

**ALASKA STATE LEGISLATURE
JOINT MEETING
SENATE RESOURCES STANDING COMMITTEE
SENATE FINANCE COMMITTEE
March 29, 2017
3:31 p.m.**

MEMBERS PRESENT

SENATE RESOURCES

Senator Cathy Giessel, Chair
Senator John Coghill, Vice Chair
Senator Natasha von Imhof
Senator Bert Stedman
Senator Shelley Hughes
Senator Kevin Meyer

SENATE FINANCE

Senator Lyman Hoffman, Co-Chair
Senator Anna MacKinnon, Co-Chair
Senator Click Bishop, Vice Chair
Senator Peter Micciche
Senator Mike Dunleavy
Senator Natasha von Imhof
Senator Donald Olson

MEMBERS ABSENT

SENATE RESOURCES

Senator Bill Wielechowski

SENATE FINANCE

All members present

OTHER LEGISLATORS PRESENT

Representative Lora Reinbold

COMMITTEE CALENDAR

PRESENTATION: WORLD OIL AND GAS MARKETS IMPACT ON ALASKA

- HEARD

PREVIOUS COMMITTEE ACTION

No previous action to record

WITNESS REGISTER

SCOTT JEPSEN, Vice Chair
External Affairs and Transportation
ConocoPhillips Alaska
Anchorage, Alaska

POSITION STATEMENT: Presented information on current oil and gas markets and their impact on Alaska.

MARIANNE KAH, Chief Economist
ConocoPhillips Alaska
Houston, Texas

POSITION STATEMENT: Provided the overview on current oil and gas markets and their impact on Alaska.

ACTION NARRATIVE

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CHAIR CATHY GIESSEL called the joint meeting of the Senate Resources Standing Committee and the Senate Finance Committee to order at 3:31 p.m. Present at the call to order were Resource members Senators Coghill, Stedman, Hughes, von Imhof, Meyer, and Chair Giessel and Finance members Senators Bishop, Micciche, Dunleavy, von Imhof, Olson, and Co-Chairs Hoffman and MacKinnon.

Presentation: World Oil and Gas Markets Impact on Alaska

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CHAIR GIESSEL introduced and thanked staff who helped arrange today's meeting and announced the only order of business was the presentation of world oil and gas markets impacts on Alaska by Marianne Kah and Scott Jepsen with ConocoPhillips. She said Alaska is an energy producing state and oil and gas markets cross international jurisdictions that affect Alaska at various levels. Energy resources has not only driven Alaska's private economy but its state budget for two generations. Policy makers must understand the nuances of these global commodities to

realistically perceive Alaska's place in the international marketplace. She welcomed Mr. Jepsen and Ms. Kah to the table.

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SCOTT JEPSEN, Vice Chair, External Affairs and Transportation, ConocoPhillips Alaska, Anchorage, Alaska, introduced himself and thanked the committees for the opportunity to present information on current oil and gas markets. He said he hoped the information would be useful to them in formulating policies and providing context for the strategic actions ConocoPhillips has taken over the last few years.

Before turning the presentation over to Ms. Kah, he provided her biography. She is responsible for developing the ConocoPhillips' market outlooks for oil and natural gas and is the company's expert in scenario planning. She has also presented her views on oil and natural gas markets at major conferences around the world. Prior to joining ConocoPhillips, she was manager of planning at Cabot Corporation, a chemicals company in Boston, a planner at the U.S. Synthetic Fuels Corporation, and a management analyst in the energy and mineral division of the U.S. General Accountability Office in Washington, D.C., where she conducted energy policies for various U.S. Senate and House energy committees. She is the past president of the U.S. Association for Energy Economics and received the Senior Fellow Award from that organization. She has also served as chair of the Committee on Economics and Statistics of the American Petroleum Institute. An economist by training, Ms. Kah holds a Bachelor of Science Degree from Cornell University and a Master's Degree from Syracuse University.

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CHAIR GIESSEL recognized Representative Reinbold as present.

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MARIANNE KAH, Chief Economist, ConocoPhillips Alaska, Houston, Texas, said it is a pleasure to be back here even for a short visit and that she was going to talk about the crude and natural gas outlook and the implications it has for ConocoPhillips as a company in its investment decision making, as well as the implications for the State of Alaska.

In 2005 the world looked like this: the U.S. oil production had peaked in 1970, then it had a second peak because Alaska production came in, but it has declined ever since. The Department of Energy (DOE) forecast is that it would continue to decline.

For liquefied natural gas (LNG) there was a belief that the U.S. was running out of low cost natural gas and the projection was that it would have to import 18 bcf/day. Today demand is about 75 bcf/day, and many companies, including ConocoPhillips, actually built regasification terminals to bring LNG into the U.S. There was also a belief that the U.S. was going to have to import energy at a growing rate.

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The shale renaissance completely turned this world upside down. In 2015, before the downturn, instead of a decline there was a huge uptick in U.S. production basically back to the peak of 1970. LNG exports went to zero and this year the U.S. is becoming a net exporter of LNG and net energy imports have actually dropped substantially as opposed to going up. This is a great story for the U.S. economy and U.S. energy security, but it has really turned the entire industry on its head.

