

2017 Long Term Gas Resource Plan (LTGRP) – Meeting 3

August 9, 2017

Orange items provide suggestions from RPAG members for direct input into FortisBC Energy Inc.'s (FEI) activities.

Green items denote follow-up questions for FEI. FEI's responses use bold black font.

Yellow-highlighted items refer to specific slides in FEI's presentation slide deck.

1. Attendees

- a. Al Kleinschmidt, Pacific Northern Gas (PNG)
- b. Cole Rheame, First Nations Energy and Mining Council (FNEMC)
- c. Chris Frye, B.C. Ministry of Energy and Mines (MEM)
- d. Dale Littlejohn, Community Energy Association (CEA)
- e. Denise Mullen, B.C. Business Council
- f. Gerald Chan, FEI
- g. Glen Cheetham, City of Kamloops
- h. Janet Rhodes, Commercial Energy Consumers Association of B.C. (CEC)
- i. Jason Wolfe, FEI
- j. Jennifer Davison, B.C. Ministry of Energy and Mines (MEM)
- k. Joyce Martin, FEI
- l. Katherine Muncaster, B.C. Ministry of Energy and Mines (MEM)
- m. Ken Ross, FEI
- n. Kevin Kingsbury, FEI
- o. Lejla Uzicanin, B.C. Utilities Commission (BCUC)
- p. Maggie Baynham, City of Victoria
- q. Matt Mason, FEI
- r. Mike Bains, FEI
- s. Mike Seaborn, B.C. Public Interest Advocacy Centre (BCPIAC/BCOAPO)
- t. Paul Chernikhowsky, FEI
- u. Robert Schuster, FEI
- v. Ryan Bracken, Northwest Natural
- w. Sarah Smith, FEI
- x. Tamy Linver, Northwest Natural
- y. Terry Penner, FEI
- z. Tom Hackney, B.C. Sustainable Energy Association (BCSEA)
- aa. Tom-Pierre Frappé-Sénéclauze, Pembina Institute

2. Feedback from Workshop 2

- a. **On slides 12 and 13**, FEI displays energy cost comparisons for natural gas, a 100 percent blend of Renewable Natural Gas (RNG) and BC Hydro Tier 1 and Tier 2 electricity.
 - i. One attendee notes that FEI should account for the efficiency of electric heat pumps in this comparison:
 1. FEI notes that the subject slides use kilowatt hour (kWh) energy as their unit basis and thus are agnostic to specific equipment efficiencies.
 2. Industry experience and research indicates that electric heat pumps do not consistently meet their rated efficiencies during seasonal operation.

- b. Do residential combined space and water heating systems work for equipment retrofits in existing buildings?
 - i. Yes, combined space and water heating systems can work for equipment retrofits in existing buildings.
 - ii. **These systems use advanced controls to regulate the interplay between domestic hot water and space heating service. The specific control strategy depends on the system manufacturer. Typically, some systems assign priority to domestic hot water and temporarily interrupt their space heating operation during domestic hot water draws, while others ramp down the availability of domestic hot water during space heating operation.**
- c. FEI is monitoring whether cellulose biogas pilot projects will be able to deliver more than 50,000 gigajoules (GJ) of RNG per year at a price of less than CAD 20 per GJ.
- d. FEI is supporting a project which pilot tests carbon capture in commercial end-use appliances:
 - i. One attendee asks what commercial by-product the pilot test produces from the carbon capture process?
 1. FEI plans to make a public announcement about this project at the end of Q3 2017. This announcement will include further details.

