

Expanding Natural Gas Markets Proceedings
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Co-chair Ian Burkheimer, Director of Business Development, Plum Energy
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Speakers:

Dan Kirschner Executive Director, Northwest Gas Association
Abraham Kim, Director, Maureen and Mike Mansfield Center, U of M
Ines Piccinino, Assistant Deputy Minister, Upstream Development Division, Ministry of Natural Gas Development of B.C.
Ian Burkheimer, Director of Business Development, Plum Energy
David A. Bennett, Director, Communications and External Relations, FortisBC
Vern Wadey, Vice President, Jordan Cove LNG

What is the Resource?

Overview of the Resource. Supply, Demand, Prices, etc. What are concerns of the region's legislator's?

Dan Kirschner began the presentations by providing a fundamental understanding of the natural gas industry. In 2007, the use of natural gas was not particularly popular. However, in the last eight years, the industry has changed to figure out where gas can be used, creating a new paradigm. Natural gas is fossil fuel from organic deposits such as bugs and algae. It creates hydrocarbons like methane, and there is more energy in methane atoms than other fossil fuels. Additionally, it is cleaner and more efficient than other fuels. The shale deposits from which the fuel is extracted is thousands of feet deep in what is essentially petrified mud. For decades, oil and natural gas has been produced from conventional clay. Kirschner explained how the source rock is clay and the fuel will bubble up from pressure. Porosity in the clay describes how much room there is for storage and permeability describes room to move. The pressure relieved by the wells allows the reservoirs to "shoot up." Horizontal-directional drilling and fracking technologies help access resources in non-permeable rock formations. Horizontal-directional drilling can access a pay zone that is larger than what can be accessed in conventional drilling. It extends up to seven miles (35,000 ft) with the pay zone along the lateral and the ability to drill on a 360 degree radius. Each drilling rig has a pad, and horizontal-directional drilling dramatically reduces this carbon footprint. Kirschner then showed a video of the development of natural gas and oil in shale deposits and explains horizontal-directional drilling compared to conventional drilling. Conventional drilling is only one mile below the surface, and the casing (pipes) protects the aquifers.

There are some concerns and issues with hydraulic fracturing, though fracking is only one step in a multi-step process. Four of the major issues include drinking water, water use, water disposal, and air. Every well that is drilled has to pierce ground water. The intent is not to have the sand create a barrier to the movement of hydrocarbons; isolation is key. The use of water amounts to less than 1% of all water use in drilling areas, the rest going to personal and agricultural use. A lot more of the water is reused. Today, there is an effort to find ways to use water that would not be used otherwise. This means staying away from using freshwater. Methods of disposal include treating water (water treatment plant) and disposal wells, though caution needs to be used with wells as they may cause seismic activity. The issue with air comes from the concern of how much methane is being used, and it is highly regulated in some places.

Kirschner showed multiple graphics assessing the oil and natural gas industry. In his shale assessment, the data showed that the total available resource has more than doubled due to better ability to access the resource. Gas can also be produced very economically. Regarding natural gas production from shale, Kirschner mentioned that it can be difficult to forecast due to technological advances. There has been a recent decline in rigs producing oil, but the actual production is increasing due to substantial technological improvements in the last five years. There are new gas resources, and there has recently been a disconnect in prices between natural gas versus oil. However, there will likely be a decline in the long run of natural gas prices. Overall, of the resources of this generation, natural gas is the least expensive. It also supports renewable energy like wind power by balancing out the "void" of wind power. Natural gas transportation is cheaper and cleaner than other fuels like diesel.

NW Energy Supply and Asia Markets

The next speaker was Abraham Kim who explained that the Mansfield Center at the University of Montana (U of M) serves as a global outreach center promoting Asian relations and leadership development for U.S. and Asian leaders. He stated that people are living in the most dramatic time of energy and that he predicts the U.S. will be a net exporter of all energy by 2030. This is due to the energy boom and technological advancements. Asia's explosion of energy demand also needs to be considered. The U of M hosted an energy conference with Korea, Japan, China, Canada, and the U.S. where they discussed energy and political demands in Japan, China, and Korea.