She said that shale is actually called "tight oil" and her chart indicated the huge size of that resource. In perspective, Prudhoe Bay was about 14 bbl/boe - barrel of oil equivalent - and the Permian Basin, Eagle Ford, and the Bakken have 100-200 bbl/boe of resource just in the major plays and new plays are continuing to be discovered. This is a new phenomenon. The same is true for gas if one looks at the Marcellus (huge gas basin with very low cost gas of \$2-2.50 per mmbtu).

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For an idea of how big this tight oil phenomenon is in the U.S., Ms. Kah compared it to the size of production of various oil producing exporting countries (OPEC). When this all started in 2010, the U.S. was producing less than 1 mmbbl/day, basically the size of Qatar or Libya. Today, despite the downturn, the U.S. is producing over 4 mmbbl/day of tight oil (not including conventional production in the Lower 48, the offshore or Alaska). The only countries that are larger are Iraq and Saudi Arabia. Most forecasts have this at least doubling and more. This is a very large production phenomenon and probably one of the key drivers of the oil downturn.

The U.S. just produced production at a rate of 1.5 mmbbl/day including natural gas liquids per year and demand was only growing at about 1 mmbbl/day. That disrupted OPEC production, which was trying to come back, but everyone saw what happened as a result of that.

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Texas has been impacted most by the shale revolution with the Eagle Ford and the Permian. And what makes the Permian so special is that there are different layers of resource and the industry is working on trying to do multilateral wells (use the same well to reach different pay zones). There is huge production potential if that can be done economically. So Texas, alone, is going to be an amazing force, but even North Dakota and Colorado production came back when the shale revolution started.

Alaska doesn't have the shale revolution, but on the other hand, Ms. Kah was amazed at how in the last five years or so its production decline has truly stabilized and last year slightly increased. Who would have expected that to occur five years ago? Part of that is due to the better business climate that industry perceived after SB 21.

The U.S. production and shale, particularly, has responded to this price downturn with a decrease in the number of oil rigs from 1,600 to 450 in one year and huge layoffs in, but Alaska has been mostly insulated from what has been happening there.

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Now, just with prices moving up towards \$50/barrel, there is a doubling of the horizontal rig count. The many productivity improvements in tight oil keep pushing the cost of supply lower and lower, so more and more is coming on line. She thought that is one of reasons why the prices kept dropping.

Another chart showed the DOE short-term forecast. The prior trend was about 1 mmbbl/day/year growth. During the downturn the U.S. lost about 1 mmbbl/day and probably more, but since September, it is on a growth trajectory again, and the prices weren't even \$50 in September. Production has been increasing and is expected to increase to basically a new record by the end of 2018. In the marketplace, everyone wonders how much of the work OPEC has done to cut production to get inventories down to a normal level is going to be offset by the increase in U.S. production.

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CHAIR GIESSEL asked what happens to rigs when the count goes down.

MS. KAH answered they get stacked. The alter rigs probably get cannibalized and never come back. The horizontal rigs and tight

oil drilling drill-days have gone way down, so not as many rigs are needed on a permanent basis. It would be an interesting experiment to see how long it would take to bring them back if it could be done. Probably the older rigs have gotten laid down and the newer more modern ones are the ones running today.

CHAIR GIESSEL asked what happens to the rigs in Alaska.

MR. JEPSEN answered the same thing happens in Alaska: the rigs get stacked. Some "age-out," but those that are still relatively new can come back into service.

MS. KAH said the way this translates to ConocoPhillips's bottom line is in terms of service industry cost inflation. There has been a great deflation, which is one of the things that has helped the economics of tight oil in the Lower 48, but the reverse is happening now and everyone is wondering just how much the inflation rate is going to be coming back - and it's only for specific items like completions or sand. She wished she owned a sand mine in Minnesota today, because it is used in hydraulic fracturing and is the kind of thing that is in short demand.

Where production goes from here revolves around two things: the rate of productivity decline that will either improve or lower the cost of supply and how much service industry cost inflation will offset that. If she knew the answer to that, she would be able to forecast very accurately what U.S. supply growth is going to be, but she really doesn't know the answer.

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Slide 10 graphed the average production profile by month for different parts of Texas. The initial production rates have gotten higher and higher there and that directly translated to a lower cost of supply per barrel. Her graphs showed where the benefits came from: how much the 90-day initial production rates were, how much recoverable reserves have gone up, and how much drilling days have dropped. "It's truly incredible," Ms. Kah remarked. For example, what used to cost \$80/bbl for U.S. tight oil, would today cost \$50/bbl and the cost of supply for resources that used to cost \$50/bbl may cost \$30/bbl today. "That is sort of the target that U.S. tight oil has put out there that investments sort of have to beat," Ms. Kah said.

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MS. KAH said the DOE long term forecast illustrated the huge impact of U.S. tight oil, but there was also an increase in

natural gas liquids (it gets turned into propane and ethane), which a lot of plays have. There is a question of how big the market is going to be for these liquids, which reduces the need for crude supplies in the rest of the world to the extent that refineries can use them.

