Clean Energy Association of B.C.

RESPONSE

to

ZAPPED ALLEGATION OF
OVERSPENDING BILLIONS ON IPPS

made in
Zapped: A Review of BC Hydro’s Purchase of Power from Independent Power Producers conducted for the Minister of Energy, Mines & Petroleum Resources by Ken Davidson. February, 2019

March 21, 2019
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Foreword

*Zapped*¹ was a political document designed to make news headlines. In that regard it succeeded. Most headlines echoed *Zapped’s* eye catching allegation about an overspending price tag of billions of dollars. A typical headline was, “BC Hydro customers set up to pay $16 billion over 20 years for power they likely don’t need.”²

The Clean Energy Association of BC (CEBC) has prepared this report to rebut that headline-grabbing allegation using direct statements and statistics from BC Hydro. They counter the misrepresentations embedded in the calculation that *Zapped* used to make its $16 billion overspending claim.

This report also debunks *Zapped’s* three overall allegations that “BC Hydro bought too much energy, paid too much for the energy it bought, and undertook these actions at the direction of the Government.”³

The body of this report contains numbers and technical facts that directly counter the incorrect numerical and positional allegations made in *Zapped*. The Executive Summary summarizes the major results in non-technical language.

*Zapped* contains many other false claims and misrepresentations beyond the $16 billion overspend allegation. They relate to the following points:

- Most of the energy that BC Hydro has contracted to buy from IPPs was covered in Electricity Purchase Agreements (EPAs) that were approved by the BC Utilities Commission.
- A material amount of the energy that BC Hydro has awarded through EPAs are to organizations that are not fully independent IPPs (i.e. Alcan, Waneta, and pulp mills).
- BC Hydro has increased its internal generating capacity substantially since 2001.
- IPPs have benefited British Columbians in many ways, including: diversity of fuel supply, improving grid reliability, First Nations capacity building, royalties and equity participation, Renewable Energy Credits, construction and operating jobs, taxes, and water rentals.
- IPPs faced significant competitive pressure to submit low-cost bids to BC Hydro Calls.
- Buying intermittent energy from IPPs has rarely caused BC Hydro to spill water or sell surplus energy at extremely low prices. Most of the energy produced during the spring freshet is generated at BC Hydro facilities.

Appendices A and B contain CEBC Information Memos that correct *Zapped’s* incorrect assertions about the poor performance and high price of wind and solar power in BC.

Endnotes include listing the pages on which specific *Zapped* allegations are made and identifying the 15 BC Hydro documents that are referenced in this report.
Executive Summary

IPPs are not costing BC ratepayers an extra $16 billion. This report shows that Zapped’s allegations and calculations are completely at odds with BC Hydro’s facts and figures.

Contrary to Zapped’s estimate that BC Hydro will export a surplus of IPP energy totaling 190,000 GWh over 20 years, BC Hydro’s historical records and forecasts total only 23,500 GWh, or 1/8 of the claimed amount.1

Zapped’s misinformed assertion that the “value of all energy is Mid-C” (the spot market price of importing energy from the USA) is not used by energy experts procuring new electricity supply. Since 1989 BC Hydro has bought energy through long-term contracts, typically called Energy Purchase Agreements (EPAs).

Utilities in regulated markets throughout North America (like BC) use the fixed prices specified in the EPAs – not spot market prices. BC Hydro Executive VPs have stated that “having us purchase from the spot market, is accepting too much volatility.”2

For Site C, neither the joint federal/provincial review panel nor the current or the previous provincial government approved building the project by comparing its cost of energy to Mid-C.3

The BC Liberals’ 2007 Energy Plan was not created with “the intent to create the appearance of an energy shortfall.” In 2007, after several years of high net imports and strong domestic load growth, the 2007 Energy Plan set a goal of self-sufficiency by 2016.

The self-sufficiency goal was also informed by BC Hydro Executive VPs stating, in 2006, that the level of imports was too high, having reached 18%, and that the price of imports was too volatile.4 They recommended increasing the security of supply and price by replacing imported energy with long-term contracts.

In 2008 and 2009, BC Hydro issued three Calls for IPP energy, the Clean Power Call and two Bioenergy RFPs. The size of these Calls was based on BC Hydro’s forecasts that demand would continue to grow at the same strong pace as it had for the previous several years.

By August 2010, BC Hydro had signed the EPA contracts with the IPPs in those three Calls. The 2010 BC Hydro load forecast still showed demand increasing strongly – as did forecasters in Alberta and the USA.5 Almost no economic forecasters foresaw the depth or duration of the 2008/09 financial crisis. By the time the drop was fully understood, construction had started on the IPPs that had received EPAs from those three Calls.

1 Total of BC Hydro Historical Net Energy Exports/Imports for BC 2009 - 2018 (Figure 5) and BC Hydro Load Resource Balance 2019-2028 (Table 2) combined together in Table 3.
2 BC Hydro testimonies to the BCUC as shown in Section 3.1.1 and Endnote #32
3 BCEAA/CEAA Section 3.1.4 Site C Example
4 BC Hydro testimonies to the BCUC as shown in Section 2.2.1 and Endnote #7
5 BC Hydro Load Forecasts vs Actual Requirements (Figure 2) prepared by Deloitte, and a similar forecast prepared for Alberta electricity demand (Figure 3).
It took until 2017 for electricity demand to recover to the 2008 level. While BC was a net importer in 2014 and 2015, in 2016 it was net exporter of 11% of demand. In 2017 and 2018 BC remained a net exporter but at slightly lower levels.

The price of energy in the EPAs that BC Hydro awarded from those three Calls were cost-effective – at the time the EPAs were signed.

BC Hydro stated in its 2010 Report on the Clean Power Call RFP that, “The price to be paid for this electricity met BC Hydro’s expectations based on comparisons to other BC Hydro processes and similar processes undertaken by other jurisdictions … [the] Call process has resulted in the acquisition of cost-effective clean, renewable electricity for BC Hydro’s ratepayers.”

BC Hydro stated in its 2012 Report on the Bioenergy Phase 2 Call that, “The cost-effectiveness is also demonstrated by comparing the RFP results to other BC Hydro calls … Furthermore, the weighted-average Average Firm Energy Price for the Bioenergy Phase 2 RFP is lower than that for the Clean Power Call … The Bioenergy Phase 2 RFP awards are also comparable to recent Hydro-Quebec awards for biomass and wind projects.”

The price of renewable IPP energy has dropped since 2009. Wind turbine costs have dropped and their performance has improved – yielding energy cost reductions of over 60%. The interest rates charged to finance wind and hydro projects has dropped substantially from 2008/2009 which was in the midst of the financial crisis.

The 2007 Energy Plan’s policy direction to use the Burrard Thermal Generating Station less and to close it by 2016 was to save money and reduce GHG emissions. Burrard was 50 years old and very inefficient.

