McCullough Research

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# Reassessment of Site C Financial Viability

## Updating Site C Cost Estimates for Seismic and Design Changes

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October 12, 2020

After ten months of study, British Columbia Hydro has not addressed a number of seismic and design concerns first reported to management in December 2019. The Peace Valley Landowners Association has asked us whether it is in the best interests of British Columbians to immediately cancel or to continue construction of Site C.

A careful review indicates that correction of the current problems will delay the in-service date by one year and raise costs by an additional C$2.1 billion dollars. The revised percentage of completion falls from 48% based on the current budget to 43% when the currently identified problems are addressed.

Site C's ability to compete in an increasingly competitive energy sector has deteriorated sharply over time. At the current schedule, if output is exported Site C will cost rate payers significantly more than the energy can be sold for in the market. Assuming an additional year of delay, Site C's value relative to the market will have declined even further.

In the most likely case, Site C's output will be surplus to needs in British Columbia. If so, BC Hydro will spend C$69.77/MWh to complete and transmit Site C to market where it will be sold for C$38.85/MWh. If, as we expect, BC Hydro will soon announce a delay and a budget increase, they will be spending C$93.98/MWh to finish Site C and then sell at Mid-Columbia at C$39.77/MWh. In this case British Columbia Hydro loses 57.7% on each MWh produced by Site C.

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| Export Case | | | | | |
|---|---|---|---|---|---|
| Scenario | Site C Costs to Completion | Cost Per MWh Delivered to BC Border | Cost Per MWh Delivered to Mid-Columbia | Mid-Columbia Price | Percentage Loss |
| | (C$ Millions) | (C$/MWh) | (C$/MWh) | (C$/MWh) | (%) |
| **2017 Budget** | $ 5,138.85 | $ 62.46 | $ 69.94 | $ 38.85 | 44.5% |
| **2020 Updated Budget** | $ 7,149.60 | $ 86.04 | $ 93.98 | $ 39.77 | 57.7% |

Alternatively, if Site C were discontinued today and replacement energy from the Mid-Columbia hub were purchased, British Columbia Hydro would lose 26.5% on each MWh purchased by finishing Site C. If project delay and budget increases occur, the loss increases to 45.6% on each MWh.

| Import Case | | | | | |
|---|---|---|---|---|---|
| Scenario | Site C Costs to Completion | Cost Per MWh Delivered to BC Border | Mid-Columbia Price | Cost Per MWh Delivered to BC Border | Percentage Loss |
| | (C$ Millions) | (C$/MWh) | (C$/MWh) | (C$/MWh) | (%) |
| **2017 Budget** | $ 5,138.85 | $ 62.46 | $ 38.85 | $ 45.88 | 26.5% |
| **2020 Updated Budget** | $ 7,149.60 | $ 86.04 | $ 39.77 | $ 46.82 | 45.6% |

The following materials address the question we have been asked. The conclusion is that yes, immediate cancellation of Site C will likely save BC Hydro ratepayers $116 million per year and the savings to ratepayers will grow over time as the cost of solar and wind power continue to drop. Cancellation of Site C will also avoid significant geotechnical risks.

The siting of major hydroelectric projects basically considers geology and cost. The best sites are narrow rocky canyons. These provide large reservoirs and firm footings. The West Coast of the U.S. and Canada has a number of such sites. Most are on the U.S. side of the border. The Peace River has an excellent site – Williston – but BC Hydro then faces significant geological problems in finding additional sites.

Site C has been on the books of British Columbia utility planners for the past seventy years. Originally, Site C was just one of five similarly sited projects: Sites A, B, C, D, and E.[1] Sites B, D and E were ruled out on geotechnical grounds.[2] Site A was ruled out due to the necessity of removing large amounts of overburden.[3] Today, Site C is considered the only viable alternative.

The cost of Site C has increased significantly in recent years, primarily as early – rather optimistic – forecasts have collided with geotechnical realities. Three years ago, British Columbia Hydro filed an 866-page report with the British Columbia Utilities Commission stating that the project was "on time and on budget".[4] Even at the time, this was widely known to be inaccurate. The bank/hillside above critical parts of the project was known to be unstable. In its independent report, Deloitte clarified this issue and indicated that potential changes to the schedule and the budget were required.[5]

Three months after BC Hydro's report, Deputy Minister Don Wright officially released the corrected budget – increasing the cost by C$1.925 billion.[6]

The project has faced many problems. Continuing contractor issues have been large – including the bankruptcy of one major contractor soon after they were selected – but the major issues were, and continue to be, a function of the geology. Simply put, Site C is not a narrow rocky canyon. The banks are unstable and there is substantial tectonic activity in the area. The surface under the structure is shale – which adds significant risk as well.[7]
In January 2020, management at British Columbia Hydro's Site C project discovered that the project faced significant delays and cost overruns. This basically mirrored the situation three years ago when similar seismic and design problems forced a C$1.9 billion increase in the cost of the project. The stabilization of the bank above the diversion work used up much of the "float" – the engineering term for flexibility in the construction schedule.