So, between the U.S. tight oil and the natural gas liquids there is huge growth, but based on her views of the geology and the rate of technology improvement, the U.S. is probably in the high resource case. If she had to personally bet, she would bet on the DOE's high case and not its low case scenario, because of all the technology development so far - like longer laterals and bigger hydraulic fracturing jobs with more water and sand - that are just now moving around throughout the industry. There are also the new operating practices are being implemented like more perforations and more clusters of perforations, and intelligent drilling, which is when a drill bit can get real time data for how to produce.

MS. KAH said big data has really come to the oil industry. Everyone is running pilot plans to get data that will allow better identification of sweet spots for understanding where to drill. The interesting thing about why innovation takes place so quickly is because thousands of wells are being drilled. So one can experiment with all the different wells and as a result learn much faster than just drilling one \$200-million well every five years offshore. That is why she thinks the productivity growth is going to improve and production will continue to drop in cost.

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SENATOR VON IMHOF asked if Alaska can see the same cost savings as Texas.

MS. KAH answered that the interesting thing about that is that new technologies, like intelligent drilling, will eventually work their way around the world. But Alaska doesn't drill that many wells, so it will be a slow process. She asked Mr. Jepsen how many wells ConocoPhillips is drilling in Alaska in the next five years.

MR. JEPSEN answered that ConocoPhillips has three rigs running now and BP has three rigs; some of the other operators aren't drilling now because of the low oil price. About 500 rigs are drilling in the Lower 48.

MS. KAH said deep water is out of the money now, but it has its own standardization of equipment and trying to compete. Oil sands is doing the same thing. Everyone is trying to lower their costs to be able to compete.

MR. JEPSEN added that ConocoPhillips Alaska is paying close attention to what is happening with their operations in the Lower 48 and sharing that data with their Alaska operations.

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SENATOR BISHOP, in response to their comments about the number of rigs in the Lower 48 drilling, said that that Alaska wells are prolific producers; some produce north of 10,000 bbl/day, and are drilling in a conventional play versus a tight shale play.

MR. JEPSEN agreed and added that some recent wells have come in at 10,000-plus bbl/day.

MR. KAH added that initial production from each well in her graph (Lower 48) is about 500 bbl/day compared to Alaska's big wells.

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MR. JEPSEN mentioned that some of the wells ConocoPhillips is drilling in existing fields do come in at a 500-700 bbl/day rate and that drives up their cost of supply in Alaska.

MS. KAH also noted that having to constantly drill is a capital-intensive operation (referring to the steep decline rate on slide 9 on the left), but it returns investment right away and is low risk.

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Slide 15 graphed a curve of all the world's supply (a characterization of 10,000 different assets and their cost of supply) with the lowest cost on the left to the highest cost on the right. Looking out as an investor at what cost of supply will be, she put them all into 2017 dollars per barrel for the year 2025. This matters to ConocoPhillips because they have lined up their portfolio this way. They have said publically they don't know what the price is going to be and will invest only in the lowest cost of supply projects to make sure they can withstand downturns like the one we have just been through. ConocoPhillips wants to be as far left on that supply curve as it can be. She noted that this slide doesn't count existing production, because she wanted to focus on the incremental

production or what an investor like ConocoPhillips can look at doing. It takes production today and declines it out to 2025, which is where starting production is 15 mmbbl/day. What happens with tight oil in this scenario? Ms. Kah said she broke it into three tranches to be able to talk about what types of things are lower cost and higher cost as best she could, but in reality projects are not in this order.

What they have learned about U.S. tight oil is that the fracs don't travel very far, therefore more wells have to be layered in to get much greater recovery out of the same acreage. Just learning that allowed ConocoPhillips to increase their Eagle Ford resource estimate by 40 percent a couple of years ago. So, the tight oil areas keep stretching out and getting more and more in volume and also dropping in cost. She would say in the next five years the main oil price-setting mechanism will be what it costs to get that tight oil into the market and then how much of it is needed to satisfy demand, because an economist would say that price is set by the most expensive supply needed to satisfy demand. For example, if the demand was 100 mmbbl/day, the chart indicates that Brazil or Gulf of Mexico (GOM) production would be needed. So, as the tight oil areas keep stretching out and taking more volume, it knocks down all the production to the right of that demand line. For example, some of the oil sands projects have become uneconomic and not a good investment. Some of the deep offshore projects won't go forward either, because they are on the right of the supply curve and have been pushed out by the lower-cost tight oil.

MS. KAH said this is how ConocoPhillips lines up their own portfolio and doesn't invest in things above certain target prices and time periods. Their current policy is to invest in things that meet today's price.

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She knew members would ask her where Alaska is. And Alaska is probably in the China/US/Canada camp (still on slide 15), so Alaska is in a "slightly precarious position," which is why increasing taxes isn't a good idea. Anything they do that pushes Alaska to the right will get knocked off by tight oil squeezing things out. So, right now Alaska is in a reasonably good position given the status quo business climate.

SENATOR MEYER asked where the Keystone pipeline oil at 800,000 bbl/day stands in that graph and if it does come on soon, what that will do to the price.

MS. KAH answered the problem with oil sands is not only is it expensive - heavy stuff with low value - to produce, but it is also expensive to transport to markets. It has to be shipped by rail now, because there isn't enough pipeline capacity and it will probably have a \$12 tariff or more. Shipping by pipe could cost more like a \$7. So, suddenly oil sands is more economic. But having said that, green field oil sands projects don't make it in the current price environment. So, investment will only be in brown field projects and will remain there.