The world is expected to grow at 1.5% and Asia will grow at 2.1%. Fossil fuels will be a major source of energy in Asia. In 2010-2035, more than half of the energy consumed in the world will be in Asia, increasing demand by 300%. There are currently 1.4 billion people in China, and those citizens are increasing their standard of living with more industrial growth. 66% of the growth is coal, and they have one of the richest deposits of oil, but China has consumed more than they produce since 2007 and continues to import more. China will need to import more liquefied

natural gas (LNG) and is currently the largest importer. They are dependent on Miramar, Turkmenistan, and recently Russia through pipeline energy. There has been paradigm shift in China where the concern is not necessarily about energy, rather, the environment is a priority due to the high level of economic development. Coal is expected to drop from 66% to 60%. In the past ten years, China has spent 425 billion dollars on renewable energy. Japan imports 37% of LNG where they are in the midst of an energy disaster. Overnight, they lost 27% of their nuclear energy production profile, causing a dramatic shift to LNG. This has added 27 billion dollars to trade, reversing a 30-year trade surplus trend and putting them into a trade deficit in 2013. South Korea is the fourth largest importer of coal, fifth in oil imports, and second in LNG. Ultimately, northeast Asia is seeking new sources of energy.

Kim noted that Australia is aggressively producing LNG terminals. Recently, there has been what Kim refers to as a “curve ball” in the oil sector. The low cost of oil has driven down gas prices creating less competition and less need to diversify. In political circles, Asia is demanding leadership from the U.S. in energy security. The U.S. needs to protect regional security and to continue to be engaged in the Middle East even though they are not dependent on that area anymore. With U.S. needs declining in the Middle East, Asia is becoming more dependent on this area. The U.S. is the only country that has the ability to keep the Middle East stable. Stabilizing delivery routes from piracy is one of the stability issues. In Melaka, 60% of oil runs into these issues. Kim emphasized that the U.S. needs to remain engaged to develop relations of the energy world. Asians are looking for alternative places other than the Middle East and Russia to get energy. Asia is very fragmented as it does not have stable energy relations. They need new institutional arrangements to manage their energy demands.

Kim’s recommendations are that the demands of Asia need to be understood and that Asia needs to be included in the conversation. Supporting small and medium sized business would promote better use of free trade agreements, Universities also need to get involved for technology innovation beyond having an open conversation.

The floor was opened up for questions at this point in time. The first question was asking why gas needs to get to market now. Why doesn’t the U.S. let other countries exhaust markets and then sell their gas in 50 years when it is more valuable? Kirschner replied that this is a matter of linking the resource to where the demand is. Kim said that part of the issue that the industry is not only looking at players in the community. Australia, Qatar, and Papua New Guinea are players. Asia is looking for partners, and this is a window of opportunity. With climate change, they are moving away from fossil fuels and more to natural gas. Kirschner added that entities are investing in natural gas, and they want the investment to be productive today and not 50 years from now.

Another audience member brought up the comparison between water in agriculture versus fracking. There are freshwater laws in Alberta. What other technologies are available for production of shale? Kirschner responded that water is a cost to

producers. The cost can be driven down by reusing water or using water that is otherwise unusable. There are other experiments using hydrocarbons like CO₂ or propane rather than water. Three to five years ago, producers would have needed freshwater. Now, water tectonics in Bellevue allow producers to use non-freshwater in fracking, and this is due to an evolving conversation. Kim mentioned that at the U of M, there is technology being developed to separate chemical from freshwater. Ian Burkheimer commented that water is a very real issue in energy conversations.

Someone else brought to light coal in Montana. The biggest threat to coal is not environmental regulations, but it is natural gas. What are the comments from the speakers? Kirschner replied that it is not quite as simple as that. Environmental regulations drive up the cost of coal. Natural gas has less environmental risk associated with it than coal does. The combination of the increasing cost of using coal and the low cost of natural gas is what poses a threat.

Government Best Practice

How do we ensure Natural Gas is responsibly produced and regulated?

Ines Piccinino began her presentation by discussing how there is no LNG production in British Columbia, there is natural gas production. Natural gas prices remain low at about \$2.50 per thousand cubic feet. North American competition remains tough with energy production decreasing in the east. LNG is a value-added product.

In B.C., there is regulatory framework in place that allows the province to own the resource and is also responsible of disposal of the resource. There is a royalty policy set up in the province. The B.C. Oil and Gas Commission is linked to the government. They regulate upstream, midstream, and downstream activities and serve as a policy taker. Objectives in the province for natural gas development include a few actions and strategies to ensure a reliable, abundant supply. There are three northern basins as well as Montney basin which are mostly shale. The resource is below 6,000 feet, as deep as 12,000 feet. The Montney basin was assessed to have more than 190 trillion cubic feet of gas. Another of B.C.'s priorities is to maintain an effective royalty regime, so in 2003, they created targeted royalty programs. These include characteristics like deductions for deep wells. Shale production became successful due to fiscal responsibility. 120 million dollars per year are dedicated to infrastructure in northern B.C. Piccinino also mention B.C.'s Amend Petroleum and Natural Gas Act (PNG) as well as Treaty 8 negotiations with First Nation's people. The province continues to support farmers as they negotiate with oil and natural gas industries.