3. Natural Gas for Transportation (NGT)

- a. On slide 24, FEI displays numbers underneath the various vehicle categories; these numbers denote vehicles that have *committed* to using Compressed Natural Gas or Liquefied Natural Gas to date. A number of vehicles are expected to become operational in the coming months.
- b. Compressed Natural Gas (CNG)
 - i. FEI's current market share for on-road vehicles is less than one percent for all vehicle types except waste haulers and transit vehicles; both transit and refuse vehicle types run on residential streets and some of them are subject to public entity emissions targets so Greenhouse Gas (GHG) and noxious emissions reductions are valuable opportunities for them.
 - ii. FEI's CNG forecast trajectories are based on market share of a relatively time-stable total vehicle market:
 1. Assumptions about engine availability and efficiencies, putative diesel and natural gas price spreads, carbon pricing, and policies to support CNG adoption primarily drive the projected market share.
 2. Realizing the Upper Bound CNG trajectory is plausible:
 - a. Some large North American fleet operators have started using British Columbia (BC) as their first jurisdiction for converting fleets to CNG.
 - b. FEI has made inroads with operators at transportation hubs; converting fleets at such hubs increases the chance of converting further fleets that are serviced by these hubs.
 3. Typically, smaller regional fleets adopt CNG primarily for economic reasons; large operators and public entities are environmentally driven but would not convert their fleets without favorable economics.
 - iii. Since the CNG vehicle market in BC is still emerging, incremental costs for new vehicles/vehicle conversions still occupy a relatively wide range:
 1. Typically, fleet operators target payback periods between three and four years as the economic life of their vehicles ranges from seven to

- eight years on average (for new market segments, payback periods target two years or less).
2. Without considering infrastructure costs, operators should have at minimum five TJ per year of natural gas consumption (about five to six waste haulers) for economics to support conversion and infrastructure investment.
 3. BC regulation enables FEI to provide higher incentives for early adopters and entities that enable further adoption (e.g. by allowing third parties to use their fueling stations) and lower incentives for the rest of the market; as market transformation proceeds, the market typically requires less incentives.
 4. CNG vehicles cost about 30 to 40 percent more than comparative diesel vehicles. FEI's incentives towards such capital costs typically enable fleet operators to meet their desired payback periods and range between 40 and 80 percent of incremental cost for early adopters (depending on a number of factors, e.g. market segment, fuel consumption, fuel supply term).
- iv. In theory, CNG may provide a fueling solution for limited segments of the maritime market; tug boats have a duty cycle that does not appear to support conversion but vessels such as the TransLink Seabus may provide an opportunity.
 - v. Hydrogen may become a viable transportation fueling solution in the future; while FEI supports diversity in the market, FEI is focusing on CNG in the commercial vehicle sector where FEI can have most impact now:
 1. Most hydrogen fueling research and field testing has focused on the personal and small vehicle market.
 2. BC ran a hydrogen pilot for Whistler transit buses during the 2010 Winter Olympics but these buses switched to diesel after the Olympics concluded and will soon be replaced with CNG.
 3. As noted in item 2., FEI is monitoring hydrogen for use in other applications, such as power-to-gas.
- c. Liquefied Natural Gas (LNG)
- i. LNG marine vessels have operated in Scandinavia for decades:
 1. Major Pacific Rim ports, including Yokohama, Singapore, and Busan, have already started exploring LNG bunkering opportunities and have signed a Memorandum of Understanding on this.
 2. The Port of Vancouver historically displayed limited interest but has shown a significant uptick in attention since BC Ferries and Seaspan have started successfully operating LNG vessels. Port of Vancouver has also joined a global coalition of ports to develop LNG bunkering.
 - ii. Compliance with the International Maritime Organization's (IMO) emissions regulations will be a major driver for the maritime market to adopt LNG:
 1. IMO regulations target the Sulfur Oxide (SOx) emissions potential of fuel per vessel.
 2. Maritime vessels can last up to 40 years but the global order book for vessels that can use LNG is growing already.