It's not just Keystone, she said, the Canadian government just approved the Trans-Mountain Pipeline to take oil sands to the West Coast. However, the project still has to happen. But that also allows the Canadian producers to diversify away from the U.S. market and send it to Asia. Those things are both helpful to oil sands.

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MS. KAH emphasized that everyone must be cognizant that each of these tranches of production are going to try to lower their cost to compete. It's a very competitive market in which you can't just sit there and not try to improve your situation.

SENATOR DUNLEAVY said the market seems to have absorbed the civil war in Syria, Iraq, the sanctions in Iran, and Egypt, and that coupled with the Venezuela situation, which is deteriorating, and the Southern Gulf, which is not being utilized, if all those things recover and Mexico begins to ramp up in the Gulf, those are things that make the oil price so unpredictable.

MS. KAH said that is part of what went wrong this time around: disrupted Iraqi and Iranian production coming back into the market at the same time U.S. production was ramping up, clearly running into an over-supply situation. Other people believe though, because the industry has lost billions of dollars of investment over the last three years that come 2019 there won't be enough production. She personally believes that the U.S. could fill any gap there is in 10 months. There are just different points of view about that and there can be very different outcomes. Those things are unpredictable. That is why the oil price is so volatile.

She would argue that because of tight oil, it will be even more volatile, the reason being that when the Saudi's managed inventories, they kept production at a fairly stable rate that sort of matched demand - so, the price was fairly stable. When

they said they weren't going to do that anymore, suddenly the price has to go up and then U.S. tight oil production is needed and has to drop when it's not needed. Therefore, the price is going to mirror a tight oil investment cycle. It took 10 months from the time the price started dropping before one actually saw U.S. production falling. This means a 10-18-month cycle of the price going up and down to get the thousands of producers to act in a way that brings up production or lowers it, and to the world that will look like volatility. But it will be more of an 18-month cycle, not the 7-year or 10-year cycle as in the past when projects took 7-10 years to come onto the market. Layering geopolitical things on top of that makes it totally unpredictable. And economic volatility is another factor people have to deal with today.

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MS. KAH said slide 13 illustrated oil demand growth by year broken down to source. Most of the demand growth is coming from China, India, and other developing countries. So, anything that affects demand or the economy in China or India has a disproportionately large impact on the oil market, because that is the source of demand. When ConocoPhillips used to just worry about the U.S. as a source of demand, the U.S. economy wasn't quite as volatile as some of these developing markets, but this has made the world demand growth much more volatile and more difficult to predict.

So, looking forward, as an economist, in terms of demand growth she worries about what happens in the global economy and second, as the dollar appreciates because the U.S. is tightening its monetary supply and no other country really is yet, that oil becomes more expensive outside of the U.S., because oil is priced in dollars. So that depresses international demand, and then many producing countries in the Middle East and Venezuela all have price controls and price subsidies, but they can't afford them anymore. So, with the low price they are taking the opportunity to reduce these subsidies. What that means is when the price of the oil comes back up, suddenly these countries are facing a lot higher price and higher demand growth.

MS. KAH said people hear a lot about peak oil in the market due to things like autonomous driving, but those things are out past 2020. That is not at all what we're seeing today. In fact, today demand growth is very strong, because of the low oil price. So, the peak oil concern that has been raised is something that one eventually has to worry about, but post-2020 and post-2030. In fact, when people talk about the impact of autonomous driving,

it is more likely for them to be electric vehicles. So that might be an impact. But if you have autonomous cars, children and people who are too old to drive will create a lot more demand and suddenly the cost of driving is reduced and the demand for vehicles will go up. She believes that in the end it could increase demand not decrease it, but the outcome is not obvious. Her belief is that demand is strong and the problem we have today is too much supply, and the world economy is one of the big factors driving demand.

She displayed a forecast by the International Monetary Fund of economic growth in the world on slide 14. On April 13 when they first started to forecast 2015 economic growth, they said it would be 4.5 percent. But by the time 2015 ended, it was 3.2 percent. The same thing happened in 2016: a bright forecast and by the end of the year it was lowered. The question arises if the same thing is being done for 2017. The risks she worries about are: if the Chinese economic deceleration happens in a controlled, safe way as it has been, or does it somehow get out of hand, what the impact of Brexit will have on Europe, what is going to be its impact on European elections, and will more countries look at a Brexit scenario for them.

Because the U.S. is the only country doing monetary tightening right now, does that affect funds flowing out of emerging markets? Ms. Kah said that the first time the U.S. announced that it was not going to be doing these treasury buy-backs, suddenly funds were flowing out of the emerging markets at a rapid rate. She worries that governments around the world might have policy missteps: does the U.S. tighten too quickly and the world isn't quite ready for that? Does something happen that threatens world trade and therefore everybody loses?

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MS. KAH said this is the first time in two or three years she has thought there is a potential for upside in the economy. So, she is watching what governments do. Putting all this together, her chart illustrated the price curve back to 1861, according to BP, who is the only company that kept track of prices back that far. She put the data into 2017 dollars and took the general inflation rate out so members could compare all the periods equivalently. She advised to ignore the beginning of the curve, because this is basically when people went from whale oil to kerosene, a very small and volatile market. But since then, she very well remembers the 1986 price collapse and in 1998 the Asian financial crisis. So, the big price moves can generally be explained by some geopolitical event.

