Critical Review of British Columbia Hydro Appendix C

ROBERT MCCULLOUGH
OCTOBER 14, 2017
What Appendix C Does Not Address

- Our analysis of their export price forecasts
- Our analysis of alternative resource prices
- Our analysis of possible savings from alternative resource scenarios -- $2 to $4 billion dollar savings for ratepayers
- Our analysis of the Sunk Costs Fallacy
- Our detailed identification of factual and computational errors in British Columbia Hydro’s answers to the Commission’s questions (F35.14 and FS35.19)
What Appendix C Does Address:

- **F35.2, F35.6, F35.11:**
  - “1 Answer to Mr. McCullough’s Comments on LNG Sector”

- **F35.3:**
  - “2 Answer to Mr. McCullough’s Comments on Pulp and Paper Sector”
British Columbia Hydro is forecasting a dramatic change in load growth in the immediate future

- Skepticism towards BCH’s load forecast is based on their past history of overestimating demand.
- We still see little evidence that electricity demand will suddenly spike in the next few years.
- Pulp and Paper and LNG will not be major expansions
- Materials from Deloitte and BCUC staff argue authoritatively for lower load forecasts
British Columbia Hydro’s Assumptions on LNG

“We have reviewed recent third-party market evaluations of the global LNG sector supply demand outlook and pricing. These third-party evaluations reach conclusions that are substantially similar to the assessment we had used to develop the Current Load Forecast that anticipated market demand exceeding supply in the later part of the 2020”

F1-1, page 59

“The largest positive developments are in the oil and gas sector, followed by the forestry sector and to a lesser extent in the mining sector. Developments in the LNG and Others sector are expected to result in a negative variance relative to the Current Load Forecast projections for those sectors. The estimated incremental energy and peak demand impacts across each customer segment are summarized in Table J-7. Specific details for individual customer accounts and new customers requesting services are described below.”

Ibid., Appendix J: Developments Since Current Load Forecast and Potential Future Developments Affecting Load (Including electrification), page 9
Almost all incremental loads are forestry and oil and gas

<table>
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<tr>
<th></th>
<th>0-3 years GWh/yr</th>
<th>4-10 years GWh/yr</th>
<th>11-20 years GWh/yr</th>
<th>0-3 years MW/yr</th>
<th>4-10 years MW/yr</th>
<th>11-20 years MW/yr</th>
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<td>Med Term</td>
<td>Long term</td>
<td>Short Term</td>
<td>Med Term</td>
<td>Long term</td>
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<td>Large Industrial (Transmission)</td>
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<td>299</td>
<td>20</td>
<td>35</td>
<td>35</td>
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<td>688</td>
<td>658</td>
<td>69</td>
<td>89</td>
<td>85</td>
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<tr>
<td>Mining</td>
<td>222</td>
<td>135</td>
<td>102</td>
<td>32</td>
<td>20</td>
<td>11</td>
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<tr>
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<td>(78)</td>
<td>(84)</td>
<td>(16)</td>
<td>(17)</td>
<td>(18)</td>
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<tr>
<td>LNG</td>
<td>(80)</td>
<td>(303)</td>
<td>(7)</td>
<td>(6)</td>
<td>(27)</td>
<td>0</td>
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<td>Subtotal Large Industrial</td>
<td>717</td>
<td>739</td>
<td>968</td>
<td>99</td>
<td>100</td>
<td>114</td>
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<tr>
<td>Light Industrial (Distribution)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Industrial Distribution</td>
<td>28</td>
<td>7</td>
<td>(3)</td>
<td></td>
<td></td>
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<td>Total Large and Light Industrial</td>
<td>745</td>
<td>746</td>
<td>965</td>
<td>99</td>
<td>100</td>
<td>114</td>
</tr>
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</table>
Liquified Natural Gas (LNG)

- LNG is a relatively simple technology where compression and refrigeration transforms a gas into a liquid
- The primary economic drivers in order of importance are:
  - Capital cost
  - Process energy (electricity versus natural gas)
  - Natural gas availability and cost
  - Travel times to Asian markets
  - Tax incentives
- We have worked on all of these issues
Appendix C has some misunderstandings of basic commodity market terms

- The market forwards are drawn from a single day of trades (listed as August 27, 2017 in Mr. McCullough’s report). There are several weaknesses with this approach. First, *spot market* values vary from day to day, and thus reflect the sentiment of the market on that day only. Second, the market becomes illiquid due to low trade volumes beyond several years from the current date. Therefore, *spot market* prices beyond 2019 are not reliable. [1]
Actual Definitions of Spot and Futures

- **spot market**
  - **Noun:**
  - a market in which commodities, as grain, gold, or crude oil, are dealt in for cash and immediate delivery (distinguished from futures market).