This information was communicated six months later in June to the British Columbia Utilities Commission in the annual regulatory report:

[1] Site C Feasibility Review: Stage 1 Completion Report, December 2007, page 3-22.
[2] Ibid.
[3] Ibid.
[4] BC Hydro Submission to the British Columbia Utilities Commission Inquiry into the Site C Clean Energy Project, August 30, 2017, page 2.
[5] BC Hydro Submission to the British Columbia Utilities Commission Inquiry into the Site C Clean Energy Project,
August 30, 2017, page 1.
[6] Site C Technical Briefing Don Wright, Deputy Minister to the Premier, December 11, 2017, page 17.
[7] STAGE 2 ENGINEERING SERVICES SUMMARY REPORT, Klohn Crippen Berger Ltd. and SNC-Lavalin Inc., page 23.

> "Recommended enhancements included design changes for the roller-compacted concrete core buttress to enhance the foundation with anchors, additional grouting for the earthfill dam and a shear key for the right bank of the earthfill dam. Additional foundation enhancements include improvements to the spillways and powerhouse roller-compacted concrete buttresses. Several options are being evaluated against Project criteria, including improvements to the drainage within the rock and changes in the design of the approach channel. The benefit of additional drainage would be to reduce the water pressure acting on the roller-compacted concrete structures. A range of options are also being compared, including piles, anchors and structural support in the approach channel.
>
> Based on further engineering analysis of mitigation measures, the foundation enhancement costs are expected to be much higher than initially expected in January. Construction cost estimates and constructability reviews are being conducted in parallel to compare the options and evaluate the cost and schedule implications to the Project. A plan to evaluate, recommend, and document the conceptual preferred measures using a structured decision-making process is underway.
> During the reporting period, an update was also provided to the Technical Advisory Board on the analysis for the earthfill dam and the potential for pore pressure increases during construction."[8]

These problems are now in the hands of a new special advisor, former deputy finance minister Peter Milburn, who will report sometime this fall. British Columbia Energy Minister Bruce Ralston has stated:

> "When we [the NDP] came into government in 2017, we had a very serious discussion about the project and made the decision to go forward," Ralston said. "So, I'm not sure [dropping Site C] is a realistic alternative. I will await the advice of Mr. Milburn on that."[9]

British Columbia Hydro is the last major utility along the I-5 corridor to pursue high cost traditional energy projects. Focus in the industry has moved to low cost renewable projects and battery storage. Load forecasts are low – or even negative – as conservation and technological improvements have outpaced population growth.

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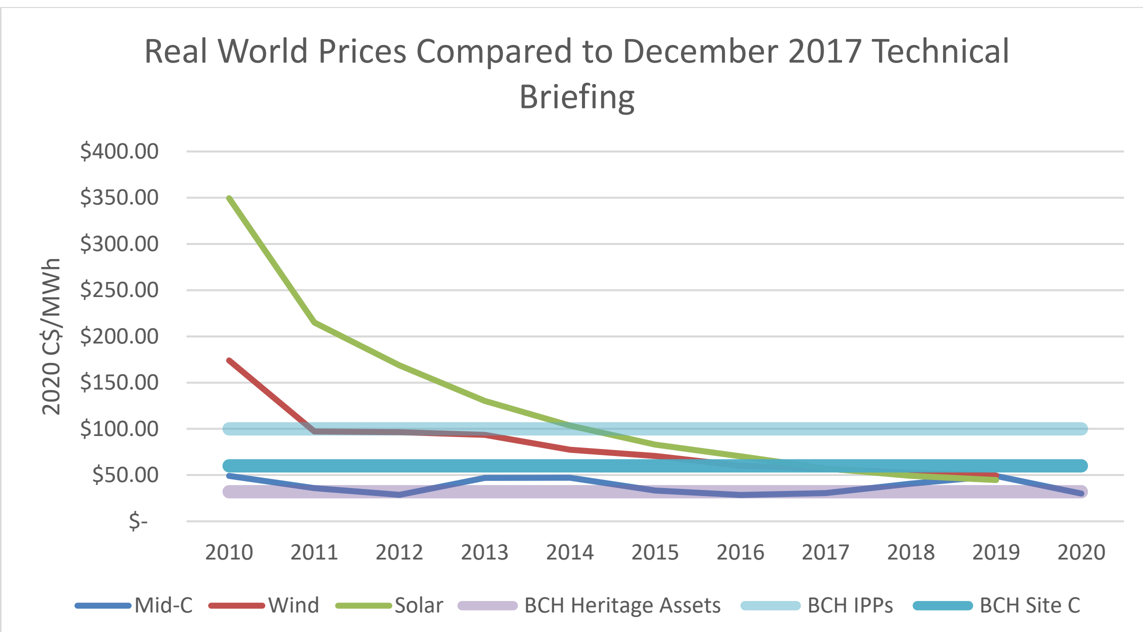
[8] PUBLIC Annual Report No. 4 and Quarterly Progress Report No 18, and Quarterly Progress Report No. 19, Chris O'Riley, July 31, 2020, page 29.
[9] Advisor appointed as Site C costs and geotechnical problems grow, Alaska Highway News, JULY 31, 2020.

