



November 16, 2017

BCUC INQUIRY RESPECTING SITE C	A-26
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Sent via eFile

The Honourable Michelle Mungall, M.L.A.
Minister of Energy, Mines and Petroleum Resources
Parliament Buildings
PO Box 9060 Stn Gov't
Victoria, BC V8W 9E2
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**Re: British Columbia Hydro and Power Authority – British Columbia Utilities Commission Inquiry
Respecting Site C – Project No. 1598922 – Final Report**

Dear Minister:

Further to our letter yesterday attaching the errata to the Site C Inquiry Final Report, please be advised we have also corrected the Commission's Illustrative Alternative Portfolio spreadsheet as described in more detail within the errata.

Please see the complete errata attached to this letter, which will now be inserted into the Commission's Final Report and associated Executive Summary.

Please contact our office if you have any questions.

Sincerely,

Original signed by Ian Jarvis for:

Patrick Wruck
Commission Secretary

Report errata

1.1 Math Error regarding Mid C price forecasts used in the Site C Calculator

Issue

The Mid C price forecasts used in the Site C unit energy cost UEC Calculator are in real terms and should have been inflated to nominal terms.

Commission comments

The Panel confirms that the graph upon which the Mid C price forecasts were derived are in real F\$2018 and therefore should be inflated to nominal. In the alternative portfolio spreadsheets, these same price forecasts were inflated to nominal.

By correcting the Mid C price forecasts to nominal in the Site C UEC calculator, we find that the rate impact (NPV) from Site C under the **low load case** is \$336 million lower, at \$2,852 million instead of \$3,188. Under the **mid load case**, the rate impact from Site C is \$68 million, at \$3,901 million instead of \$3,969 million. There is no impact on the high load case as there is no surplus energy in that scenario.

1.2 Formulas issues regarding the Commission Illustrative Alternative Portfolio

Issues

1. In the “Energy & capacity gap” sheet, the text box pointing to cell R42 says “Assumes ramp up at 800 GWh/yr” but the ramp up did not occur in the cells to the right of R42. This should be corrected to include the 800 GWh/yr ramp up for the years F2037 to F2041.
2. In the “Low LF – portfolio” sheet, the cells titled “(capacity) gap to fill” beginning at Y28 and ending at CB28 contain equal values of 1145 MW but the corresponding values in row 33 of the “Energy & capacity gap” sheet are 985 MW (*i.e.*, Site C gross capacity less 14% planning reserve). This should be corrected so that the values in both sheets are the same and the correct value is 985 MW.
3. Pursuant to the change made according to #2 above, a further change is required to cells AJ31 to CB31 of the “Low LF – portfolio” sheet, all of which have the hard number of -629.96 MW rather the cell difference formula which appears in the adjacent AI31 cell and would yield a result of -470 MW.
4. Pursuant to the changes according to #1 to 3, there is no need for capacity from industrial curtailment in F2039 and F2040 and the in-service date for the first wind project (PC 18) can be delayed by one year from F2039 to F2040.

Commission comments

The Panel confirms that the issues outlined above need to be corrected. By correcting them, we find that the rate impact (NPV) from the Illustrative Alternative Portfolio under the **low load case** is \$87 million lower, at \$3,147 million instead of \$3,234. There is no impact on the mid and high load cases as the issues affected only the low load case.

The tables and figure in the Executive Summary would read correctly as follows:

Corrected Table on p. 7 of the Executive Summary:

Scenario	Rate Impact (\$ million)			Unit Energy Cost (\$/MWh)	
	A. Illustrative Alternative Portfolio	B. Site C	Difference (A - B)	Illustrative Alternative Portfolio	Site C
Commission Assumptions	\$3,147	\$2,852	\$295	\$31	\$44