3. Maritime fleet operators could theoretically meet IMO regulations by using LNG, installing emissions scrubbers on their vessels, or using ultra low sulfur diesel fuel:
 - a. Fuel accounts for about 70 percent of operations costs for maritime vessel operators and profit margins in the industry are very thin.
 - b. As the LNG vessel market reaches scale, capital costs for converting vessels and procuring new vessels are expected to decline.
 - c. Currently, SOx emissions scrubbers have lower capital costs than converting vessels to alternative fuel types or procuring new vessels; however, ports have started banning scrubbers due to the noxious effluent that they produce (scrubbers also reduce engine efficiency).
 - d. Ultra low sulfur diesel is more costly than traditional bunkering fuels and refinery capacity for this fuel type is expected to remain limited.
4. The 2017 LTGRP's Upper Bound LNG annual demand assumes 12 to 15 percent of inter-Pacific vessels calls at the Port of Vancouver adopt LNG as a maritime fuel and all fuel is procured in BC.
- iii. FEI plans to sell LNG to end users and has no intention for operating fueling terminals or vessels; in 2017, FEI did pioneer a world-first solution for tanker-to-ship LNG bunkering with BC Ferries and Seaspan because no third-party market solutions were capable of supporting the requirements and timelines.
- iv. Within the ambit of the 2017 LTGRP, it is uncertain whether LNG initiatives beyond Tilbury Phase 1A will be regulated or non-regulated in the future.

4. Demand-Side Management (DSM)

- a. The Total Resource Cost Test (TRC) evaluates resource acquisition costs of DSM measures versus energy supply from the perspective of the utility, the DSM program participant, and the general utility customer; as such, the test ratio is not an indicator of how much profit FEI derives from DSM.
- b. The 2017 LTGRP's DSM analysis requires each measure to meet the cost test threshold and does not package measures into programs (where individual non-cost effective measures could be rendered cost effective by other measures):
 - i. This approach is consistent with the analysis in the BC Conservation Potential Review (BC CPR).
 - ii. The 2017 LTGRP's DSM analysis represents a long term directional forecast of addressable DSM initiatives; FEI's DSM program plans and expenditure schedules bundle measures into specific programs, consider operational program deployment factors, and request BCUC approval for the expenditure schedules.
 - iii. Two attendees note that the 2017 LTGRP's DSM analysis should account for potential future regulatory easements (e.g. in relation to energy performance regulation that would ordinarily remove DSM potential) which consider the potential non-energy and social policy benefits of DSM:
 1. The 2017 LTGRP's DSM analysis applied the MTRC test to all program areas for scenarios that are subject to the Accelerated outcome on the

Non-Price Carbon Policy Action critical uncertainty in order to directionally account for potential future regulatory easements.

- c. **What causes the considerable decline in estimated commercial DSM expenditures from 2024 to 2025?**
 - i. **Based on the simulation of future DSM activity in FEI's forecast models (rather than FEI's expectation about specific future events), addressable energy savings opportunities for building controls and roof/ceiling insulation decline substantially.**
- d. **What are some examples of residential measures that do not pass the TRC and rely on the Modified Total Resource Cost Test (MTRC)?**
 - i. **Some notable examples of measures that rely on the MTRC include Combination System (i.e. combined space and water heating systems), Net Zero Home, Passive House, and R-2000 Standard New Home.**
- e. The 2017 LTGRP's long term DSM expenditure estimates decline toward the end of the planning horizon because addressable energy savings opportunities are saturated over time:
 - i. The DSM analysis does not account for unforeseen future technologies which may provide future addressable energy savings opportunities; for example, FEI's 2010 CPR did not include residential Smart Thermostats but these are one of the top addressable opportunities in the BC CPR.
 - ii. FEI is unable to project the expenditure impact of unforeseen future technologies as these depend on their per-measure DSM expenditure as well as their total DSM participation rate.
- f. **One attendee notes that FEI should carefully consider the context under which it presents the combined annual demand forecast that includes the impacts of both NGT and also DSM; the attendee is concerned that lay members of the public may infer from the combination that FEI intends to show DSM as insignificant in relation to NGT:**
 - i. FEI notes that both NGT and DSM have their own merit and that the BC regulators have thus enabled FEI to run NGT and DSM initiatives under separate regulatory frameworks.
 - ii. The 2017 LTGRP forecast pairs the respective Reference Case, Upper Bound, and Lower Bound projections for base demand, NGT demand, and DSM impact because this yields the Reference Case and boundary range of annual demand that the 2017 LTGRP considers to determine an adequate level of resources.