In the mid-2000s there was a huge increase due to the industrialization of China. It happened so rapidly that people wonder whether it will be repeated by India and to the same degree, but she didn't think it would. The discovery of being able to produce shale economically is responsible for the latest downturn. She concluded that one thing can be said these days: prices are extremely volatile. ConocoPhillips used to be focused on equilibrium prices, but stopped that. In a complex system like the oil market there may not even be an equilibrium price and it may never be at equilibrium. So, Ms. Kah said, she spends more time now worrying about what the price path will look like and what will set prices. How is it going to move over the next three or four years? What part of this investment cycle for tight oil are we in?

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Another chart showed the range of 20 or 30 external views of what the price is going to be between now and 2020 (the futures curve). This has to be taken with a grain of salt, because a lot of the independents who produce shale hedged their production and there are more people trying to hedge production and sell forward than trying to buy forward. Therefore, it sort of drives down the futures price. So, she doesn't take the futures price as literally as in the past. But it is still an indication of where things are trading. She just doesn't know how to quantify the risk component.

Experts think that the price will be anywhere between \$50 and \$80/bbl in 2020. There are completely different camps of thinking. Goldman Sachs is a good example of the \$50 camp. They believe that Permian productivity improvement is going to just keep driving the price down, even though there is inflation. The \$80-camp believes in the things further to the right of the tight oil on the supply curve. Therefore, the price has to rise to a level that will get one there and maybe overshoot it because of the supply/investment hole.

She believes it will be somewhere in between, because in looking at between now and 2020, besides the projects that are already under way that are known in non-OPEC production, it doesn't look like more is needed than OPEC and tight oil production to satisfy demand in 2020. One assumption is that decline rates will be higher because of the downturn, and she wasn't sure she agreed, because one of the best things one can invest in is maintaining existing production. That is one of the last things that gets cut when capital expenditures have to be cut. A lot of

people in the higher priced camp believe that the decline rates on existing production will go up. When she looks back in history she can't find evidence or data that supports that, although there is no dated evidence that will tell you one way or the other. Production can't be dissected that cleanly.

CHAIR GIESSEL asked for questions about oil, and finding none, Ms. Kah moved on to natural gas.

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She said about one-third of the shale gas revolution is associated with tight oil production. Shale gas is a lot easier to produce, because it is in impermeable reservoirs and a gas molecule is smaller, so it's easier for it to move. The Marcellus is huge and the only reason it doesn't ramp up at a higher rate is because the Northeast ran out of infrastructure. They added more infrastructure and suddenly it started ramping up again, and with this big price decline production has flattened for a time but will probably start rising again.

The same thing happens in terms of the production profile. Over the years, productivity is still improving in the shale gas wells, because the things industry has learned in tight oil are translating back to shale gas. She pointed out the 7 million cubic feet (cf)/day wells in the Marcellus wells: unbelievable! The Permian is associated gas coming out of an oil well, so it is smaller production.

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MS. KAH said the Wood Mackenzie forecast for the U.S. and Canada is completely dominated by shale gas and associated gas from tight oil. The big animal again, is the Marcellus, which has already grown by 16 bcf/day and will grow by another 20 bcf/day by 2030.

SENATOR VON IMHOF asked who benefits from the Marcellus wells: the State of Pennsylvania or private land owners who own one-acre-by-one-acre parcels. Where is the money going?

MS. KAH answered what makes the Lower 48 really unique is that private landowners own the mineral rights and that is one of the reasons it happened so quickly. All of the people on the East Coast benefit from it, because they used to be at the end of the pipeline. Now they are at the beginning and their prices are lower than the rest of the country when they used to be higher. In fact, it has reversed pipelines in the Lower 48. They used to flow from the Gulf Coast up to the East Coast. Now they are

starting to flow from the East Coast down to the Gulf Coast where the petrochemical plants are and to the Mid-West.

SENATOR VON IMHOF asked if private owners are called shaleionaires. She remarked that if you own a parcel of land and are being paid royalties similar to what the state of Alaska is being paid now, that is pretty tremendous.

MS. KAH agreed. She wished she had the job of handling royalty owners' checks. These are poor rural areas that don't have jobs and it is really changing their communities and their lives.

SENATOR DUNLEAVY asked if it is also rearranging the entire electrical grid concept where Quebec used to send hydro down there and there were nuclear and coal plants.

MS. KAH replied that she is seeing more natural gas-fired power plants, but interestingly, even in Texas, but not as many as one would think, because so much wind is coming on that the power prices are negative at night sometimes, and there is no capacity charge for bringing on a natural gas-fired power plant. So, there is no incentive to build any. Even in a state like Texas that is swimming in gas - it has a low CO2 profile - the country is not taking advantage of it. It is not changing the grid as much as she had hoped.

