Expanding Natural Gas Markets in the Region Proceedings
PNWER Annual Summit – Whistler, British Columbia
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Co-chair Ian Burkheimer, Director of Business Development, Plum Energy
Co- Chair Hon. Rich Coleman, Deputy Premier and Minister of Natural Gas Development, British Columbia

Speakers:
Ian Burkheimer, Director of Business Development, Plum Energy
Hon. Rich Coleman, Deputy Premier and Minister of Natural Gas Development, British Columbia
Dave Bennett, Director, External Relations, FortisBC
Brian Dracup, Senior Director, LNG Rail & Tender Program Development, Westport Innovation
Dan Kovachich, Vice-President, Maxum Petroleum
Paul Evans, Vice President, Ferus

Hon. Rich Coleman began the session by welcoming every one and explained that the focus was on domestic LNG and CNG. He pointed out that this was an opportunity to talk about security, shared technology, and British Columbia's rich natural gas. LNG and CNG is an opportunity for cleaner air, innovation, and low cost fuel alternatives and cross-border innovation.

Introduction to Small Scale LNG (and CNG) Value Chains

Ian Burkheimer started by saying that there was a lot of exciting new innovations and developing new businesses in the industry. Plum Energy is a small scale LNG company based in Seattle. Small scale LNG's value chain includes drilling, agriculture and industry, marine propulsion, mining, trucking, rail, on site storage and regasification. There is an increasing price difference between raw resources and commodities. When it comes to stricter emission levels, natural gas is much cleaner than diesel. Flaring in the North Dakota's Bakken Shale is a huge issue due to the lack of infrastructure. Plum Energy is looking to build liquefiers in this market to capture the natural gas rather than flaring it off which will helps displace other more expensive fuels.

LNG for Off-Grid Industrial Applications

Dave Bennett began by introducing his company, FortisBC, as the largest energy provider in British Columbia. He explained that there is a plentitude of natural gas in British Columbia and although focus is on exporting there is an opportunity for a renaissance of supporting industry. One of FortisBC's projects is the Woodfibre

small scale LNG facility near Squamish, British Columbia that if approved should be operational by 2016. With this facility they propose to liquefy and export 2 million tonnes of LNG per year. Another is the expanding the Tibury peaking plant, repurposing it to facilitate natural gas for transportation while also keeping its "peaking" capabilities.

The Government of British Columbia has authorized public utilities to take a leadership role in developing the NGT market. The way to do this is to have customers using the infrastructure to get the industry going, with margins offsetting the incentives that were in place to get started. It is important not to underestimate the change that is required to be successful. There are great opportunities across industries for NGT and creative solutions to meet the demand for LNG.

Question: What are the capital costs for LNG production centers?

Dave Bennett: Tilbury's current expansion is producing the cost of $4.25/kJ. The actual expansion is $400 million and will produce three to four times as much liquefaction.

Ian Burkheimer: The cost is roughly $10 million per plant, allowing for variables like the location of the plant.

Question: How is gas being transported from the field and are other gases being removed?

Ian Burkheimer: Heavy carbons, propane, and methane are being removed from the gas. Transportation depends on the infrastructure. Small plants can be on wellheads. This project is focusing more on treated gas; there are other capital expenses for untreated gas.

Question: Are road taxes applied equally to diesel and LNG?

Dave Bennett: There are no road taxes for LNG but it is still possible to see economic and environmental benefits. LNG needs to see no big tax burden in the short term. Carbon tax is the only tax that I am aware of.

Ian Burkheimer: On the U.S. side there is tax irregularities between diesel and CNG/LNG.

Question: When is the question made between LNG and CNG?

Ian Burkheimer: Paul's presentation will go over that.

<u>Natural Gas for Trucks and Trains:</u>

Brian Dracup started his presentation by saying that there is a shift in the conversations that drivers are having from "if" to "when," but there is still a lot of work to be done at the governmental level. Westport, originally a research and development company based out of the University of British Columbia, is at the intersection of LNG transportation. The decision to store natural gas as either CNG or LNG is based upon consumption over time.