In addition to having to buy much more fuel than the average gas-fired power plant in North America, it faced huge carbon taxes. In 2006 a senior executive at BC Hydro stated, “Burrard is no longer economic for providing energy.” Its inefficiency also resulted in it having much higher GHG emissions than the average gas power plant.

In conclusion, BC Hydro figures do not support Zapped’s allegation of a $16 billion overspend. Zapped’s estimate of over-purchased volume is 8 times more than BC Hydro’s historical record and forecasts of net exports from surplus IPP energy. Zapped’s Mid-C overcharging theory is irrelevant to the pricing of new projects energy and is not used by BC Hydro or anyone else.

The surplus energy that does exist was not intentionally created by the previous government and was not forced upon BC Hydro. The amount of energy BC Hydro purchased through the EPAs was based on its own forecasts and it signed them before it and other forecasters recognized the extent of the drop-in demand after the financial crisis.

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6 BC Hydro Average BC Load 2002-2019 (Figure 1)
7 BC Hydro’s Net Energy Exports/Imports in BC 2009 – 2019 (Figure 5)
8 BC Hydro testimonies to the BCUC as shown in Section 2.3 and Endnote #29
Clean Energy Association of BC

Response to

Zapped allegation of overspending billions on IPPs

1. Zapped’s $16.2 Billion Allegation

Zapped’s Executive Summary and Conclusion both repeat the following allegation:

“Government directed BC Hydro to purchase 8,500 GWh/year of Firm energy BC Hydro did not need. This direction of BC Hydro’s actions is manifest in the Response EPAs … The Response EPAs cost ratepayers an Estimated $16.2 billion over 20 years, the estimated period during which BC Hydro will likely not need the energy Government told it to buy.”

Zapped arrives at the $16.2 billion “Estimate” using the following formula:

\[ 9,500 \text{ GWh/year} \times \$85/\text{MWh} \times 20 \text{ years} = \$16.2 \text{ billion} \]

The 9,500 GWh/year amount is the total energy contracted under all the EPAs (Electricity Purchase Agreements) signed since 2007 (the “Response EPAs”). The 8,500 GWh/year amount is the amount that Zapped alleges the previous government directed BC Hydro buy from IPPs since 2007 that was not needed. Zapped alleges that the government directed BC Hydro to buy 8,500 GWh in 2007 which has now resulted in BC Hydro buying 9,500 GWh. And that 9,500 GWh is surplus to BC’s needs for 20 years.

This rebuttal report refutes Zapped’s $16.2 billion Estimate by critiquing each of the three numbers in the aforementioned formula in three sections:

- Volume of energy that was unnecessary and forced (9,500 GWh/year),
- Price overpaid ($85/MWh), and
- Duration of the unneeded surplus volume (20 years).

2. Volume of “Unnecessary” and “Forced” Energy Demand

Zapped links the related amounts of 9,500 GWh/year and 8,500 GWh/year as follows:

“The Response EPAs represent approximately 9,500 GWh of additional contracted energy. These EPAs act as a proxy for the impact. Of note, total energy contracted under the Response EPAs includes both Firm and non-Firm energy, whereas the policy directive demanded BC Hydro deliver 8,500 GWh in Firm energy. BC Hydro was trying to buy 8,500 GWh of Firm energy, but likely managed to buy only 9,500 GWh of blended energy.”
This section will critique Zapped’s allegation that the previous government erred in establishing policies that resulted in BC Hydro issuing Calls for IPP power amounting to 8,500 GWh/year because that amount was unnecessary.

### 2.1 Government Policy Directions

Zapped states:

- “Given Government’s direction and BC Hydro’s intent to comply, the Estimate of the impact of the policy direction could be based on 8,500 GWh of incremental Firm energy.”
- “… the 2007 Energy Plan and Special Direction #10 amounted to direct Government interference with the energy planning process at BC Hydro, with the intent to create the appearance of an energy shortfall. The resulting energy shortfall was then used to justify an expansion of the IPP portfolio and gave rise to the calls for power issued since 2007…”
- “In Recommendation 19 of the 2007 Energy Plan Government directed that the province would achieve zero net greenhouse gas emissions from existing thermal generation plants by 2016. This was effectively a direction that BC Hydro must close Burrard Thermal by 2016.”
- “After 2007, BC Hydro operated with the intent that it needed to buy 8,500 GWh of incremental Firm Energy.”

The following table summarizes the policy directions that Zapped claimed constituted government interference in BC Hydro’s load forecasting and planning:

<table>
<thead>
<tr>
<th>Direction</th>
<th>Document and Date</th>
<th>Added Demand</th>
<th>GWh/yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eliminate market purchases</td>
<td>Special Direction #10 issued December, 2007</td>
<td>2,500</td>
<td></td>
</tr>
<tr>
<td>Insurance</td>
<td>Special Direction #10 issued December, 2007</td>
<td>3,000</td>
<td></td>
</tr>
<tr>
<td>Reduce use of Burrard</td>
<td>Recommendation #19 in 2007 Energy Plan</td>
<td>3,000</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>8,500</strong></td>
<td></td>
</tr>
</tbody>
</table>

### 2.2 Zapped Allegation: “Intent to create the appearance of an energy shortfall.”

Zapped claims that these three Government Directions “amounted to direct Government interference with the energy planning process at BC Hydro with the intent to create the appearance of an energy shortfall.” This is not true.
2.2.1 Policy to Eliminate Market Purchases Responded to High Levels of Importing at Spot Prices

In 2006, two senior executives at BC Hydro gave the following testimony to the BCUC (with underlining added):

- “Right now we rely on spot market for about 18% of our domestic load, and we’ve made an assessment that we feel that’s too heavy a reliance on spot market. And so the actions we are taking in this LTAP are moving us away from a reliance towards more energy security ...”
- “We fundamentally believe that having 18% of our reliance on the spot market, because we fundamentally have a plant that looks like it’s producing energy but it really isn’t. It’s just having us purchase from the spot market, is accepting too much volatility, and that replacing the energy of that plant with longer-term products that have less volatility is more cost-effective overall.”

BC was a net importer of energy for 6 of the 7 years from 2001 to 2007. That is based on the tables on the BC Hydro website that show the Net Actual Flows across the US Tie-lines.

The government made self-sufficiency a primary theme of the 2007 Energy Plan because BC Hydro was relying too heavily on imports.

Self-sufficiency is especially relevant for BC because, at the very same time when BC faces a drought, Washington and Oregon typically face the same drought. BC Hydro has advised that, “Access to the electricity markets and delivery of the CE all rely on the same I-5 transmission corridor through the Seattle region that is frequently constrained.” The transmission interties with Washington can often be congested at the same time that BC needs to import electricity. For all these reasons, the government’s self-sufficiency policy was and still is prudent.

2.2.2 Insurance Policy Added to Reflect Strong Domestic Load Growth on top of High Imports

The 2007 Energy Plan pointed to the high and growing level of imports and added strong domestic load growth as the rationale for adding “insurance”:

- “BC Hydro must acquire an additional supply of “insurance power” beyond the projected increases in demand to minimize the risk and implications of having to rely on electricity imports.”
- “BC Hydro estimates demand for electricity to grow by up to 45 per cent over the next 20 years.”