5. System Requirements and Options

- a. **FEI should clarify how its traditional versus its exploratory peak demand forecast method relates to the end-use method annual demand scenarios:**
 - i. FEI uses its traditional peak demand forecast method to make infrastructure upgrade decisions. The traditional method does not estimate any forecast changes in peak demand Use per Customer (UPC_{peak}) over the forecast period.
 - ii. FEI's traditional peak demand forecast method relies on 20-year extreme value analysis across 60 years of historical data to determine its design degree day temperatures; while this method does not include climate change temperature forecasts, it has resulted in FEI recently lessening its design degree day temperature by 0.5 to 1 degree Celsius in many regions.
 - iii. The exploratory end-use peak demand forecast method is a theoretical construct developed for the 2017 LTGRP and FEI has not field-tested this

- method with metered consumption data yet; as such the exploratory end-use peak demand forecast method currently is informative only.
- iv. The end-use peak demand method is calibrated to the same extreme design degree day temperatures as the traditional method, but provides a means of applying the same end-use scenarios used in annual demand forecasting to predict changes to peak demand Use per Customer (UPC_{peak}) over the forecast period. Therefore, in theory, it has a direct relationship to the end-use annual demand scenarios.
 - b. FEI takes between two and four years to build new compressor and pipeline infrastructure; this range depends on whether the capital for such upgrades falls within FEI's existing revenue requirement schedule or requires a separate Certificate of Public Convenience and Necessity (CPCN):
 - i. One attendee notes that FEI should engage First Nations early and often when it plans for infrastructure upgrades; such engagement may also enable co-benefits of infrastructure upgrades, such as using waste heat from compression facilities for other purposes.
 - ii. FEI's infrastructure does not have a minimum demand threshold that it requires to operate (i.e. the system can operate without adverse consequences with little or no demand); FEI's system is thus not expected to experience technical operation issues even under the 2017 LTGRP's Lower Bound demand forecast.
 - c. The 2017 LTGRP's exploratory peak demand forecast method displays DSM impacts on projected peak demand; this analysis is not based on targeted DSM but rather relies on the end-use changes included in the 2017 LTGRP's DSM analysis:
 - i. One attendee notes that FEI should display DSM impact as a ratio of sales for both peak and also annual demand.
 - ii. At a theoretical level, the cost of capital over the deferral period represents the monetary value of DSM deferring infrastructure upgrades:
 1. The 2017 LTGRP has not developed this value for inclusion in DSM cost tests since the exploratory peak demand forecast method which underpins the DSM peak demand impact analysis is a theoretical construct and has not undergone field testing in BC.
 2. Two attendees note that the 2017 LTGRP should develop the broad monetary value of DSM infrastructure deferral for general information purposes.
 - d. Slide 87 displays hypothetical expansion options for FEI's Coastal Transmission System (CTS) to meet forecast LNG demand:
 - i. The slide illustrates multiple sequential expansion steps.
 - ii. Since the Upper Bound LNG forecast would trigger multiple expansions in close succession, one larger expansion may replace multiple incremental expansions if sufficient secure market demand exists to underwrite such a larger expansion.

6. Portfolio Impact Analysis

- a. Delivery Rate Impact Projections
 - i. The 2017 LTGRP's delivery rate impact projections are based on comparing forecast delivered energy amounts with forecast delivery costs:¹

¹ The 2017 LTGRP's delivery rate impact projections do not drive changes in annual demand for two reasons: (1) rate impact projections are directional only and actual rates are set through a separate process which involves