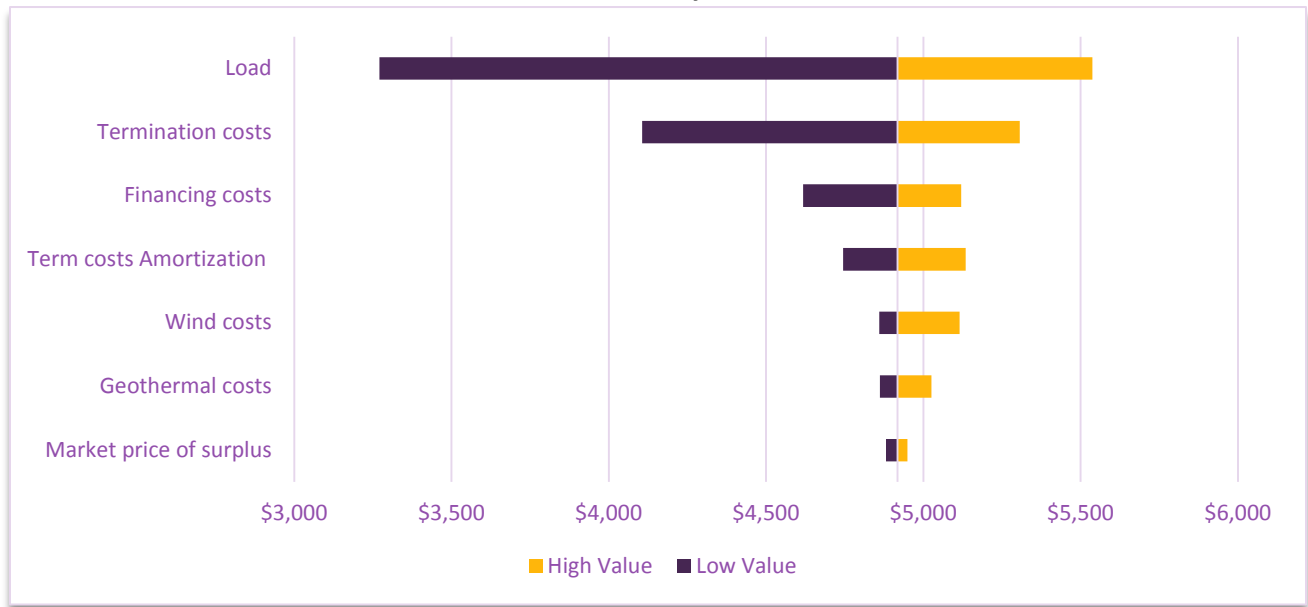
Finding: The Panel confirms there is no change to its finding that “[a]s can be seen in the table below, the cost to ratepayers of Site C and the Illustrative Alternative Portfolio are virtually equivalent, within the uncertainty inherent in the assumptions.”

Corrected Table on p. 15 of the Executive Summary:

Summary Results of the Illustrative Alternative Portfolio (2018\$)

	High Load Forecast	Medium Load Forecast	Low Load Forecast
Revised Alternative Portfolio composition	<ul style="list-style-type: none"> 441 MW of wind projects starting in F2025, 288MW in F2026 DSM initiatives (energy efficiency, optional time of use (TOU) rate, capacity focused DSM, industrial curtailment) 81 MW of geothermal projects starting in F2025 	<ul style="list-style-type: none"> 438 MW of wind projects starting between F2029 and F2031 DSM initiatives (energy efficiency, optional TOU rate, capacity focused DSM, industrial curtailment) 81 MW of geothermal projects starting in F2025 	<ul style="list-style-type: none"> 444 MW of wind projects starting between F2040 and F2041 DSM initiatives (energy efficiency, optional TOU rate, capacity focused DSM)
Rate Impact of portfolio	\$ 5,121 million	\$ 4,618 million	\$ 3,147 million

Corrected Illustrative Alternative Portfolio Rate Impact Sensitivity Analysis on p. 15 of the Executive Summary



Finding: The Panel confirms that the paragraph starting with “The graph shows” in the middle of page 16 should read: “The graph shows the cost to ratepayers of the Base Case described below, and variations around the base case. The Base Case is in the centre of the graph and is \$4.918 billion. Then, each variable is changed to a low or high value and the cost to ratepayers of that single change (while holding the other inputs constant) is shown. For example, if the Load forecast is changed to Low instead of Medium, the cost to ratepayers would be reduced by ~~\$1.558~~\$1.647 billion from \$4.918 billion to ~~\$3.36~~\$3.271 billion, while all the other inputs remained as defined in the Base Case.”

Corrected Site C Rate Impact Sensitivity Analysis on p. 16 of the Executive Summary



Finding: The Panel confirms there is no change to its finding that “For Site C, as seen in the graph above, the base case is completion costs of \$10 billion, BC Hydro’s mid load forecast and the Panel’s Mid C forecast assumptions. The inputs and assumptions that have the greatest impact on rates are the Site C total costs and the load forecast. The market price of surplus energy has much less impact on the costs to ratepayers.”

Corrected Sensitivity Analysis on page 17 of the Executive Summary

Scenarios	Rate Impact (\$'m)			Unit energy cost (\$/MWh)	
	A. Revised Illustrative Alternative Portfolio	B. Site C	Difference (A - B)	Revised Illustrative Alternative Portfolio	Site C
Commission Assumptions	\$3,147	\$2,852	\$295	\$31	\$44
Scenarios					
Medium load forecast	\$4,618	\$3,901	\$717	\$34	\$44
Medium load forecast + \$12 billion Site C cost	\$4,618	\$4,842	(\$224)	\$34	\$54
Low load forecast, \$12 billion Site C cost	\$3,147	\$3,793	(\$646)	\$31	\$54
Low load forecast + higher wind-geothermal financing	\$3,271	\$2,852	\$419	\$32	\$44
High load forecast	\$5,121	\$4,325	\$796	\$31	\$44
High load forecast, \$12 billion Site C cost	\$5,121	\$5,266	(\$145)	\$31	\$54

Findings: The Panel confirms there is no change to the paragraph introducing the sensitivity analysis: “The sensitivity analysis illustrates the effect of changing one input assumption at a time. To see the effect of changing more than one variable at a time, we provide a few sample scenario results below.”