- **futures market**
  - **Noun:**
  - A market where contracts for future delivery of a commodity or a financial instrument are bought or sold.

- **Why this matters:**
  - Forward markets provide actual prices for the products being bought and sold. When you purchase natural gas in 2027, the commodity is delivered in 2027.
Natural Gas Market Forwards

• The forward market for natural gas reflects long-term market sentiment

• The market does not become illiquid after 2019. Today’s Chicago Mercantile Exchange report shows 25,000 trades between 2025 and 2027.

• Actual prices are the best evidence of future prices since they reflect actual transactions. Forecast need to incorporate this information – not refute it.
BCH’s explanation why they only addressed three LNG plants and neglected to consider completion risk:

“The sector is unique in that it is not yet developed, there are only three proponents that are proposing to electrify from the grid (therefore not allowing for confidential aggregation of a probabilistic load forecast) and is of keen public interest.” [2]
LNG Research: Forwards, Hubs, and Monte Carlo
Ongoing analysis for McCullough Research clients

- Capital costs are significant because British Columbia LNG terminals cannot take advantage of existing infrastructure.
- British Columbia is further from its gas source than the Gulf Coast. LNG Canada needs a $4 billion pipeline.
- Competitive forces are adverse.
In 2014, did TD Economics forecast LNG’s success?

- BCH Appendix C quote: “Furthermore, while the TD Economics report acknowledges there are challenges facing BC LNG projects, its overall assessment is the opposite of what Mr. McCullough implies” [5]
- But TD Economics says: “Resource producers are still weighing the benefits of developing this capacity against the significant capital costs and risks associated with future market uncertainty.” [6]

First Mover Advantage

“The current amount of global proposed LNG liquefaction capacity is set to outpace demand. As each new project is built, the construction of proposed projects becomes more unlikely, as excess market capacity will result in lower prices, which may not be able to offset the capital expenditure needed to build capacity. While LNG importers may see value in diversifying their supply, it may not be enough to recover costs. This same principal also applies within countries, as issues with competition for labour (cost inflation) and excess capacity can lower the probability of proposed projects being economically feasible.”

TD Economics, page 7.
British Columbia Hydro misconstrues TD Economics 2014 Conclusions

“Resource producers are still weighing the benefits of developing this capacity against the significant capital costs and risks associated with future market uncertainty. While no final investment decisions have been made yet, two projects are expected to make a final decision by the end of this year. The ultimate shape of Canada’s LNG future remains a question mark. While many issues factor into these decisions, the real deal breakers to LNG development in Canada concern shifts in the exchange rate, cost recovery and uncertainty over future demand.” [7]
Analyzing the Probability of a Final Investment Decision

- The proposed unit must be able to finance a FID
- The Monte Carlo model runs two million combinations of capital costs, Japanese Landed Costs, and Alberta Monthly Prices
- These, plus other significant costs, are fed through a financial model of the LNG plant
- The final product is a probability distribution of possible outcomes
FERC’s View of World LNG Prices
Forward prices for Japanese LNG?

- Our model using an independent variable that’s proven to predict Japanese prices[8].
- Brent Crude Oil [9]

8) [https://ycharts.com/indicators/japan liquefied natural gas import price](https://ycharts.com/indicators/japan liquefied natural gas import price)
Forward prices for Alberta natural gas?

- The model uses an independent variable proven to predict AECO prices [10].

10) [http://www.ngx.com/?page_id=646](http://www.ngx.com/?page_id=646)
Combining the market analysis

• What matters is the spread between Alberta prices and Japanese prices.
• Buy low and sell high.
• The expected spread at FID must provide a positive return at a high $/mtpa.
• What is the probability that exports will be feasible from BC?
Why did BCH suddenly choose not to submit a probabilistic estimate?

- In their answer to this inquiry they admit they have used them in the past: “BC Hydro adopted a binary approach to including the three LNG projects requesting service from BC Hydro in its load forecast. This approach differs from the probability-based approach we typically use in developing our industrial load forecast.” [10]
- A binary approach fails to discount for uncertainty
- It overstates the expected load.

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Monte Carlo model for British Columbia:

Distribution of Net Present Value Outcomes
January 1994 through July 2017
Wisdom from the Calgary Energy Roundtable last Wednesday:

- Plentiful cheap natural gas is no guarantee that a Canadian LNG export industry will develop, says an executive with Progress Energy Canada, a division of Malaysia’s state-owned Petronas, which cancelled its $36-billion Pacific NorthWest LNG project in July. [13]

- "We're actually very pessimistic," said panelist Dave Tulk, a partner with consulting company Gas Processing Management Inc., adding neither the industry nor governments are working together to come up with a "master plan" for the industry.