In general, construction data on the Site C project is incomplete and irreproducible. Although periodic reports are produced by British Columbia Hydro, both the data and format are often incompatible. In the 2017 regulatory review, BC Hydro stated that the project was on-time and on-budget – months after everyone involved in the project, its external reviewers, and even the general public knew better. The situation is the same today.

The data in the most recent reports are unchanged from Deputy Minister Don Wright's briefing of December 11, 2017.[10,11]

Even in 2017, the relevance of B.C. Hydro's estimates to the real world surrounding British Columbia was questionable. The continued delay and cost escalation for Site C is especially significant since alternatives and market prices have declined enormously since Site C received its final investment decision.

The chart below shows actual wholesale prices for the Pacific Northwest and estimated construction costs for utility scale solar and wind:



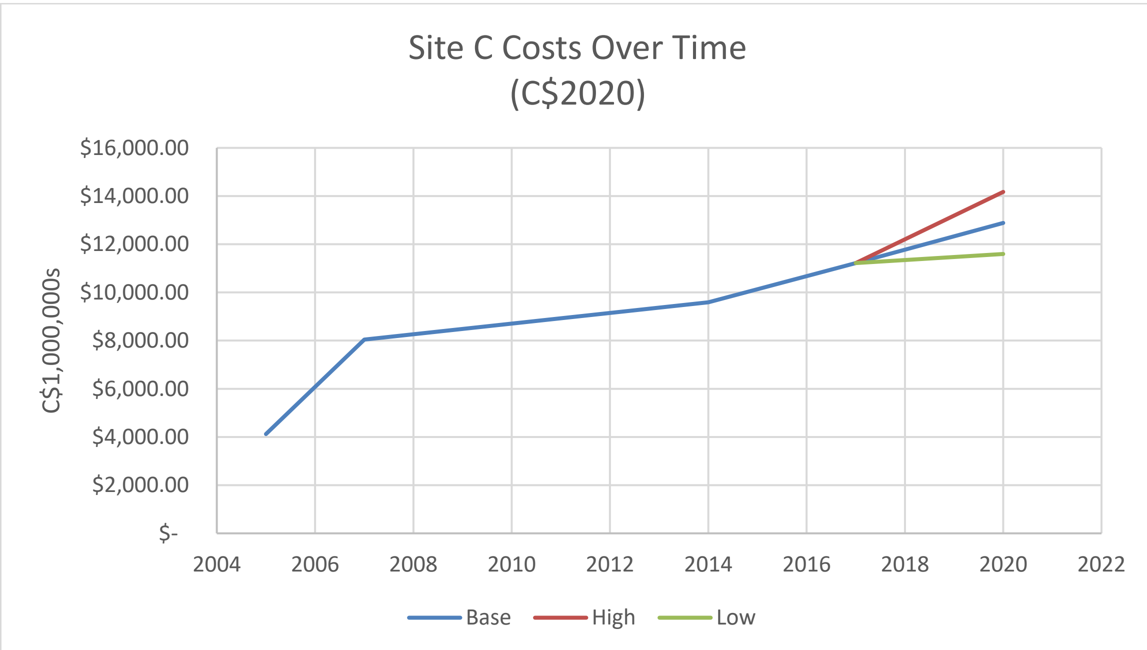

The line labeled Mid-C represents prices in the Pacific Northwest market. This represents the benchmark price for British Columbia resource when brought to market. Lazard, a highly respected Wall Street bank, publishes market prices for solar and wind resources on

[10] Site C Technical Briefing, Don Wright, Deputy Minister to the Premier, December 11, 2017, page 17.
[11] PUBLIC Annual Report No. 4 and Quarterly Progress Report No 18, and Quarterly Progress Report No. 19, Chris O'Riley, July 31, 2020, page 79.

an annual basis. The values entitled "BCH" are the values included in Deputy Minister Don Wright's December 2017 briefing on Site C.[12] All values are in 2020 Canadian dollars.

Such precise forecasts of major hydroelectric projects are generally inaccurate and when tabled in an official report tends to bring the credibility of the report into disrepute.[13]

A careful review of the various official reports indicates that Site C's costs have increased steadily over time:




In real terms, the cost of Site C has roughly tripled since 2005.

In this report, we have added two alternative cases – one high and one low. The high case adds British Columbia Hydro's current losses in interest rate derivatives used to hedge Site C to the total project costs. The low case assumes that the seismic upgrades required at the project will not delay the in-service date by one year.

