing Committee meeting was adjourned at 2:39 p.m.