1. Forecast delivery costs include estimated expenditures from the 2017 LTGRP DSM analysis, FEI's forecast for short term capital project expenditures, a CAD 20 million annual allowance for major capital projects in the medium and long term, and an assumption that current base costs will escalate by two percent annually (the Bank of Canada inflation target):
 - a. Multiple attendees note that FEI should vary its medium and long term allowance for major capital projects across the Reference Case, Lower Bound and Upper Bound scenarios.
 - b. Attendees expect that, intuitively, the Upper Bound should require more capital projects than the Lower Bound.
2. On slide 112, FEI displays delivery rate impact projections for its base load after including the impacts of DSM and NGT:
 - a. Based on the current Rate Schedule 50, the 2017 LTGRP's delivery impact projections assume that LNG energy customers will pay for those capital projects that their consumption requires and will also credit CAD 0.10 per GJ back to the FEI pipeline system; FEI's analysis currently assumes that this amount will not increase with inflation:
 - i. This treatment does not differ between LNG FEI Energy (orange bars) and LNG Non-FEI Energy (purple bars).
 - ii. Multiple attendees note that the CAD 0.10 per GJ should likely increase with inflation.
 - ii. Two attendees note that FEI should develop the projected delivery rate impact of potential DSM infrastructure deferrals for general discussion purposes:
 1. FEI emphasizes that the exploratory peak demand forecast method which provides insight into potential DSM infrastructure deferrals, in contrast to FEI's established traditional peak demand forecast method, is a theoretical construct that is not based on BC metered consumption data.
 2. FEI recommends that verifying the exploratory peak demand forecast method based on metered data should occur before using the exploratory method to assign monetary value to infrastructure deferrals. FEI expects that such verification will take multiple years and deployment of substantial resources.
- b. Greenhouse Gas (GHG) Emissions Impact Projections
 - i. One attendee asks to what numeric extent the innovative technologies that FEI highlights in item 2. (cellulosic biogas, power-to-gas, carbon capture, combined heat and power, fuel cells, etc.) enable FEI to meet GHG reduction objectives?
 1. FEI is monitoring and, where applicable and cost-effective, supporting the emergence and adoption of innovative natural gas technologies.
 2. FEI has not included the technologies that it highlights in its quantitative forecast model because it is unclear whether these technologies are commercially scaleable in BC. FEI will consider including such innovative

multiple intervening factors, and (2) accurately including rate impact projections in the annual demand analysis would increase the complexity and cost of the forecast model since multiple complex factors impact rates.

technologies in the quantitative forecast model of its future Long Term Gas Resource Plans as wider scale BC test data becomes available:

- a. Two attendees note that the 2017 LTGRP should develop a scenario which shows (while assuming economic growth) to what extent and at what impact to the ratepayer such technologies could help BC meet its legislated GHG emissions reduction targets.
 - b. One attendee emphasizes that the LTGRP is not an appropriate forum for developing provincial BC energy and emissions abatement plans.
- ii. After displaying the discrete GHG emissions impact of its base load, DSM, RNG, and NGT initiatives, FEI, on slide 122, displays the combined impact of all initiatives:
1. Emissions from natural gas combustion by FEI's customers decrease by 26 percent from 2015 to 2036 in the Reference Case. This figure changes to 135 percent and 50 percent in the Upper and Lower Bound scenarios, respectively. If we assume a linear trajectory between BC's legislated sector-agnostic 2020 and 2050 GHG emissions targets, BC as a whole province would have to reduce its emissions by 57 percent between 2014 and 2036 (the BC government expects actions from the Climate Leadership Plan to reduce these emissions by 35 percent).
 2. FEI clarifies that only a portion of its projected NGT LNG emissions impacts accrue to the current boundaries of the BC emissions inventory (this primarily impacts the Upper Bound NGT forecast, whereas a significant portion of the projected Reference Case NGT activity occurs within BC's reporting jurisdiction). FEI has noted this clarification on its presentation slide deck.
 3. FEI emphasizes that climate change represents a global challenge and that emissions reductions help address this global challenge no matter under which reporting jurisdiction they occur.
 4. FEI further notes that, for clarification purposes, its analysis and slide deck do break out NGT from non-NGT emissions impacts and simply indicate the projected ambit of emissions reductions that are projected to occur from FEI's customers.
 5. FEI will publish these RPAG meeting notes alongside its presentation slide deck to provide context to the slides.

7. Wrap-Up & Next Steps

- a. FEI thanks the RPAG for its engaged discussions and valuable feedback on the 2017 LTGRP and encourages RPAG members to provide further feedback within two weeks after FEI publishes the meeting slide deck and notes.
- b. FEI plans to file the 2017 LTGRP to the BCUC on November 30, 2017.
- c. FEI encourages RPAG members to become involved in the public review process that the BCUC establishes for the 2017 LTGRP after FEI files this document.