[12] Site C Technical Briefing, Don Wright, Deputy Minister to the Premier, December 11, 2017, page 6.
[13] For example, BC Hydro has lost approximately C$1 billion in interest rate speculations tied to Site C. Deputy Minister Wright's estimates from 2017 were not updated to include these losses. Derivation of the interest rate speculation losses will be addressed below.

At the heart of the problem are geological issues with the stability of the banks where the dam is being built and concerns over the specific choice of construction measures that have been adopted.

The June report to the BCUC goes on to say:

> "Main Civil Works
>
> Engineering design for the main civil works continues to focus on finalizing plans for advancement of the river diversion schedule.
> Detailed geological mapping of the excavations and instrumentation monitoring continued during construction. This information has been used to update the design parameters for the site geology and foundations, which has resulted in additional requirements for the right bank structures.
> Recommended enhancements included design changes for the roller-compacted concrete core buttress to enhance the foundation with anchors, additional grouting for the earthfill dam and a shear key for the right bank of the earthfill dam.
>
> Additional foundation enhancements include improvements to the spillways and powerhouse roller-compacted concrete buttresses. Several options are being evaluated against Project criteria, including improvements to the drainage within the rock and changes in the design of the approach channel. The benefit of additional drainage would be to reduce the water pressure acting on the roller-compacted concrete structures. A range of options are also being compared, including piles, anchors and structural support in the approach channel.
>
> Based on further engineering analysis of mitigation measures, the foundation enhancement costs are expected to be much higher than initially expected in January. Construction cost estimates and constructability reviews are being conducted in parallel to compare the options and evaluate the cost and schedule implications to the Project. A plan to evaluate, recommend, and document the conceptual preferred measures using a structured decision-making process is underway."[14]

A term very infrequently mentioned in Site C reports is "roller-compacted concrete". This is a cost-effective alternative to traditional construction methods being used at Site C. As opposed to the dam being composed of cement cast in place, roller compressed cement

[14] PUBLIC Annual Report No. 4 and Quarterly Progress Report No 18, and Quarterly Progress Report No. 19, Chris O'Riley, July 31, 2020, pages 31 and 32.

more closely resembles a layer cake, with layers being laid down sequentially and compressed. The first such dam was the Willow Creek Dam in Oregon. The layer cake approach proved to be cost effective, but seepage through the layers required lengthy and controversial repairs.

While roller-compacted concrete is now an established construction practice, a number of articles have questioned the reliability of this approach if exposed to tectonic shocks. For example, the study, "Seismic behaviour of roller compacted concrete dams under different base treatments" concludes:

> "The response of two scaled concrete dam monoliths were investigated via the PsD testing method. The following conclusions can be drawn on the basis of the observed response of the test specimens:
>
> - RB specimen did not exhibit sliding-type motions whereas SB specimen sustained sliding displacements as high as 70% of the total tip displacement.
> - The base treatment had an important effect on the behavior of concrete gravity dams. The response of a gravity dam with smooth base (SB specimen) was highly dominated by the base sliding motions. Consequently, the full capacity of the dam body could not be obtained as the sliding capacity at the interface was the major source for the failure mechanism. On the contrary, the intentionally roughened base (RB specimen) caused a body cracking mechanism, which was possible due to the presence of sufficient base adherence.
> - The sliding analysis of Chopra and Zhang (1991) was found to be in reasonable agreement with the test results. This provided confidence for its use while assessing or designing a gravity dam with untreated base as long as the coefficient of friction was selected appropriately.
> - The crack lengths were slightly overestimated by the finite element analysis. In addition, the cracks started to spread more around the previously opened cracks, which resulted in considerably more dispersed cracking than the observed ones.
> - Finite element simulation was successful in predicting the global parameters such as the base shear force and the tip displacement compared to the crack patterns. Therefore, its possible use for rough base case can be seen as acceptable,

while judging a failure mechanism from observed cracks remains to be challenging.

- Estimating the coefficient of friction, which seems to change as a function of loading history, is the important challenge in design and assessment as it tends to determine the expected failure mode."[15]

In short, the authors are finding that there is a significant risk of sliding or cracking depending on the nature and preparation of the surface under the roller compacted concrete. Like Site A, Site B, Site D, and Site E, the challenge of building a major dam where the footing and banks are not stable can be immense. The silence – ten months and counting – on these issues raises major concerns, especially since British Columbia Hydro has taken a significant gamble by delaying the diversion of the Peace River into early October after stating in many forums that the diversion must occur in September.

BC Hydro has consistently argued – before both courts and the BCUC – that missing the mid-September diversion date would delay the project for a year.

The river diversion has just been completed – three weeks later than BC Hydro's plans required.