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Slide 18 showed natural gas demand in the U.S. in two-time periods: from 2016-2020 and from 2020-2030, and there is a small increase in power use of natural gas. With renewable tax credits and state mandates - Texas has a mandate - there just is not enough gas being used. This is not just a U.S. problem; this is a global problem. Europe has added so much renewable and have made their carbon price so low and can easily meet their standards with the renewables that gas is ignored. So, she worries that even though there is all this gas it is not even being used as a bridge fuel. Given the resource this country has of gas, this is a problem. An IHS forecast based power growth after 2020 on the Clean Power Plan that is in the process of being dismantled, so that 2020-plus growth on this chart might not happen.

MS. KAH said there are still some bright spots for natural gas. LNG exports out of the Gulf is the biggest source of demand growth over the next five years and pipeline exports to Mexico are really big. Whatever investment ConocoPhillips has they focus on oil not on gas. This is a great opportunity for gas

producers in the U.S. Overall, she summarized that demand growth is reasonably strong, but she worries that the power demand growth just isn't there when everyone five years ago thought it would be.

CHAIR GIESSEL asked if base load is still needed and if the renewables are variable in meeting that base load.

MS. KAH answered a natural gas plant is very good at backing up renewables, because coal plants take too long to start and can't be tuned. They also create noxious pollution. The best one is a single cycle gas plant that can be ramped up in seconds although it is inefficient. The problem is that they are not run that often and they don't create that much gas demand.

MS. KAH explained that gas isn't being used as a base load fuel partly because it has the highest variable cost. It's the cheapest plant to be built, but it is the last plant to be dispatched, because it has the higher fuel cost. So, if you add anything into the grid you're knocking out gas demand and that is really what is happening.

LNG capacity in the U.S. has huge growth. Several companies are continuing to add capacity now, which she finds amazing since we are going through a boom/bust investment cycle in LNG capacity right now. The reason is because they are inexpensive plants to build and we already have a lot of regasification terminals built for taking in gas, berths for ships, a lot of tankage, and that is why they were built in such a large quantity.

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MS. KAH said the Wood Mackenzie forecast is a little more optimistic than IHS' because they argue that a lot of this new capacity won't be used simply because there is an oversupply in the world LNG market right now and there just is no room. Almost like a natural gas-fired power plant, these plants were the cheapest to build because a lot of capital costs were already in place, but they are the most expensive to dispatch because the fuel cost is \$3 where if you are in a place that has stranded gas, the gas may cost \$.50. So if any plant is going to shut in the world it's probably going to be in the U.S. Gulf Coast.

Australia has much lower fuel prices, so the cost of dispatching Australian gas is going to be lower and they are closer to the Asian market. She expects to see problems in the next three years. In 2017 we were bailed out by a cold winter, particularly in Asia, and a storage problem in Europe. Some Australian plants

were down or hadn't come up on time. A combination of circumstances made 2017 be not as bad as what the industry expected.

SENATOR BISHOP commented that it looks like industry is switching gears a bit, because he sees an uptick in value-added in the Gulf Coast where a lot of capex is being spent over the next 10 years.

MS. KAH agreed saying slide 18 indicates that industrial demand growth for gas is very robust within the context of no industrial demand growth for years. This is because of all the new petrochemical facilities coming on line over the next three years in the Gulf Coast that were planned because of low shale gas prices.

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The global LNG supply/demand balance through 2025 starts with excess and adds more by 2025. There is huge growth in supply for U.S. and Australia; just in 2016 and 2017 enough LNG capacity was added the size of Qatari LNG production. The magnitude of changes is really large. The whole world market is only 40 bcf/day and we're talking about 25 bcf/day growth by 2025. This is also changing rapidly.

On the other hand, demand is robust but not quite enough to keep up with supply. One of the reasons is that Japan has its nuclear power plants coming back on line and Korea and Taiwan have all had nuclear power plants down. So, they will lose gas demand over this time period unless Japan decides not to bring back its nuclear power plants, in which case there would be upside potential.

The big growth is expected to be in China and India. In India it's because prices are low. In fact, they are discovering a lot of new markets and new, smaller countries - Pakistan, Argentina, Brazil, and Chile - can now afford to buy LNG in this lower price environment, because now you can have a floating regasification terminal that just pulls up to the country; it doesn't take very long. So, lots of new markets are being found to place the surplus demand. In fact, there is not going to be a surplus. There is very little LNG storage in the world and you can't have a surplus. What the chart really means is that the price has to drop to a level to make this new demand appear and to make Europe switch from coal to natural gas, which would take a price of \$3-\$5/mmbtu to happen. And some U.S. capacity will probably be shut in.

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MS. KAH said this is a very long investment cycle, but it is an investment cycle. We have a very nasty-looking surplus now, but this clearly has to change because the world does have demand for LNG that will rise. In fact, because demand is healthy that isn't the problem.

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Another chart showed gas prices around the world as reported by Bloomberg. The Japanese import price, the U.S. Gulf Coast Henry Hub price, and the European prices all come down and converge. This makes it very hard to ship LNG between regions, because all of the prices have moved together. This is what one would expect to see in a surplus. What you would expect to see when things recover is Japan and Europe to come back up.

The biggest reason that contracts have declined is because crude prices have declined, but also China has weakening economic and natural gas demand growth. But in 2016, Chinese LNG growth is pretty strong. Substantial increases in Australian and U.S. LNG capacity is probably the biggest factor.