BC’s net imports were also rising because domestic load growth was consistently strong. BC Hydro’s Average Hourly Flow graph below shows the very strong electrical load growth ramping up from 2002 to 2007 upon which the 2007 Energy Plan insurance policy was based.
The irony is that for the purposes of BC Hydro’s Clean Power Call – and in particular its forecast energy gap for F2020\(^{16}\) – the 3,000 GWh insurance requirement was not included. According to BC Hydro:

“None of the 3,000 GWh/year insurance called for in the 2007 Energy Plan or subsection 6(2)(b) of the Clean Energy Act is included. If the insurance requirement is added to the load/resource balance figures, the energy gap would increase considerably by F2021, or sooner if the additional 3,000 GWh is acquired on a phased basis.”\(^{17}\)

2.2.3 Depth and Duration of Market Change After 2008 Crisis was not Immediately Apparent

In 2008 the global financial crisis dramatically changed the direction of BC’s load growth. The crisis resulted in the biggest economic downturn since the 1930’s Great Depression. US household wealth fell by trillions, the Dow dropped in half, the housing market collapsed and Government bailouts were required to save banks and the auto sector.\(^{18}\)

In BC the industrial and export commodities sectors shrank along with their electricity consumption. After decades of steadily increasing electricity demand in late 2008, BC started to experience an unprecedented decrease in demand, ultimately dropping 6% over the next two years.

Zapped stated that “the change in the energy market was apparent in January 2009 and the reducing levels of industrial load were apparent soon after.”\(^{19}\) While today, 10 years later, the change can be seen, for the first few years after the 2008 financial crisis professional forecasters at BC Hydro (and elsewhere) did not foresee the amount or duration of the load reductions.

The graph\(^{20}\) below compares 16 load forecasts made by BC Hydro’s Load Forecast department each year from 2000 to 2016 to the Actual Requirements.
Up to 2008, most of the actual load requirements matched the load forecasts. None of the forecasts foresaw the big load decrease that occurred from 2008 to 2010. Even the forecasts made in 2008 and 2009 by the BC Hydro Load Forecast department did not see the load decrease. Indeed their 2010 Forecast anticipated a big rise of 3,000 GWh by 2011 but the actual load kept falling.

A similar graph\textsuperscript{21} below compares 16 load forecasts made by the Industrial Power Consumers Association of Alberta (IPCAA) from 2006 to 2017 to the Actual Requirements.
Again, up to 2008, most of the actual load requirements matched the load forecasts for Alberta. None of the forecasts foresaw the big load decrease that occurred from 2008 to 2010. Even the forecasts made in 2008 and 2009 by IPCAA did not see the coming load decrease. Indeed their 2009 Forecast anticipated a load in 2012 that was about 4,000 GWh or 6% higher than the actual load.

The point here is not to criticize the load forecasting made by IPCAA or BC Hydro. No one correctly forecasted the timing and scale of the recession - including the International Monetary Fund\(^\text{22}\) and the Federal Reserve Bank of New York\(^\text{23}\).

The point is to rebut Zapped’s claim that “the change in the energy market was apparent in January 2009” and that “by this time (December 21, 2009) Government had been advised by both Ministry and BC Hydro analysts that the market had changed.” BC Hydro’s bullish load forecasts made in 2008, 2009 and 2010 refute those claims.

This timing is also important because it severely undercuts the 9,500 GWh volume figure that Zapped claimed the Government should have stopped BC Hydro from awarding EPAs after BC Hydro reduced its forecasts. By August 2010 BC Hydro had already signed all the EPAs that resulted from the Clean Power Call and the Bioenergy 1 RFP. The energy covered by the EPAs signed after August, 2010 totalled 3,817 GWh\(^\text{24}\) which is only 40%\(^\text{25}\) of all the energy in the 9,500 GWh figure that Zapped uses in its $16.2 billion calculation.
In summary, BC Hydro’s expressed concerns about chronic and high volumes of net importing plus strong domestic demand and bullish BC Hydro load forecasts prompted the government to establish self-sufficiency policies in 2007 to end “market purchases” and adding “insurance.” They were not done “with the intent to create the appearance of an energy shortfall,” as asserted by Zapped.

BC Hydro Load forecasts remained bullish throughout 2010. By that time BC Hydro had already signed EPAs with IPPs for 60% of the 9,500 GWh that Zapped claimed could have been avoided based on Zapped’s false allegation that BC Hydro had advised government of the change in market in 2009.

2.3 Zapped Allegation: “BC Hydro must close Burrard Thermal by 2016.”

This is not true for the following reasons:

- The 2007 Energy Plan did not state “close Burrard,” it stated: “reduce use of Burrard.”
- The 2007 Energy Plan acknowledged the plant’s unique benefits by stating the following:
  “Burrard Thermal still provides significant benefits to BC Hydro as it acts as a ‘battery’ close to the Lower Mainland, and provides extra capacity or ‘reliability insurance’ for the province’s electricity supply. It also provides transmission system benefits that would otherwise have to be supplied through the addition of new equipment at Lower Mainland sub-stations.”
- The 2007 Energy Plan gave BC Hydro flexibility on timing by stating: “BC Hydro may choose to retain Burrard for capacity purposes after 2014.”
- The 2007 direction to reduce its use had a very minor practical impact because it was hardly used except as a mask for imports. The direction said “3,000 GWh/year.” For the prior years, Burrard “was seldom operated … generating in the range of 100-300 GWh/year.”

Burrard Thermal was built in the early 1960s. By 2007 it was commonly agreed that it was outdated, inefficient and costly to run. Burrard required 25% more gas to generate electricity than the average US gas-fired power plant. That meant it produced 25% more CO2 emissions than the average plant. The resulting high cost of fuel gas and the high level of carbon taxes made Burrard’s energy cost very expensive.

In 2006, a BC Hydro senior executive gave testimony to the BCUC, stating:

“The only thing I will say about Burrard is that we’re very clear that Burrard is no longer economic for providing energy. And really when you think about providing energy from Burrard, we’re just buying from the market. And it’s been masking that for several years now.”

Zapped also claimed that:

“Burrard Thermal, BC Hydro’s gas-fired generating facility had just been upgraded with $150 million in new catalytic converters, arguably making it as clean or cleaner than the gas generation California relies upon today.”
Burrard's high level of inefficiency made that physically impossible. Compared to the average gas-fired power plant in California Burrard required 29% more gas and therefore created 29% more CO2 per MWh.\textsuperscript{30} The catalytic converters were installed to reduce NOx – not CO2. Cleaning up NOx is fine but the remaining extremely high CO2 emissions would not be seen as anyway near “clean” by Californian standards.

The 2007 Energy Plan included the goal of “zero net GHG emissions from existing thermal generation plants by 2016.” Reducing Burrard’s use was consistent with that policy goal.