> "River diversion can only take place after Labour Day holiday (first Monday in Sep) and must be completed by mid-September"[16]

Site C must meet several critical dates in order to stay on schedule. To complete the dam, the river must be diverted into tunnels in September 2020. The diversion's date is required since the preliminary dam must be completed before the spring freshet:

> "The latest permitted start date for river closure is October 1st as a result of the following constraints:
>
> a) Requirement to reliably construct the upstream cofferdam to the final crest elevation prior to the start of the flood window the following year. Previous analysis has indicated that the current upstream cofferdam construction schedule is nearing the limit of what can be reliably constructed in the available window.

[15] Seismic behaviour of roller compacted concrete dams under different base treatments, Ali Gharibdoust, Alper Aldemir & Baris Binici, Structure and Infrastructure Engineering, 2020, VOL. 16, NO. 2, 355–366, page 365.

[16] YM-80004 Schedule Basis: Site C Implementation Phase, page 12.

> b) Consequences to the BC Hydro Generation System to meet restricted flow requirements during winter. Extending restricted flow controls into the winter months will have a high likelihood of restricting upstream Peace discharges throughout the entire winter period due to the downstream ice formation. This imposed winter restriction would have a cascading impact on GM Shrum and Peace Canyon generation, and consequently system reliability during this winter season, since these two plants generally supply 1/3 of the BC Hydro load during the winter months."[17]

The engineering documents give specific details.[18] Simply stated, BC Hydro has stated before courts and regulators that the September delay will risk power supplies and completion dates. These are not minor risks – if the preliminary dams are not completed before the spring freshet, the risk of a dam breach exists:

> "5.2.1.2 FID schedule contingency
>
> A critical milestone is the Start of River Diversion, as it is both significantly time sensitive and on the critical path. It requires construction of cofferdams, which must be completed outside of the May-through-August period due to the risk of floods, and outside of the winter period due to constructability constraints. In addition, construction of the cofferdams must occur in a period with a high likelihood of controlled low discharges from the upstream W.A.C. Bennett Dam.[12]
>
> This schedule restricts the Start of River Diversion to a window between September 1 and October 1 of a given year. <u>If the diversion window is</u>

[17] Site C Review - Responses to questions raised by Deloitte, August 22nd, 2017, CONFIDENTIAL, No. 159,
Date/Source of Question: Email from August 22, 2017 at 9:06 am follow up from BCUC tour on 08/18/2017, page 1 at https://www.sitecproject.com/sites/default/files/159-Site-C-Review-Deloitte-Questions-August-2017.pdf.
[18] PART 1 Start and Finish Constraints
Start and finish constraints include ·
a. Start after freshet flooding.
b. Finish before winter low temperature limits fill placement.
c. Finish before high water levels due to ice formation.
d. Manage environmental constraints
1. Freshet Constraint- freshet season is normally May 15 to July 15, but local storm floods can occur in August. Assume September 1st as a safe date.
2. Winter low temperature
a. Main Dam - Impervious material should not be placed when air temperature is below -2 degrees, and granular material cannot be placed when air temperature is below -5 degrees. The average (1953 to 2012) range of dates with these temperatures is as follows."

> missed, the Start of River Diversion would be rescheduled to the following year, directly impacting schedule contingency and project completion.[13] The Project's FID schedule includes six months of schedule contingency related to critical civil work leading up to river diversion. This contingency is represented by the schedule activity "Waiting for Diversion Window" shown in Figure 2. It is also seen when comparing the milestones for "Complete all Civil Work for Diversion" and "Start River Diversion."[19] (emphasis supplied)

The lesson to be learned from the delayed river diversion is that the updated budget will also need to factor in a compressed construction window between now and next spring, over and above cost and schedule delays to address the new seismic and geotechnical issues. A more financially prudent strategy would have been to delay the diversion until the design changes were finalized. The gamble that good weather will offset the untimely diversion indicates that a further substantial delay is also in the works.

The scale of the budgetary change is also clear. The additional costs are going to exhaust the current level of contingency or the changes would simply have been adopted without additional research. The 2017 budget set out by Deputy Minister Don Wright established a total contingency level of C$1,566 million.[20] It can safely be concluded that the existing and predicted budget overages are going to exhaust the current contingency level.

In our base case, therefore, we are assuming an increased direct construction cost of C$1,715 million for 2021 plus a one-year delay for an in-service date of 2025. This matches the approach taken to increased direct construction cost adopted in 2017.
The term "direct construction cost" is also commonly referred to as "instant cost." It reflects the cost of construction without considering timing of expenditures. As in any construction project, the instant cost does not include indirect costs, contingencies, or interest during construction. Shifting the project out one year also adds significant interest costs. And, of course, the contingency items in the budget will need to be refreshed.

In total, in my view, the in-service cost of Site C is most likely to exceed C$12,722 million. In calculating the impact on rate and tax payers of such an increase, all assumptions were taken from the 2017 British Columbia Utilities Commission's Site C Inquiry.