- "The challenges that (LNG Canada) has to get over in terms of pipelines, to dig a 670-kilometre pipeline, go through two mountain ranges, to get all that in place without the full support of the federal and provincial governments and industry, we just think that's going to be a difficult challenge," he said. [14]

13) The Canadian Press, “Cancelled $36B LNG project was 'wake-up call' to industry, says energy exec,” CBC News Calgary Oct 12, 2017
14) Ibid.
Will there be enough new LNG demand for BC?

- British Columbia Hydro relies on forecasts that current supply levels of LNG will be insufficient to meet demand several years from now.
- The Monte Carlo model includes this possibility.
- If true, LNG supply doesn’t have to come from British Columbia.
- Far more likely that Gulf Coast of US will expand capacity to meet demand.
Canadian NEB: BC LNG facilities are cost prohibitive

“Canadian LNG projects would generally be greenfield sites and incur higher costs than U.S. projects built on existing LNG import terminal sites,” said the NEB market review. “Most proposed Canadian LNG projects would rely on inland supply sources in northeast British Columbia and Alberta. This would require major new long haul pipelines or expansions of existing systems to transport natural gas to coastal liquefaction facilities -- a major additional project expense that also requires regulatory approvals.” [15]

Although our analysis preceded Deloitte’s, our conclusions are more conservative than theirs

“We find the assumption that LNG Canada will proceed with certainty to be overly optimistic. LNG Canada has officially deferred their final investment decision, and its prospects of being built are unclear.”

Deloitte Report 2, page 74
Pulp and Paper:

• British Columbia Hydro’s primary complaint is that they did a very careful job:

  “As stated in our response to BCOAPO IR 1.19.2 from our Fiscal 2017 to Fiscal 2019 Revenue Requirements Application (Exhibit B-1-1), BC Hydro’s load forecast for the forestry sector is based on external expert analyses that projects continued forestry sector decline. The external sources are specialized and industry recognized consultants who are highly experienced with assessing and forecasting forest industry commodities and individual mill operations. “ [16]

• They then reproduced their consultant list from their original submission [17]

British Columbia Pulp and Paper Research
Original source: F1-1, Appendix H, Page 12

- Pulp and paper market: Brian McClay
- Pulp and paper mills: Murray Hall
- Wood products: Russ Taylor
- Fiber supply modeling: Jim Girvan (MDT Ltd.)
- Mill fiber demand: Murray Hall
- Pestilence, wildfires and log supply: Rob Schuetz (IFS Ltd.)
The question is not how many consultants they have hired but how far out of date their reports are:

- Pulp and paper market: 2016?
- Pulp and paper mills: 2010?
- Wood products: No date
- Fiber supply modeling: No date
- Mill fiber demand: 2016?
- Pestilence, wildfires and log supply: No date
This appears to be the sum of British Columbia Hydro’s evidence – a reduction of 500 [sic] tonnes.
How far out of date is their data? They predict a 500,000 tonnes drop over thirty years. The newsprint reduction in North America so far this year has been 975,000 tonnes.

<table>
<thead>
<tr>
<th>Mill</th>
<th>Location, State</th>
<th>Status</th>
<th>Million Tons</th>
<th>Date</th>
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<td>Calhoun/Gatineau</td>
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<td>40,000</td>
<td>Jul-05</td>
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<td>Resolute</td>
<td>Liverpool, NS</td>
<td>Closure</td>
<td>250,000</td>
<td>Jun-12</td>
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<td>Catalyst</td>
<td>Snowflake, AZ</td>
<td>Closure</td>
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<td>Reduction</td>
<td>100,000</td>
<td>Sep-17</td>
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</table>
Norpac has just won a trade action against their Canadian competitors

- “Two federal agencies recently agreed to launch investigations into whether Canadian manufacturers are dumping cheap groundwood products in the U.S. market, undercutting paper prices for Norpac and other domestic manufacturers” [18]
- “Separately, the Department of Commerce will conduct a two-pronged investigation into the dumping charges to determine whether the U.S. should impose duties. Both investigations are expected to be complete by July 2018.”

Why does this matter at this late date?

- Staff and Deloitte research indicate that less expensive alternatives exist meeting existing mandates.
- British Columbia Hydro has not rebutted our alternative resource estimates where others have developed higher levels of savings than ours.
- British Columbia Hydro has not rebutted our evidence on Mid-Columbia markets nor our criticisms of their later submissions.
- Their only new evidence in A1-12 is based on vintaged data and opinions.
Thank you.

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