The government’s three 2007 policies that resulted in BC Hydro acquiring 9,500 GWh/year were necessary and prudent.

3. Price Overpaid

\textit{Zapped} alleges that BC Hydro paid $85/MWh too much for the 9,500 GWh of energy it acquired through the EPAs signed after 2007. It reached the $85 premium using the following formula:

\[ $85/MWh = $110/MWh - $25/MWh \]

\textit{Zapped} states that the:

- “… average cost of 9,500 GWh of blended energy acquired in 2009 is assumed to be $110/MWh.”
- “… estimated market value of this surplus energy, if sold at Mid-C is assumed to be $25/MWh.”

3.1 Mid-C is Irrelevant as a Comparator

\textit{Zapped} asserts that “energy has only one price and that is the price it can be bought or sold at in the market. In the case of BC Hydro, the market value of all energy is the Mid-C rate.”

This is a bizarre assertion. In the absence of a competitive pool-based market, such as those in Alberta and Texas, no one builds new electrical generation projects based on a spot price like Mid-C.\textsuperscript{31} BC Hydro and utilities throughout North America purchase electricity through holding competitive Calls and then signing long-term EPAs with the lowest price bids to get security of supply and price.

3.1.1 Security of Long-Term Supply

In 2006, two senior executives from BC Hydro gave the following testimony\textsuperscript{32} to the BCUC (with underlining added):

- “… we’ve made an assessment that we feel that’s too heavy a reliance on spot market. And so the actions we are taking in this LTAP are moving us away from a reliance towards more energy security ...”
• “We fundamentally believe that having 18% of our reliance on the spot market ... is accepting too much volatility, and that replacing the energy of that plant with longer-term products that have less volatility is more cost-effective overall.”

• “We are moving away from a reliance on spot market. So that’s why we have proposed these two future calls going forward ... We’ve set those call volumes based on what we feel we need to bring on to close this supply gap that we’ve got.”

3.1.2 Cost-Effectiveness

BC Hydro stated in its Report on the Clean Power Call RFP that:

“The price to be paid for this electricity met BC Hydro's expectations based on comparisons to other BC Hydro processes and similar processes undertaken by other jurisdictions, and to 2008 LTAP projections. BC Hydro's Clean Power Call process has resulted in the acquisition of cost-effective clean, renewable electricity for BC Hydro's ratepayers.”

BC Hydro stated in its Report on the Bioenergy Phase 2 Call RFP that:

“The cost-effectiveness is also demonstrated by comparing the RFP results to other BC Hydro calls. ... Furthermore, the weighted-average Average Firm Energy Price for the Bioenergy Phase 2 RFP is lower than that for the Clean Power Call ... The Bioenergy Phase 2 RFP awards are also comparable to recent Hydro-Quebec awards for biomass and wind projects.”

3.1.3 Mid-C Spot Market vs. Long-Term Market

Zapped does not understand the critical difference between spot-market prices and the price of long-term electricity in an EPA.

The spot price does not provide any return on capital that is necessary to build a new project. The price in a long-term EPA does provide for a return on capital which is necessary to get the financing to build the project.

The electricity in the Mid-C spot market is made up of the highly variable daily surplus of utilities located between California and Alberta. To secure the supply necessary to meet the core needs of its customers, BC Hydro cannot rely on buying whatever surplus is left over after neighbouring utilities have met their customers’ core needs. Mid-C’s highly variable daily supply is reflected in its highly variable daily price. Though often in the $20 - $40/MWh range, last year it exceeded $100/MWh for 10 days.

Since 1989 BC Hydro has bought power from IPPs through firm, long-term EPAs, and to pay the associated firm, long-term price. When BC Hydro applies to the BCUC about building its own projects the BCUC compares the long-term cost of BC Hydro’s projects to the long-term price of IPP projects, not the Mid-C price.
3.1.4 Site C example

The most recent local project example is BC Hydro’s own Site C. The current government approved continuing Site C based on BC Hydro stating that its price would be $65/MWh. That is over twice the price of Mid-C, which has hovered around $30 for years. And the calculation of this very low Site C prices is certainly debatable.

The CEAA/BCEAA Joint Review Panel did not compare the price of Site C to Mid-C in its 2014 Assessment. Nor did the BCUC consider Mid-C in its 2017 Inquiry.

If the value of Site C energy was determined based on using Zapped’s theory that “the market value of all energy is the Mid-C rate,” then it would be the biggest money loser in the history of BC. Using Zapped’s $25/MWh price for Mid-C would result in the present value of all the energy generated from Site C totaling about $3.5 billion. That is far less than the $10.7 billion cost that BC Hydro estimates to build it. Applying Zapped’s methodology would mean that building Site C would result in a loss of $7.5 billion.

In summary, BC Hydro executives recommended reducing reliance on Mid-C imports and increasing reliance on long-term EPAs. Federal and provincial government Assessments and the BCUC Inquiry did not use Mid-C as comparator for building Site C (or other new projects). The only person using Mid-C for that purpose is the author of Zapped.

3.2 Zapped’s Mid-C Forecast Level is Too Low

In addition to Zapped incorrectly assuming that Mid-C is relevant to judging the cost-effectiveness of procuring energy through EPAs or building new power projects, Zapped’s $25/MWh forecast level for Mid-C is too low.

BC Hydro submitted the following Mid-C forecast to BCUC for its 2017 Site C Inquiry.

Figure 4: BC Hydro Forecast of Mid-C Average Price from 2016 to 2040
BC Hydro’s average Mid-C forecast starts at $40/MWh in 2020 and increases to $68/MWh in 2040. The average price during that 20-year period is $54/MWh. That is over twice the $25/MW price that Zapped used in its calculation over the same period.

Mid-C is irrelevant in judging the cost-effectiveness of acquiring energy from new projects. And even if it were relevant, Zapped’s forecasted Site C price is completely at odds with the forecast advanced by BC Hydro to the BCUC with respect to the spot price that BC Hydro would receive for the surplus electricity created by Site C.

BC Hydro executives recommended reducing reliance on Mid-C and increasing reliance on long-term EPAs. And BC Hydro Call Review reports stated the RFP competitions were robust and the price of energy in the awarded EPAs were cost-effective.

4. Duration: 20 Years Exporting the Full IPP EPA Surplus

Zapped states that “this report expects the annual impact of the over-buy will be felt for some 20 years.” Zapped starts its tally of the 9,500 GWh/yr of overbought Response EPAs in 2009. Zapped’s $16.2 billion estimate is based on the full amount of the overbought energy being surplus to domestic needs and therefore being sold to the export market at Mid-C.

This rebuttal will compare Zapped’s estimate to BC Hydro’s actual records looking back 10 years and then to BC Hydro’s forecast looking forward 10 years.

4.1 From 2009 to 2018

Zapped estimates the total exported surplus was 95,000 GWh (9,500 GWh x 10 years).

The total of the actual net exported surplus over those years is 15,531 GWh according to following BC Hydro graph.