For example, to calculate the cost of Site C energy sold at the Mid-Columbia hub, the following calculations need to be made:

[19] British Columbia Utilities Commission Site C Construction Review, Deloitte, September 8, 2017, page 18.
[20] Site C Technical Briefing, Don Wright, Deputy Minister to the Premier, December 11, 2017, page 17.

1. The total cost before the budget increase required today is C$8,775 million.

2. Currently, this is being financed by British Columbia with thirty-year bonds and an assumed interest rate of 3.43%.[21] Since British Columbia Hydro does not finance projects on its own, its spending is simply a cash flow requirement for the provincial budget. The interest rate is a complex question. While overall interest rates have fallen, British Columbia Hydro has lost C$1,067 million in its ill-fated effort to hedge interest rates using derivatives. British Columbia tax and rate payers are unlikely to see any benefit from falling interest rates given the massive losses in the interest rate hedging program. This point is discussed in more detail below.

3. British Columbia Hydro has assumed a low level of O&M for this project – approximately one third the level used by the U.S. Energy Information Administration.[22] We have adopted BC Hydro's optimistic assumption.

4. Transmission from Site C to load center (and the British Columbia border) is estimated to face 11% losses.[23]

5. Transmission from the Mid-Columbia hub (the major dams along the Columbia River near the Tri-Cities in Washington state) hass also been taken from the BCUC.[24] These estimates appear dated, but have not been adjusted to reflect tariff changes on the U.S. side of the border.

6. Is British Columbia Hydro likely to be surplus or deficit in future years?

   BC Hydro load forecasts have traditionally been unrealistically high. Neighboring utilities like Seattle City Light have much lower load forecasts. Rather than address this debate in this report, we have assumed both cases – Site C is completed and the energy is exported at a loss and Site C is not completed and less expensive energy is imported from the U.S. or provided by renewables in British Columbia. We did not forecast Mid-Columbia

[21] https://www.bcuc.com/Documents/wp-content/10/00550_A-22_Alternative-Portfolio.pdf
[22] DOC_90353_F1-5-1_BC-Hydro_Excel-Spreadsheet.xlsx
[23] https://www.bcuc.com/Documents/wp-content/10/00550_A-22_Alternative-Portfolio.pdf
[24] https://www.bcuc.com/Documents/wp-content/10/00550_A-22_Alternative-Portfolio.pdf

> prices since there is a forward market quoting prices in 2024 and 2025. Unlike a forecast, a forward market allows actual purchases or sales today for energy to be delivered five years from now.[25]

In sum, the question of whether Site C should be terminated is quite simple. The percentage of direct construction costs not yet committed as of the end of the third quarter 2020 is 48%. With the budget and schedule changes facing us today, the percentage of direct construction costs not yet committed is estimated to increase 56%.

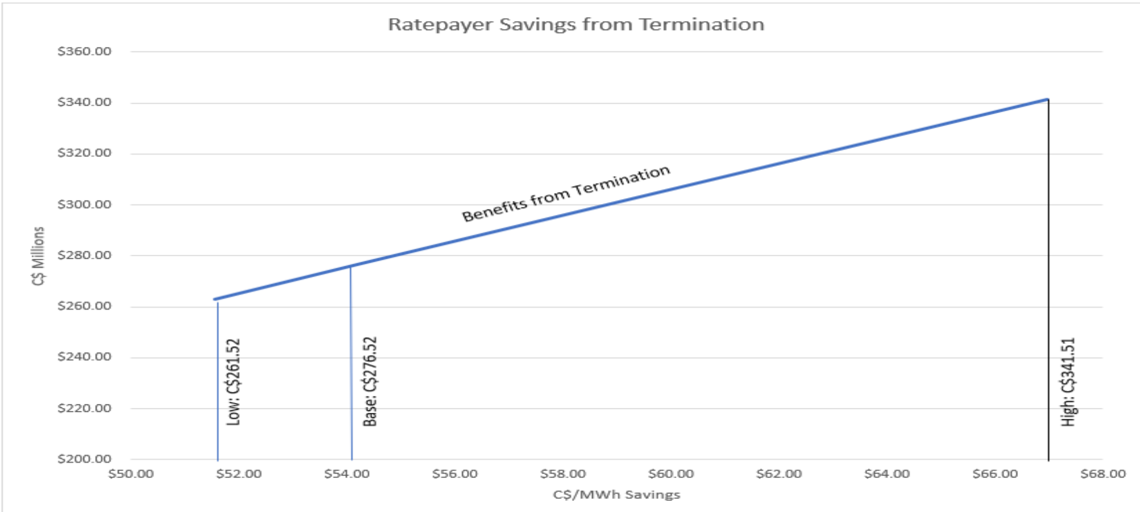
The nature of politics is such that economic analysis in Site C has always considered sunk costs as a critical item in the decision whether to go forward with the project. Economic theory categorically states that sunk costs are, in fact, sunk. They are not part of the analysis in any economic decision. In the case of Site C, the basic question is: can the future costs of Site C compete successfully with alternatives? The clear answer is, no, they cannot.