ConocoPhillips has reacted by dramatically reducing capital spending from \$17 billion in 2014 to \$5 billion/year and that won't go up even if prices do, Ms. Kah said. They are deciding to live in a lower cost of supply world whether the world stays there. ConocoPhillips wants to be immune to price changes.

The good news is that ConocoPhillips hasn't reduced spending much at all in Alaska. It's almost strange coming up here after seeing what is going on in Houston - how Alaska has been somewhat immunized against what the rest of the oil industry is facing - although she has been assured it is just a time lag. She didn't think Alaska would be hit as hard, because it didn't have the huge activity ramp up.

MS. KAH said just like ConocoPhillips is creating its own cost of supply curve for their portfolio and ranking all the projects and only investing in the ones that have the lower cost of supply, people don't even bring projects forward that don't meet that hurdle. ConocoPhillips is also driving down operating costs and that has translated to a loss of people in Houston. Everyone has to do this because everyone has to survive in what the price world is.

In terms of production, because ConocoPhillips has hi-graded and have invested in the things that maintain production and the lowest cost things, even with those capital cuts thus far, they have met their production target.

MR. JEPSEN added that their Alaskan oil production went up by 3 percent in 2016.

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MS. KAH summarized the market outlook for Alaska on slide 23. She thinks the tight oil renaissance has changed the supply landscape. She worries about volatile economic growth and is less worried about the peak oil demand right now, but it is a longer-term issue. We are clearly in a weaker crude price for a long time just because of circling around the shale cycles. Forecasts indicate an oversupply extending through 2020 and it's unclear how much longer after that. A convergence of regional natural gas prices is also being seen, which is currently making LNG project economics not look very good, but it will be needed eventually. It's just whatever LNG projects are coming into the market have to compete at a \$6-\$8 mmbtu price, because that is what the alternative project cost is in places like Mozambique or the Gulf Coast projects.

For Alaska, to ConocoPhillips this means a very challenging environment, a lot less capital to invest, and they are being forced to allocate it to only the lowest cost of supply projects. Alaska has to compete with this in the Lower 48. Everyone has to compete with the Gulf Coast projects that are all brown field and relatively low cost. Also, it tends to be one of the cheapest places in the world to build in terms of service industry lack of inflation.

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MS. KAH said this is not a hopeless case and Alaska can do somethings to make itself economic, which it has done over the years. The single best thing is make sure of a competitive and stable fiscal policy. Greater access on federal acreage is also looking promising under the new administration, along with reliable and timely federal permitting processes: it takes five to seven years to get something permitted in Alaska on federal land and it takes 10 months to get projects in the ground in the Lower 48. Anything that can be done to improve that situation would make Alaska more competitive.

Finally, she is "jazzed" about a state-led LNG project. It has issues, but the state has a way of reducing the cost so

dramatically that it can keep that project in the game: that is if it was a state project that didn't have to pay federal income tax, a rate of 35 percent. Accepting a lower return on equity than a private investor is another thing. Her numbers suggest the state could reduce the 40 percent. Her point is that it's rare to have something you can do that is that dramatic to improve cost of supply.

CHAIR GIESSEL asked if it is truly lowering the cost of supply if the state simply takes less return on investment.

MS. KAH answered that it really does, because the state can accept a lower rate of return than a private investor (it's like a subsidy) and therefore get so many benefits by doing that that it will get that return on the investment. Whereas for a private investor, anything that is a government tax is a cost of supply.

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CHAIR GIESSEL said she appreciated the word "subsidy."

MS. KAH responded that it's an opportunity as opposed to an outright expenditure of money. You're getting less money than you might have gotten if you had charged a full tax rate, but then you would have no project, because it wouldn't be competitive.

CHAIR GIESSEL said it is a tradeoff, and Alaska's Constitution mandates getting the best return for the state's natural resources for its citizens.

MR. JEPSEN said like building roads or any other kind of infrastructure, it certainly provides access to huge amounts of natural gas on the North Slope which otherwise won't get produced. He said ConocoPhillips has more opportunities than capital which goes for the industry as a whole. There is a special place for a state-led project in Alaska and that is why they support the direction the state is going on the AKLNG project.

MS. KAH said the other thing going for Alaska is that with economic incentives industry does everything in a herd, and, of course, that is what creates the oversupply. Because this project takes longer than the normal LNG project, Alaska is sort of out of cycle with the market and it might just end up bringing it on line at a good time as opposed to the worst possible time.

SENATOR VON IMHOF thanked them very much for the presentation and asked if getting a federal tax exemption is a deal breaker.

MS. KAH answered yes; it would be very hard to jump start a project and get cost of supply much lower without that.

SENATOR VON IMHOF asked not necessarily getting a suite of FERC permits at this time?

MS. KAH said that would obviously be needed also, but getting the federal tax exemption may be the most important thing.

MR. JEPSEN added that clearly if you can get to the point of having cost of supply that competes in the world market, Alaska is in a very good position to move ahead. He also understands the desire to continue to progress the project and bring things together at the same time. It's a judgement call in terms of how much time and effort the state wants to spend and what it considers priorities. He believes that AGDC is pursuing both of those options.

SENATOR VON IMHOF asked Ms. Kah's opinion on the state being able to amass sufficient funding from a variety of sources to be able to make such an expensive project go forward.