There are significant opportunities in mining, exploration and production, rail and marine propulsion. Westport signed a partnership with CAT in 2012 for large mine haul trucks with HPDI technology, which is currently in development. Rail and mining companies are interested in HPDI technology because it has a unique combination of high-substitution and high efficiency over fuel. So far in rail there has been a 30-38% adoption of natural gas. This is not the first shift in technology that rail has seen, it started the conversion from steam to diesel fifty years ago. Westport is focusing on rail in two ways: HPDI technology (on engine) and LNG technology (off-engine).

There is a need to go back to LNG tender. There is currently not enough space for storage. AAR formed a NG Fuel Tender technical advising groups in January 2013 to create LNG tender standard.

Dave Bennett's recommendations for governmental support within PNWER is to remedy state taxes to be on a DGE basis as 18 states have done, Washington is the only state currently to have done so under PNWER. He also asks for there to be weight exemptions for LNG on state roads. Coordination between states to build regional corridors is important and governments need to include NGV's on their approved vehicle purchase lists.

Question: What will the size of ferry tanks be in the future, and is LNG applicable for long term ferry transportation?

Dave Bennett: There are 40-foot storage containers for LNG. The containers for ferries are often custom built and can have different configurations. Natural gas needs 1.7 times more storage for the same amount of energy and this cannot be changed. Larger ferries fill every night but small ferries fill less so, storage really isn't that big of an issue.

<u>Marine LNG Fueling:</u>

Dan Kovacich, with Maxum Petroleum, began by talking about Emission Control Areas (ECAs). The IMO and EPA, through the ECAs, have begun a three-year phase approach to limiting Intermediate Fuel Oil (IFO) consumption for deep draft vessels. These ECA's place restrictions on sulfur oxide, nitrogen oxide, and particulate matter emissions pursuant to the IMO International Convention for the Prevention of Pollution. Due to this LNG will be needed, as other fuels will no longer be viable.

There needs to be a collaborative bunker barge workforce and LNG bunker infrastructure. Customer problems are dependent on scale and collaborative effort is required. The list of regulatory agencies, and the people filling the posts within them, is massive and fluid. There has been support abroad, especially from the Swedish Marine technology forum.

Looking towards the future there needs to be LNG standardization for sustainability, among other things. There is a growing confidence in LNG technology for marine propulsion but profit is the driver for change. There is a lube oil side to the industry, which is helpful, and LNG is far quitter than diesel across all industries.

Compressed Natural Gas (CNG) for Industrial Uses

Paul Evens from Ferus began his presentation with the statement that there are an unlimited number of uses for cheap fuel, both internally and as an export. Flaring is environmentally better than venting but there is still so much waste. 30% of the natural gas in Dakota is sent to the flare stack even though it is cheaper and cleaner than diesel. GE and Ferus can provide the infrastructure to capture that natural gas and to put it onto trucks. There are economic limits to plants so these CNG and LNG transportation trailers are a fringe expansion.

The decision to store as either CNG or LNG is based upon the distance that the product needs to travel. It is the same product; there is just a logistical difference in transport. CNG and LNG are competitive to 116 miles and then CNG becomes more expensive to transport. The off-road market is a substantial chunk of the diesel market, making up half of the Canadian Market. Natural gas is 30-50% less expensive and is safer (the example was given that you don't use diesel to cook in your home). Complications that come up are the lack of harmonization in regards to units of measure, regulations, safety, and taxation.

Question: In regards to the ECAs, are militaries participating in this as well?

Dan Kovacich: Yes.

Action Items

1. Products, experiences, and source markets that connect across the border
   - Come up with best-practices in regards to regulations, and how to make consistent applications of what machinery can be used
     - Delivery systems
     - Standardization in sector

2) Standardize Regulations
     - Balancing

- PNWER can add value
- Special project on regulation
- Standardize and understand taxes
- Ben Hampston (?) as leading organizational role