The declining cost of electric energy in the Mid-Columbia market continues to outpace spending on Site C. Each year Site C has become less and less competitive with market prices, solar, and wind.

In the current analysis, completing Site C will cost C$91.98/MWh if delivered to the Mid-Columbia hub. Unfortunately, we can purchase energy at half that price – today – for C$39.75/MWh. Additionally, while the cost of Site C is likely to increase over the years, market prices for electricity have been falling for years and are expected to continue to do so in the future.[26] Even if British Columbia defies current trends in the demand for electricity and faces rapid growth in the future, we can purchase electricity from Mid-Columbia – again today – delivered to the BC border for C$46.22/MWh. This is much less than the cost of Site C delivered to the same location -- C$86.04/MWh.

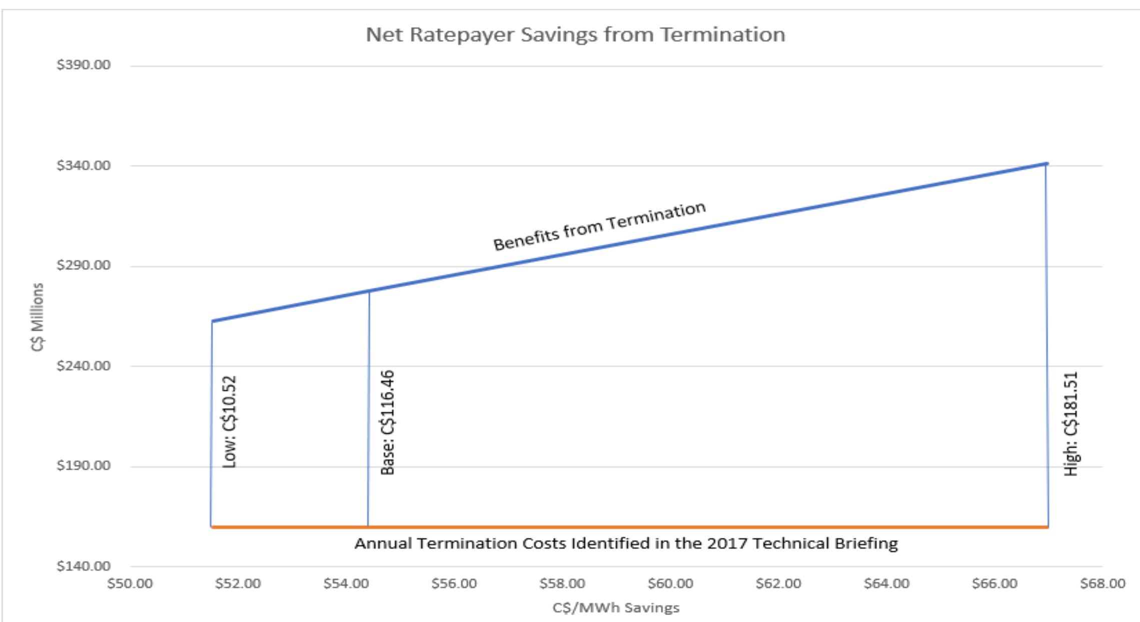
The following chart shows the savings to ratepayers on the proposed in-service date if the project is terminated:

[25] Outside of British Columbia, resource plans published by large utilities along the I-5 corridor frequently depend on market purchases – frequently at the Mid-Columbia hub.
[26] As shown above, renewable prices have fallen dramatically over time – even when subsidies are not included in the cost calculations.




A central theme of the Deputy Minister's 2017 presentation was the long-term impacts on British Columbia citizens if the project were terminated.[27] The fundamental question is whether the benefits of termination offset the costs British Columbia might face.

The benefits are large and increase every year as the costs of alternatives diminish. In all three cases, the benefits of termination are much larger than those termination costs identified by the Deputy Minister in 2017:



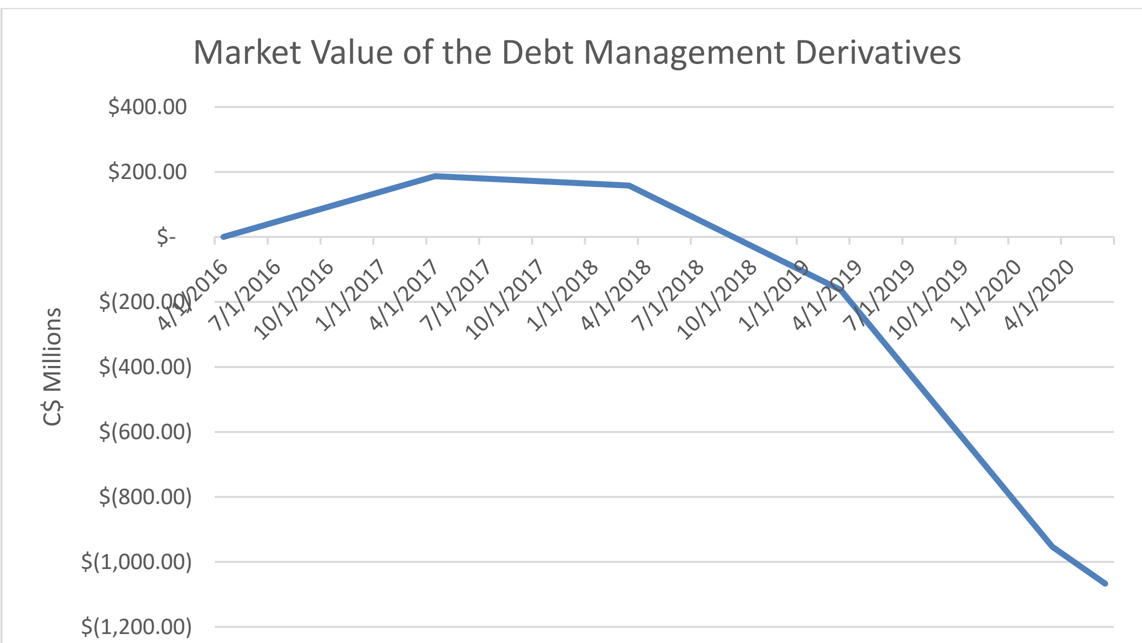

[27] Site C Technical Briefing Don Wright, Deputy Minister to the Premier, December 11, 2017, page 32.

In sum, while the costs of alternatives to Site C have declined significantly – and continue to decline – Site C's cost continues to increase.

In conclusion: Yes, immediate cancellation of Site C will likely save BC Hydro ratepayers $116 million per year and the savings to ratepayers will grow over time as the cost of solar and wind power continues to drop. Cancellation of Site C will also avoid significant geotechnical risks.

The discussion above uses the interest rate determined appropriate by the British Columbia Utilities Commission in 2017. Interest rates have diminished significantly since then. Unfortunately, BC Hydro has purchased derivatives designed to hedge against rising interest rates.[28] The Debt Management Regulatory Account is treated as an adjunct to the Site C project although it is not specifically restricted to hedging Site C alone.[29]

As with any derivative, the value of the investment can vary wildly depending on changes in the underlying asset. The following chart shows the balance in the Debt Management Regulatory Account.




[28] "This past year, BC Hydro developed a debt management strategy and one component, a Debt Management Regulatory Account, was approved by the BC Utilities Commission (Commission), which will lock-in low long-term interest rates to protect customers from the risk of rising interest rates." 2015/16 ANNUAL SERVICE PLAN REPORT, British Columbia Hydro, page 8.
[29] Order Number G-42-16, Application for Approval of Debt Management Regulatory Account

In other words, BC Hydro has lost almost $1.1 billion on interest contracts. The dramatic fall in the value of the interest rate derivatives poses a difficult question: Should these losses be included in the cost of Site C?

In Deputy Minister Don Wright's December 2017 presentation, the total amount of interest during construction was forecasted as C$1,285 million.[30] As of June 30, 2020, losses in the Debt Management account stood at -C$1,067 million.[31]

To some degree, the derivative losses will be offset by reductions in actual interest paid during construction of the Site C project. However, since the losses now approximate the total forecasted interest, it seems impossible for the losses to be totally offset by lower interest rates at Site C.

British Columbia Hydro's estimates of their exposure to additional interest rate declines – a common policy measure during major recessions – are very high:

> "For the interest rate contracts, an increase of 100-basis points in interest rates at March 31, 2020 would otherwise have a positive impact on net income of $820 million and a decrease of 100 basis points in interest rates at March 31, 2020 would otherwise have a negative impact on net income before movement in regulatory balances of $1.02 billion but as a result of regulatory accounting would have no impact on net income or other comprehensive income as all gains and losses will be captured in the Debt Management Regulatory Account."[32]

An even more difficult question is whether the current loss estimate is a sunk cost. Recent financial reports indicate that hedges with a nominal value of C$5,000 million are still outstanding.[33] This is a large position with terms and conditions that may make it difficult to liquidate. If so, predictable future losses – such as those that reflect further interest rate declines – will not be avoidable even if Site C is terminated.

[30] Site C Technical Briefing Don Wright, Deputy Minister to the Premier, December 11, 2017, page 17.
[31] British Columbia Hydro and Power Authority 2020/21 FIRST QUARTER REPORT, page 19.
[32] British Columbia Hydro and Power Authority 2019/20 Annual Service Plan Report, page 93.
[33] PUBLIC Annual Report No. 4 and Quarterly Progress Report No 18, and Quarterly Progress Report No. 19, page 80.