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MS. KAH said she is not personally trying to finance a \$50 billion project, but that has always been the challenge with this project. To look for the money, though, she would look to the governments that want to purchase the gas - the Japanese investors that have teamed together to do joint purchasing - the potential consumers of the gas and try to get them to finance it. They may demand things like ownership, or building of the tankers, for instance.

SENATOR MEYER said a consultant testified to the Resources Committee, and said they didn't feel like Alaska is competing with the Lower 48, especially in terms of unconventional oil that tends to come on faster, but also depletes faster, whereas Alaska oil takes longer to come on but stays in production longer. Still, any oil company has limited capital dollars and they are probably going to go with the project that they can bring on quicker just because of the time value of money. What is your opinion?

MS. KAH answered that the slides in their analyst presentation make a case for having a diversified portfolio with some long-

term projects as well as short term projects. ConocoPhillips is obviously still investing in Alaska, so they clearly think differently about that.

MR. JEPSEN expanded that means there is a place in their portfolio for Alaska, but only as long as it doesn't climb too high in the cost of supply side of the chart. ConocoPhillips has done a lot to try to reduce its cost of supply here, and is still competitive within its portfolio. However, Alaska is on the high end of cost of supply, so if something pushed that higher, like increased taxes, they have plenty of other places to invest. "That diversification of the portfolio isn't diversification at any cost. Total cost matters." he said.

MS. KAH added that ConocoPhillips just announced the sale of 50 percent of their joint operations of oil sands with Cenovus Energy in Canada, a \$13 billion sale. That was long-lived assets, but they just didn't feel it fit their cost of supply: an example of ConocoPhillips putting its money where their mouth is.

SENATOR BISHOP asked if the jury is out on fracking as far as the life of the well.

MR. JEPSEN answered that ConocoPhillips has been doing facing since the 40s and they used to do it by just dropping nitroglycerin down the well. So, fracing isn't new technology, but recently it has been advancing. In terms of the life of the frack, sometimes it is beneficial after 20 years to go back in and refrac a well, because they can become contaminated with fines or has degraded somehow with sand migration or some such, although they haven't seen a lot of that in their conventional North Slope production. Each well must be diagnosed for potential upside.

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MS. KAH added that there is a great misunderstanding. Everyone knows the wells drop off very quickly and then have long tails, but as an industry decline isn't taking place anymore, because so many wells have reached the plateau portion of their production.

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SENATOR MICCICHE went back to the incremental global oil supply on slide 15 and noted that companies seem to take advantage of the lower cost of materials, labor, design, and engineers, and

one sees investments preparing for price improvements, but he didn't see that right now, and that is worrisome.

MS. KAH responded that there were no acquisitions through 2015, but some started in the second half of 2016. People had to believe the price was at the bottom. ExxonMobil made an acquisition in the Permian, for instance, where lots of acquisitions are taking place along with consolidation. Industry sentiment is very cautious, because a lot of companies had been downgraded. While the industry's "animal spirits" can't be seen, the truth is that it is a lot stronger and healthier now.

SENATOR MICCICHE said the imbalance seems different from the way it felt in the past where there were price challenges. It seems more permanent.

MS. KAH replied that one thing she has learned over the years is that nothing is permanent, but it is unpredictable. So many people did not see this coming that it spooked them, so they are going into this wait and see and let's keep healthy mode of operation that ConocoPhillips is doing.

CHAIR GIESSEL asked if ExxonMobil is selling some properties they had in Norway.

MS. KAH said she had not seen that.

SENATOR DUNLEAVY asked how this is going to change the behavior in the Middle East where the Saudi's controlled the price more.

MS. KAH answered when the Saudi's stepped back and said they wouldn't keep their production down to match supply and demand, the market took over and found a price that balanced supply and demand. The way these countries fit on the supply curve really isn't their cost of production, which is very low, but it is what they need to match their fiscal budget. They won't change for shale, although they said they would reduce production for a crisis.

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SENATOR HUGHES asked how soon the African rural to urban movement will make a significant difference in what is happening in terms of greater needs for oil and gas as well as exploration, development and production in Africa.

MS. KAH replied that is one of the reasons she doesn't believe in peak demand, because there is this urbanization that is

taking place in China, India, countries in Africa, and other countries that will keep demand growth going in developing countries even if peak demand is seen in the industrialized countries. Africa has a lot of deep water resource, but it is expensive and there is no infrastructure. ConocoPhillips was recently in Senegal, but left. One of the issues is that strong institutions are needed to get high economic growth and stability. Not knowing what rules and regulations are in place also makes it difficult for investors. Mozambique is a great example: it has a lot of gas discoveries and companies want to invest in LNG there, but it has no infrastructure, no service companies, and the governments haven't quite set the rules - and now there is competition from this lower risk/lower cost investment that just delays the higher cost areas from coming into fruition. Eventually the demand growth will come in from those areas, but the governments need to settle down and allow that to occur.

SENATOR HUGHES said if there is no expectation for the 2030s, what about the 2040s?

MS. KAH said she couldn't speculate on the politics of any of these countries.

CHAIR GIESSEL thanked Ms. Kah and Mr. Jepsen.

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CHAIR GIESSEL adjourned the Joint Senate Resources and Finance Committee meeting at 4:57 p.m.