In B.C., water quality associated with hydraulic fracking has been investigated by studying issues with seismic activity. They found that geological features and water disposal affect seismic activity. A regulatory fracturing component was created, and there remains to be very strict regulations. The industry is getting creative using non-freshwater for fracking. Until 2006, there was an increased number of wells

drilled. With the shift to shale production, less new wells were drilled, but production continues to increase. Horizontal drilling continues to get longer and longer while still remaining productive. If the shale is thick enough, horizontal drills can be on top of each other. B.C. has 25 % of the natural gas wells in Canada. Natural Gas is not a scarce commodity anymore with the progress of the past decade. Piccinino predicts that there is about 100 years left of natural gas resources.

B.C.'s success can be attributed to investments in natural gas, looking at research, having a world-class resource, and using flexible government policy and fiscal framework. The future of natural gas in B.C. will need to stop comparing conventional drilling to horizontal drilling. It is assumed that B.C. maintains North American markets. There will be between 50 and 82 million tons annually of LNG with about 1,500 will drilled every year. Water use was less than 0.01% of runoff in BC used in 2012 and 2013 in natural gas production. 0.2% of land in northeastern B.C. is used for well pads. There are 19 proposed LNG facility, 11 of which are approved, and 33 companies are behind these facilities.

The co-chairs opened up the floor for audience questions. The first question asked if water recycling and methane recycling are regulated. Piccinino confirmed that they are, but water more so than methane. Potential methane leaks are being looked into with studies being conducted in the U.S. about old wells that leak. There are also efforts being taken to develop a snapshot in B.C. of what the situation is and how to reduce leakages in wells. Energy planning in 2007 called to get rid of routine flaring by 2016 which was obtained in 2012. This area is still missing methane leakage.

The next audience question brought up the 19 proposed LNG terminals. What is the typical environmental review? Piccinino responded that there are two different processes and that B.C. chooses to coordinate with the federal government. This is a 180-day process with no stopping the clock. The federal process can elect to stop the clock to get more information about the location of the plant. Caddy McKeown added that the U.S. federal, state, and local process can be lengthy and arduous as one plant began its process in 2003 and still hasn't broken ground.

Another audience member asked about a pipeline that could go to the coast. Piccinino stated that the proposals are advanced, but not ready.

Someone else brought up how the liquefaction process is intensive and that hydro cannot be used to cost. How will the province reconcile LNG plants with the agreement to reduce impact to the climate? Piccinino explained that some small projects in B.C. are planning to go completely electrical along with some big plants, and no gas is going to be used. The clear framework for LNG plants is online. There is a goal for the amount of emissions produced, and companies must pay for extra. B.C. is continuing to learn more about LNG production and policies have been put in place as of a few months ago which can be found online.

The next question referred to how aboriginal rights have impacted plants in B.C. Piccinino responded that most aboriginal groups have been in favor. There is less

concern of potentially exporting oil. There are big conversations about delivery routes, but agreements have been reached. In general, there has been a very positive outcome. First Nations are proponents of LNG development. In the Treaty 8 area, an understanding of shale projects compared to conventional drilling needs to be developed. It is a 36 billion dollar investment for one project.

What are the Opportunities for Our Region?

Mining

Ian Burkheimer presented information about PLUM Energy that is based out of Seattle. Vista Utilities and World Fuel Services (Fortune 100) are outside investors. PLUM is small scale LNG which means they distribute between 200-500 miles. They have a stake in the mining and drilling industries, but the drilling industry has been challenged as of late with recent decrease in oil prices. The railroad is looking at using LNG for the rail industry. There is a consensus to move to LNG due to reduced emissions and improving local air quality.

In the last year, there have been 4 LNG plants developed in the U.S., and PLUM has two in North Dakota. One plant produces 85,000 gallons per day of LNG which is the equivalent of 60,000 gallons of diesel. The challenge in North Dakota is that production hasn't met demand. PLUM is looking at various regions in North America to place new plants. Their base is the Pacific Northwest as they maintain good relations with Fortis.

Burkheimer showed how the price of LNG is competitive with diesel as LNG is a tool used to decrease emissions and increase cost-savings. Both drillers and well-completion companies have been switching from diesel to natural gas. Off-grid communities like West Yellowstone need large tanks to be transported to them, vaporized, and distributed. Burkheimer went on to describe the Powder River Basin which is the site of the Eagle Butte Mine. Large trucks here that use LNG replace 30% of diesel. CO₂ emissions there have dropped dramatically, displacing diesel and lowering the cost of operation. There is a need to replace fueling methods with a mobile refueler. Burkheimer also mentioned that Alpha Natural Resources and Arch are the only two mining companies that use natural gas, and PLUM is Alpha's supplier.