Figure 5: BC Net Energy Export & Import Volumes - Fiscal 2009 to Fiscal 2019 per BC Hydro
This comparison demonstrates that, to date, Zapped’s surplus estimate was 79,469 GWh too high or 6 times higher than BC Hydro’s records (95,000/15,531).

4.2 From 2019 to 2028

Zapped estimates the total exported surplus will be 95,000 GWh (9,500 GWh x 10 years).

BC Hydro’s most recent 10-year forecast shows that, after deducting Site C, the total net surplus from 2019 to 2028 is expected to be 7,925 GWh.

The energy generated by Site C is deducted in this determination because it was built by BC Hydro, not an IPP. And Site C was started after 98% of the Response EPAs (that are the subject of Zapped’s “overbought” allegation) were signed. This is shown in the following table.

Table 2: BC Hydro Energy Load Resource Balance, 2019 to 2028, after deducting Site C

<table>
<thead>
<tr>
<th></th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
<th>2027</th>
<th>2028</th>
<th>Total from 2019-2028</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surplus/(Deficit) - Operational View</td>
<td>3,524</td>
<td>5,697</td>
<td>4,411</td>
<td>2,582</td>
<td>1,509</td>
<td>991</td>
<td>3,735</td>
<td>4,257</td>
<td>3,695</td>
<td>2,926</td>
<td>33,327</td>
</tr>
<tr>
<td>Site C (Addn to Heritage Resources &gt; 2023)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>366</td>
<td>3,892</td>
<td>5,286</td>
<td>5,286</td>
<td>5,286</td>
<td>5,286</td>
<td>25,402</td>
</tr>
<tr>
<td>Surplus/(Deficit) after deducting Site C</td>
<td>3,524</td>
<td>5,697</td>
<td>4,411</td>
<td>2,582</td>
<td>1,143</td>
<td>2,901</td>
<td>1,551</td>
<td>1,029</td>
<td>1,591</td>
<td>2,360</td>
<td>7,925</td>
</tr>
</tbody>
</table>

For the next 10 years, Zapped’s surplus estimate is 87,075 GWh too high or more than 12 times higher than BC Hydro’s forecast (95,000/7,925).

BC Hydro’s above forecast was extracted from its October 5, 2018 Application to the BCUC and does not include any new energy expected to be needed to support the many electrification programs in the government’s CleanBC Plan announced on December 5, 2018.

4.3 Summary 2009 to 2028

Over the 20 years that Zapped based its $16.2 billion overbuy calculation it overestimated the surplus by 166,275 GWh compared to BC Hydro historical records and forecast. The table below shows that Zapped overestimated the surplus by a factor of 8 times too much. Or the corollary, BC Hydro’s amounts are only 12% of the Zapped estimate.
Table 3: Comparing Zapped’s IPP Surplus vs. BC Hydro Record or Forecast over 20 years

<table>
<thead>
<tr>
<th>Surplus Comparison</th>
<th>Zapped Estimate</th>
<th>BC Hydro Historical Record or RRA Forecast</th>
<th>Overestimate Amount</th>
<th>Overestimate Factor (# of times over BC Hydro amount)</th>
<th>Percent BC Hydro vs Zapped</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period</td>
<td>GWh</td>
<td>GWh</td>
<td>GWh</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009 - 2018</td>
<td>95,000</td>
<td>15,531</td>
<td>79,469</td>
<td>6.1</td>
<td>16%</td>
</tr>
<tr>
<td>2019 - 2028</td>
<td>95,000</td>
<td>7,925</td>
<td>87,075</td>
<td>12.0</td>
<td>8%</td>
</tr>
<tr>
<td>Total 2009 - 2028</td>
<td>190,000</td>
<td>23,456</td>
<td>166,544</td>
<td>8.1</td>
<td>12%</td>
</tr>
</tbody>
</table>

The figure below shows Zapped’s estimated surpluses vs. BC Hydro records and forecast.

Figure 6: Comparing Zapped Estimate of Surplus due to IPP Over-purchasing to BC Hydro Historical Records and Forecast from 2009 - 2028 (GWh)
5. Summary

5.1 The Numbers

Each of the amounts that Zapped used to calculate the $16.2 billion overspend are incorrect.

The price paid for that energy was the market price, not some “overpaid” amount above Zapped’s mis-utilized spot price at Mid-C.

And even if there was some overbuying and/or the Mid-C price was relevant, over the 20 years of the supposed massive energy exporting, BC Hydro’s records and forecast show only 10 years of modest exports totaling only 23,725 GWh or 12% of the amount in Zapped’s estimate.

The amounts in Zapped’s formula are compared in the following table.

Table 4: Summary comparing the price and volume used by Zapped to the results of this report

<table>
<thead>
<tr>
<th>Component</th>
<th>Amount used in Zapped Estimate</th>
<th>Amount determined in this report</th>
<th>BC Hydro statement, statistic or approach that supports the amount determined in this report</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price overpaid ($/MWh)</td>
<td>85</td>
<td>0</td>
<td>BC Hydro (and other utilities in regulated markets) do not use Mid-C (or spot prices) to compare prices when buying or building new plants. BC Hydro stated that the prices in the EPAs from the Clean Power and Bioenergy Calls were cost-effective.</td>
</tr>
<tr>
<td>Volume of surplus IPP energy to export (GWh)</td>
<td>190,000</td>
<td>23,456</td>
<td>BC Hydro records for 2009-2018 show Net Exports of 15,531 GWh. BC Hydro forecast for 2019-2028 expects Net Exports of 7,925 GWh, after deducting Site C. The total is 12% of the amount estimated by Zapped.</td>
</tr>
<tr>
<td>Total overspent (billion)</td>
<td>$16.2</td>
<td>$0</td>
<td></td>
</tr>
</tbody>
</table>

5.2 The Three Underlying Allegations

5.2.1 Volume of Unnecessary and Forced Energy Contracts

Zapped’s allegation that Government Directions that resulted in EPAs total 9,500 GWh/yr “amounted to direct Government interference with the energy planning process at BC Hydro with the intent to create the appearance of an energy shortfall” is wrong.

Senior BC Hydro executives’ testimonies in 2006 supported the Governments policy directions in 2007 to end importing from the spot market and to reduce the use of Burrard. They said import levels were too high and the prices too volatile. Burrard’s high level of inefficiency made its fuel costs and carbon taxes very expensive and its CO2 emissions excessive.

BC Hydro Load forecasts remained bullish up to 2011. By that time BC Hydro had already signed EPAs with IPPs for the majority of the 9,500 GWh/year that Zapped claimed could have been avoided.
5.2.2 Price Overpaid

Mid-C is irrelevant in judging the cost-effectiveness of acquiring energy from new projects. BC Hydro, the BCUC, the CEAA and other utilities do not use Mid-C as a comparator. Even the former and current governments did not use Mid-C when they decided to approve and continue with Site C. Its only relevance was in relation to the value of revenue that could be generated from the forecast surplus of electricity resulting from Site C and even then BC Hydro’s forecast price is much higher than Zapped’s.