Transportation

David Bennett introduced transportation of natural gas by discussing FortisBC, which is responsible for large projects. FortisBC is an investor-owned utility based in Canada that deals primarily with gas and electric located all over North America and in to the Carribean. This company came from Newfoundland Power, and now the assets are 50/50 between Canada and the U.S. They are also in the energy infrastructure business. They serve more than 1.1 million customers in B.C., delivering 22% of the energy in B.C. which is more than other energy businesses in

the province. They are looking at long-term investments such as geothermal energy and are active in 135 communities in B.C.

In 2007, energy policy was implemented in B.C. Emissions attributed to transportation make up 36%, 45% of which come from trucking. FortisBC has a lot of experience with LNG and is looking into using it in trucking. Challenges they face include lack of information, infrastructure, and the cost of conversion. Fortis needed to work a lot with the government using B.C.'s clean energy act, a policy that encourages clean energy in vehicle fleets. The program has been running for three years now, and they have the most vehicles in Canada that run on clean energy. 42 million dollars was invested into stations (infrastructure). 411 vehicles/vessels have been converted, including 123 heavy duty trucks. Regarding marine development, there are B.C. ferries on LNG with diesel as a backup. There has been pushback from trains due to lack of knowledge of the LNG process.

Bennett described different projects including the Tilbury expansion that has been producing LNG for half the price of diesel and putting it into trucks. The WesPac midstream Jetty Proposal encourages growth in the marine industry. He also explained that LNG can be stored in a tank for two months and stacked like regular containers. This has allowed LNG to be transported to Inuvik in one tanker truck per week.

LNG Exports

Vern Wadey discussed the role of Jordan Cove LNG (JC) which is an energy and infrastructure company headquartered in Calgary. He also mentioned that coal and oil are declining in usage and natural gas has been increasing in the past ten years. Renewable energy also has tremendous growth, but big consumables are oil, coal, and natural gas. In 2025, 25% of energy will be LNG. Natural gas can grow in the markets through LNG. JC will go to China, India, Southeast Asia, and is already serving Japan, Taiwan, and South Korea, not to mention Hawaii is looking at LNG.

Wadey explains that converting gas to the liquid form shrinks to 1/600 of the size. LNG is a transition fuel that is used in the absence of a pipeline, and there is a tremendous surplus of LNG. Russia, the Middle East, and West Africa are large producers of LNG. New suppliers are Canada, the U.S., and Australia. JC is working on big LNG projects in western Canada that have to go through an extensive four-year regulatory process. Natural gas is not only in western Canada, but there is also plenty in the U.S. In Canada, the total proposed production is 53.7 billion cubic feet per day. Combining that with the U.S., the production is 80 billion cubic feet per day, though a lot of these facilities will likely not be build. It takes five years to construct facilities and is a ten year project from the start of the regulatory process. The 2021 outlook for the U.S. and Canada combined is 10-12 billion cubic feet per day. The political and community acceptance for JC is very high, and JC is likely to be part of the 2021 exporters.

A competitive location for JC is in Coos Bay, Oregon. This provides a mild climate and a federally maintained channel. It will also be a long-term supplier of jobs as southwest Oregon values JC through support in the legislature, they have local zoning permits, there is already 8 billion dollars of investment, and they have the FERC environmental impact statement. Wadey mentioned that JC does not source supply and LNG is sold under an oil-linked pricing formula. Their competitive advantage is that direct competitors are in the U.S. Gulf Coast which is 22 days from Japan, and JC will only be nine days from Japan. Their final investment decisions are in regards to the regulatory process and the EPC contracts to construct.

The floor opened for audience questions. One person was curious about the liquefaction process. Heat is available, so is it being used? Wadey stated that JC has a power plant and electricity runs the liquefaction units, fully efficiently using heat.

Another audience member asked about the hazards associated with transporting LNG by truck or shipping. Bennett fielded the question, explaining that natural gas is brought through a pipeline. The cooling process is relatively simple, but expensive. It is then held in tanks and shipped to the destination where it is unloaded.

A follow up question asked about what happens when the tanker falls apart. Bennett responded by describing that one tanker going to Whitehorse did fall over, but no natural gas was released. There are risks like any other fuel, but natural gas does not have the residual effects that propane or petroleum have due to the fact that it is lighter than air rather than heavier.

Action Items

***These were taken during the working group – I don't have a record of these.*