BC Hydro executives recommended reducing reliance on Mid-C and increasing reliance on long-term EPAs. And BC Hydro Call Review reports stated that the price of energy in the awarded EPAs were cost-effective.

5.2.3 Duration of Years of Full IPP EPA Surplus

The number of years of having any surplus since 2009 is 10 years; not the 20 years assumed in Zapped. And over the 20 years the average surplus is 1,200 GWh/year resulting in a total surplus that is 12% of the Zapped estimate.

6. Conclusion

Zapped’s allegation of a $16.2 billion overspend is totally incorrect and unfounded.
Appendix 7.1

CEBC Wind Power Information Memo: Response to Zapped: BC Wind Can Supply Lowest Cost Power

The declining cost of utility scale wind and solar energy to a price below that of most other generation alternatives is one of the major energy stories of the past year globally.9 Further to the celebrated falling prices, it is clear British Columbians like all Canadians have a more positive view of wind power than other energy options.10

The Canadian Wind Energy Association (CanWEA) recently announced that Canada’s wind energy industry further expanded its installed capacity in 2018, while solidifying its status as the lowest-cost source of new electricity generation. Newly commissioned projects brought total national wind energy capacity to close to 13,000 megawatts (MW). Meanwhile, competitive auction results in Saskatchewan and Alberta confirmed the wind industry’s ability to continue to deliver record-low prices.

Unfortunately for British Columbia, which has one of the world’s best wind power climates, the author of the political Zapped Report did not research the social acceptance, declining costs and improved efficiencies of BC wind power with expert renewable power developers before dismissing BC’s wind power as “non-competitive.”

BC’s current large utility-scale wind projects were built based on a previous era of global renewable economics. The power purchase contracts were awarded more than 10 years ago. Since 2009, the average Levelized Cost of Energy for utility-scale wind projects has dropped 69 per cent due to declines in the cost of system components and improvements in efficiency.11 BC wind costs today among new large utility-scale projects bidding in a competitive RFP would be expected in the range of $50 MWh, or 5 Cents/kWh based on recent Canadian competitive pricing in adjacent provinces.

Many BC regions are first in line to harvest energy from the prevailing westerly winds and weather systems that dependably cross the province from the North Pacific enroute to other Canadian provinces including Alberta and Saskatchewan.

And while a new generation of proposed BC utility-scale wind projects are ready to bid supply of clean power, the price of wind has not been tested by BC Hydro in a competitive process for more than 10 years. The Zapped Report fails to acknowledge the current economic and technical reality of BC’s outstanding wind and solar resources. By doing so, Zapped performs a disservice to British Columbia and its electric ratepayers.

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9 The November 2018 Levelized Cost of Energy Analysis by Lazard (12.0) determined that in the U.S., the mid-point of the cost range for unsubsidized wind energy ($42) is lower than any alternative, with natural gas combined cycle generation coming in cheapest among conventional options with a cost range midpoint of US$58.
10 March 12, 2019 Poll conducted by LNG Canada from Vancouver shows that 80% of Canadians have a positive view of wind power, the highest approval of all energy options. The recent poll interviewed 800 British Columbians out of a total of 1,000 Canadians. https://www.newswire.ca/news-releases/four-in-five-canadians-support-resource-development-projects-895410510.html
BC’s first wind farm began commercial operations in November 2009. At the end of 2018, the province had almost 700 MW of installed wind energy capacity, supplying nearly two per cent of British Columbia’s electricity demand.

BC has some of the strongest, most consistent wind regimes in Canada and has the ideal hydro resource base to integrate substantial amounts of wind power. The reasons for BC to increase the use of its abundant, world-class wind resource are rational and compelling.

According to CanWEA, analyses presented to the BC Utilities Commission’s 2017 review of the Site C hydroelectric project clearly showed that wind energy was cost-competitive with new hydro generation. Wind energy’s costs have only fallen further since then. Indeed, three recent procurements for new wind energy in Alberta and Saskatchewan all produced winning bids at an average price of less than $40/MWh. (4 Cents/kWh).\(^2\) The projects brought billions in investment, created thousands of jobs and will pay hundreds of millions in regional benefits. On a levelized cost of energy basis, CanWEA states there is no new source of electricity available in Canada today that can compete with wind energy.

Wind developers with experience in all of Canada’s three western provinces have confirmed the lowest cost for proposed utility-scale BC wind projects would be expected to be similar prices to Alberta and Saskatchewan and with similar capacity factors. BC wind projects are proposed for a variety of terrains and regions, including wind swept foothills and easy build plains regions similar to Alberta. BC also has an offshore wind regime.

To CEBC’s knowledge, the author of the Zapped Report did not consult with any experienced BC or Canadian wind developers prior to stating opinions that BC wind is unreliable, more intermittent than neighbouring jurisdictions, and has lower capacity factors and is more costly to build. All of those false statements demonstrate a lack of understanding of contemporary wind technology and the energy profiles of new generation of wind projects waiting for an opportunity to bid supply of lowest cost power to the system.

BC’s wind energy potential is largely untapped and it is well positioned to bring on more wind energy with its existing hydroelectric base and interconnections with other jurisdictions. The 2016 Pan Canadian Wind Integration Study (PCWIS) (https://canwea.ca/wp-content/uploads/2016/10/pcwis-britishcolumbia-summary-web.pdf) found that BC could reliably integrate up to 15,700 MW of wind energy capacity with minor transmission expansion and limited additions to regulating reserves.

Wind energy also provides additional value to the province. As a major electricity exporter, BC Hydro has an opportunity to bundle wind and hydro to deliver a product that meets green energy requirements of states in the western US and earn additional revenue by accessing renewable energy credits not available to large hydro alone. The PCWIS found that expanded deployment

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\(^2\) Both Saskatchewan and Alberta contracted for significant additional new wind energy capacity in 2018 at an average bid price of $42 and $39 per megawatt-hour, respectively, which is comparable to the record low average bid price of $37 recorded in Alberta in late 2017. Wind energy figures prominently in these provinces’ progressive strategies to increase renewable generation. Downward wind energy price trends were confirmed by a 2018 U.S. analysis (Lazard 12.0) which found a further seven per cent year-over-year decline, and a 69 per cent decline since 2009.
of wind energy in British Columbia could enable increased electricity exports and more revenue for the province.

Wind projects can be deployed quickly and at a scale that matches load growth, creating less risk for ratepayers. According to CanWEA, BC tax and royalty payments made by independent power producers currently total $244 million a year, a figure that will grow as new projects are brought on line. The distributed nature of renewable energy projects also produces local economic development benefits, including opportunities for British Columbia’s 203 First Nations.

Over the long-term, increased supplies of new zero-emission energy will be key to realizing the province’s aggressive climate change goals. BC is targeting greenhouse gas reductions of at least 80 per cent below 2007 levels by 2050, a goal that can only be met through the long-term electrification of the economy. This is clearly recognized in the province’s new Clean BC plan. Wind energy is well-positioned to provide the reliable, low-cost, emissions-free electricity that will drive that transition.

By strategically exploiting huge reserves of renewable energy resources, the province can build a more resilient, geographically diverse, and affordable power system that will benefit BC families and businesses for generations to come.
Appendix 7.2

CEBC Solar Power Information Memo: Response to Zapped:
BC’s Solar Resource - Canada’s Best and Lowest Cost

New international solar research has determined that southern regions of British Columbia are enriched with Canada’s best “commercial grade” Solar PV resource. BC’s potential for low-cost solar energy is similar to Alberta, confirming utility-scale solar power is another important BC renewable energy resource.

The new solar information distinguishing the significant potential of BC’s outstanding solar resource was shared with Canada in 2018 by the US Department of Energy and its National Renewable Energy Laboratory (NREL). This result is also confirmed by other international solar development agencies.

The Zapped Report’s opinion that cloud cover and the aspect of the sun at our Northern latitude makes BC solar “not worth considering” compared to other solar areas including Alberta is misleading and unfounded. Zapped denigrates BC’s outstanding solar resource and is a disservice to our province and electrical ratepayers. It further demonstrates a deep lack of understanding of Solar PV technology and the beneficial reasons for solar's explosive growth. Advancements in solar technology, and declines in cost to pennies a kilowatt hour, are two reasons why more than 100,000 MW of utility-scale Solar PV projects are scheduled to be constructed globally in 2019.

For reasons well understood, an unstoppable wave of solar power development is sweeping the world. In Canada, the wave passed through Ontario several years ago, and more recently spread west into other provinces with high solar irradiance values. In Alberta alone, there is now more than 4,000 MW of utility-scale Solar PV projects representing an estimated $6 Billion in clean technology investment proposed for system interconnection. In February of 2019, three solar projects were awarded supply contracts in Alberta for a solar power price of 4.8 Cents per kilowatt hour. Select regions of southern BC and Alberta share the same high solar irradiance values. This bodes well for BC, as the next province which may experience the benefits of a new generation of low-cost utility-scale Solar PV projects.

NREL in late 2018 published new North American continental Solar PV observation data and mapping which covers BC north to the 60th Parallel. The solar mapping is based on 19 years of satellite observation and other measurements. NREL’s solar observation data demonstrates that BC’s top Global Horizontal Irradiance (GHI) 13 solar zone has long-term average yield of 3.5 to 4 KWh/sq.m/day. This top BC solar irradiance zone is the same as the best of southern Alberta, where a proposed 82 utility-scale solar projects are currently in the AESO interconnection queue. NREL has made it clear that portions of southern BC and Alberta share the same exceptional solar resource.

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13 Global Horizontal Irradiance is the average amount of radiation from the sun received by a flat surface horizontal to the ground. This value is important to Solar PV projects, and includes both Direct Normal Irradiance (DNI) and Diffuse Horizontal Irradiance (DIF). DNI is solar radiation that comes in a straight line from the direction of the sun at its current position in the sky. DIF is solar radiation that does not arrive on a direct path from the sun, but has been scattered by particles in the atmosphere (ie. clouds).
NREL is recognized as a global leader in solar power research and analysis, and is currently sharing its solar observation data with Canada. The Canadian government has no comparable program. NREL is staffed by more than 2,000 scientists, engineers and expert personnel - and is supported under a US Department of Energy budget of $34.5 billion (2018 fiscal).

The great news about BC’s solar resource gets even better. When a solar panel in BC’s highest value solar regions is tilted such that its surface is always perpendicular to the incoming solar radiation, the new NREL results are truly amazing. Some BC locations in the Thompson Nicola, Okanagan, Boundary and Kootenay regions have long-term average Direct Normal Irradiance (DNI) values of 4.5 to 5 kWh/sq./m/day. (See Footnote 2). This highest Canadian and BC DNI value zone is the same as much of the US midwest, eastern Atlantic and southern Gulf Coast states. Solar panels mounted on racking with sun tracking technology seek to capture the additional energy revealed by the DNI value.

Canada’s highest multi-year average GHI solar irradiance value zone of 3.5 to 4 kWh/sq.m/day is yellow in this 2019 NREL solar map. The map is created from new NREL data based on 19 years of satellite and other observation. Regions of southern BC, Alberta and Saskatchewan share the same exceptional solar resource zone, which is the best in Canada and northern US states.

In February 2019, three (3) Alberta utility-scale Solar PV projects with site irradiance values same or similar to southern BC’s best solar areas were awarded 94 MW in power supply contracts by the Government of Alberta at the stunning unsubsidized power price of 4.8 Cents a kilowatt hour (kWh).
According to the Canadian Solar Industries Association (CanSIA) the new Alberta solar price of 4.8 Cents/kWh represents a new low price for Canadian solar. The price is a lower Levelled Cost of Electricity (LCOE) than the average annual wholesale price paid by the Alberta power pool to combined cycle and single cycle natural gas fired electricity generation from 2008 to 2018.\textsuperscript{14} The future price for BC utility-scale Solar PV power located on BC’s best solar sites in the same solar irradiance zone as the winning Alberta projects, and using the same technology, would be expected to be similar in a competitive acquisition process.

What’s not to like about BC solar? The sun appears daily, regardless of season or weather. Energy carrying “photons” arrive in BC in just 8 minutes, ready for conversion into low-cost clean electricity to help meet daytime peak loads. Recent advances in battery storage technologies hold the promise of extending solar power deliveries into evening hours – or for other useful purposes. And the summer seasonal peak of BC solar energy generation is complementary to the winter peak hours of BC wind power generation.

In 2019 alone, more than 100,000 MW of new Solar PV modules will be manufactured and installed globally as the technology continues to improve and costs fall year-on-year. Solar has high social acceptance, no discernible sound or GHG emissions, and a low visual profile. Solar PV panels are a rapidly advancing clean technology without moving parts. And because Solar PV is modular, projects can be constructed quickly without heavy equipment and scaled in size from kilowatts to megawatts according to the need.

Enlightened with new BC solar data, there is no reason why our province can’t benefit from advancements in Solar PV technology in a manner similar to Alberta. In 2018, Alberta’s solar electricity generation exceeded 50 MW. A recent supply chain study of the solar electricity sector in Alberta by Solas Energy Consulting Inc. found a potential of $4.1 billion in market value and a labour force rising to 10,000 in 2030. BC’s solar developers have identified similar opportunities in our province for new low-cost solar energy, investment and clean technology jobs.

Many of the new Solar PV projects being developed in the US are located in states with similar GHI and DNI values to BC and Alberta. The US electric power sector plans to add more than 4,000 MW of new solar capacity in 2019 and almost 6,000 MW of additional new solar in 2020, a total increase of 32% from the operational capacity at the end of 2018. Because of this increase, solar is forecast to be more than 2% of total US utility-scale generation in 2020.

The \textit{Zapped} Report expressed the misinformed opinion that “there is little prospect of BC being market competitive with solar…” and further that “BC should delay such projects until there is a change in that market.” Fortunately for BC, the opinions are not correct. The good news is that positive change has already occurred in the solar market. And BC utility-scale Solar PV may now be considered one of our province’s lowest-cost clean power options.

\textsuperscript{14} CanSIA The Canadian Solar Industries Association (CanSIA) is a national trade association that represents the solar energy industry throughout Canada.
8. Endnotes

1 Zapped: A Review of BC Hydro’s Purchase of Power from Independent Power Producers conducted for the Minister of Energy, Mines & Petroleum Resources by Ken Davidson Feb 2019
2 BC Hydro customers set up to pay $16 billion over 20 years for power they likely don’t need: report Global news.ca February 16 2019
3 Zapped page 1.
4 Zapped pages 1 and 72.
5 Zapped page 43.
6 Market purchases mean BC Hydro purchasing energy from a neighbouring jurisdiction to meet domestic demand. Market purchases are made in the spot market. Market purchases are distinct from Powerex practice of time-shifting which is when it buys energy during low load hours and sells it back during high load hours.
7 Transcripts from BC Hydro Executive VP-Operations and BC Hydro Executive VP –Customer Care and Conservation at the BCUC review of the BC Hydro 2006 Integrated Electricity Plan and Long Term Acquisition Plan, Volume 9, pages 1125 – 1127.
8 B.C. Utilities Commission
9 BC Hydro’s 2008 Long Term Electricity Plan.
10 The energy crisis in California in 2000 - 2001 resulted from an apparent energy shortage as well as low water on the west coast. It caused very high electricity prices. In 2000 annual rates peaked at $200/MWh.
11 Calculated from totaling the annual volumes shown in the column titled “US Tie Lines” in the spreadsheets titled “BC Hydro Hourly Tieline Data” on the BC Hydro website: https://www.bchydro.com/energy-in-bc/operations/transmission/transmission-system/actual-flow-data/historical-data.html in the section titled “Net Actual Flow”.
12 Over 85% of generation in B.C. is from hydro making droughts the biggest single risk. NEB shows that 86% of BC Hydro generation was hydro in 2015 at https://www.neb-one.gc.ca/nrg/sttstc/1ctct/rprt/2016cndmwnblpwr/prvnc/bc-eng.html
13 BC Hydro Response to Information Response No. 1.45.4 in the BCUC Hearing on BC Hydro’s Waneta 2017 Transaction, issued January 18, 2018. CE stands for Columbia Entitlement which is power that may be repatriated from the U.S.
14 The majority of B.C.’s net imports come through Washington. The balance comes from Alberta where B.C.’s other intertie is connected.
17 BC Hydro 2010 Clean Power Call: Report on the RFP Process, Page 18
18 According the US Federal Reserve figures; US household wealth fell by $16.4 trillion dollars during the crisis. The Dow Jones industrial average fell 54% in 18 months. Many lenders failed and the housing market collapsed. Government bailouts were required to save banks and the auto sector.
19 Zapped page 45.
20 Site C – Alternative Resource Options and Load Forecast Assessment, submitted by Deloitte to the BC Utilities Commission. September 7, 2017 Figure 3: Total Gross Energy Requirement Forecast Models between 2000 and 2016 (with DSM)

21 Graph titled System Load Annual Energy versus Forecast from 2006 through 2017 LTO, slide 11 of the Presentation to AESO Adequacy and Demand Curve Working Group by the Industrial Power Consumers Association of Alberta on August 9, 2017


24 Zapped page 50; Cumulative Annual Energy acquired after August 13, 2010 is 3,817 GWh.

25 3,817 GWh divided by 9,500 GWh equals 40%.

26 Zapped page 30.

27 The efficiency of a thermal power plant is reflected in its heat rate, measured in GJ/MWhr. The higher the ratio of GJ/MWhr the lower the efficiency.

28 Burrard’s heat rate over was 10.16 GJ/MWh (according to BC Hydro’s Facility Asset Plan for Burrard Generating Station F2004/06). The heat rate of the average U.S. natural gas power plant was 8.16 GJ/MWh (according to https://www.eia.gov/electricity/annual/html/epa_08_01.html). The calculation is: 10.16 minus 8.16 equals 2.00 And 2.00 divided by 8.16 is 25%.

29 Transcript from BC Hydro Executive VP-Operations at the BCUC review of the BC Hydro 2006 Integrated Electricity Plan and Long Term Acquisition Plan, Volume 8, pages 983 – 984.

30 The heat rate of the average Californian natural gas power plant was 7.90 GJ/MWh (according to Figure 4 of the California Energy Commission report on Thermal Efficiency at https://www.energy.ca.gov/2016publications/CEC-200-2016-002/CEC-200-2016-002.pdf) The calculation is: 10.16 minus 7.90 equals 2.26 And 2.26 divided by 7.90 is 29%.

31 Mid-C stands for Mid-Columbia. That is the price at which energy trades at the Mid-Columbia hub in the western USA.

32 Transcripts from the BC Hydro Executive VP-Operations and the BC Hydro Executive VP – Customer Care and Conservation at the BCUC review of the BC Hydro 2006 Integrated Electricity Plan and Long Term Acquisition Plan, Volume 9, pages 1125 – 1127.

33 The energy crisis in California in 2000 - 2001 resulted from an apparent energy shortage as well as low water on the west coast. It caused very high electricity prices. In 2000 annual rates peaked at $200/MWh.


36 BC Hydro based that $65/MWh price on an estimated capex of $8.9 billion. The government approved a budget of $10.7 billion.

37 Canadian Environmental Assessment Act and BC Environmental Assessment Act

38 $3.5 billion = PV ($212,000/year, 70 years, 6% discount rate). $212,000/year = 5,300 GWh/year x $40/MWh. $40/MWh = $65/MWh - $25/MWh. BC Hydro estimated the energy cost of Site C to be $65/MWh when the government approved it.

39 The $3.5 billion present value assumes it will receive payments for 70 years.

40 BC Hydro presentation to the BCUC Inquiry Respecting Site C, October 14, 2017. The “ABB market price” was the forecast made by ABB Engineering and Consulting.

41 Zapped page 48.
Response EPAs are the EPAs that BC Hydro awarded to IPPs since 2007. Zapped states that they total 9,500 GWh/year.

Zapped Page 53, starting with the Dokie Wind 2009 EPA and adding the subsequent EPAs for projects listed in red ink. The annual volumes on the graph are from adding the hourly volumes shown in the columns titled “US Tie Lines” and “AB Tielines” in the spreadsheets titled “BC Hydro Actual Interchange” on the BC Hydro website: https://www.bchydro.com/energy-in-bc/operations/transmission/transmission-system/actual-flow-data/historical-data.html in the section titled “Net Actual Flow”. The years on the graph correspond to BC Hydro’s Fiscal Year. BC Hydro Application to the BCUC dated October 5, 2018, Appendix B, Table 3-8; revised F2017-2019 Revenue Requirement Application, Load Resource Balance After Planned Resources - Energy.