The Panel also confirms there is no change to the paragraph immediately below the sensitivity analysis: “The Illustrative Alternative Portfolio indicates that it is possible to design an alternative portfolio of commercially feasible generating projects and demand-side management initiatives that could provide similar benefits to ratepayers as Site C.”

1.3 “Copy & Paste Error” in Table 43 (\$4.9 billion, -\$293 million)

Issue

In Table 43 in the Final Report, in the scenario “Medium load forecast + \$12 billion Site C cost”, Site C NPV should read \$4,911 million and the difference (-\$293 million).

Table 43: Summary of Sample Scenarios

Scenarios	Rate Impact (\$'m)			Unit energy cost (\$/MWh)	
	A. Revised Illustrative Alternative Portfolio	B. Site C	Difference (A - B)	Revised Illustrative Alternative Portfolio	Site C
Commission Assumptions	\$3,234	\$3,188	\$46	\$32	\$44
Scenarios					
Medium load forecast	\$4,618	\$3,969	\$649	\$34	\$44
Medium load forecast + \$12 billion Site C cost	\$4,618	\$4,129 <u>\$4,911</u>	\$489 <u>(\$293)</u>	\$34	\$54
Low load forecast, \$12 billion Site C cost	\$3,234	\$4,129	<u>(\$895)</u>	\$32	\$54
Low load forecast + higher wind-geothermal financing	\$3,360	\$3,188	\$172	\$33	\$44
High load forecast	\$5,121	\$4,325	\$796	\$31	\$44
High load forecast, \$12 billion Site C cost	\$5,121	\$5,266	<u>(\$145)</u>	\$31	\$54

Commission comments

The Panel confirms there was a copy and paste error in Table 43. The numbers should have been \$4,911 and (-\$293), therefore adding an additional scenario where the Alternative Portfolio is less expensive than Site C.

Finding: The Panel notes that these numbers are now outdated due to the need to correct the Mid C price forecast and the issues pertaining to the low load case in the Commission Illustrative Alternative Portfolio. The Panel also notes that the correction to Mid C price forecasts results in changes to a number of scenarios.

1.4 Other Corrected Tables and Figures in the Final Report

The following tables and figure in the Final Report would read correctly as follows:

Corrected table for Illustrative Alternative Portfolio Results (p. 165)

Summary Results of the Revised Illustrative Alternative Portfolios (2018\$)			
	High Load Forecast	Medium Load Forecast	Low Load Forecast
Revised Alternative Portfolio composition	<ul style="list-style-type: none"> 441 MW of wind projects starting in F2025, 288MW in F2026 DSM initiatives (energy efficiency, optional time of use (TOU) rate, capacity focused DSM, industrial curtailment) 81 MW of geothermal projects starting in F2025¹ 	<ul style="list-style-type: none"> 438 MW of wind projects starting between F2029 and F2031 DSM initiatives (energy efficiency, optional TOU rate, capacity focused DSM, industrial curtailment) 81 MW of geothermal projects starting in F2025² 	<ul style="list-style-type: none"> 444 MW of wind projects starting between F2039 F2040 and F2041 DSM initiatives (energy efficiency, optional TOU rate, capacity focused DSM, industrial curtailment)³
Rate Impact of portfolio⁴	\$ 5,121 million ⁵	\$ 4,618 million ⁶	\$ 3,234 3,147 million ⁷

Corrected Table 39: Cost to ratepayers and UEC of Site C (p. 167)

Output: Low LF - Alternative Portfolio	
A	Site C Termination Cost (F\$18) \$ 1,395 million
B	Alternative Portfolio Cost (F\$18) \$ 2,539 million
C	Surplus Energy Sale (F\$18) \$ (788) million
D	Total Rate Impact (A+B+C) \$ 3,147 million
E	Alt. Portfolio Volume (F18) 82,784
F	UEC (F\$18) (B/E) \$ 30.67 per MWh

¹ Appendix **HC** – Commission Illustrative Alternative Portfolio, Tab ‘High LF – portfolio’, with costs in Tab ‘High LF - portfolio costs’.

² Ibid, Tab ‘Med LF – portfolio’, with costs in Tab ‘Med LF - portfolio costs’.

³ Ibid, Tab ‘Low LF – portfolio’, with costs in Tab ‘Low LF - portfolio costs’.

⁴ Discount rate of 4% real, 6% nominal; export revenues valued at Panel’s Mid C Forecast (at plant gate location), Site C \$1.8 billion termination costs amortized over 30 years and assuming all resources are financed at BC Hydro’s financing rate.

⁵ Appendix **HC** – Commission Illustrative Alternative Portfolio, Tab ‘Input and Output’, Cell O26.

⁶ Ibid, Tab ‘Input and Output’, Cell O17.

⁷ Ibid., Tab ‘Input and Output’, Cell O8.

Corrected Table 40: Cost to ratepayers and UEC of Site C (p. 167)

Output: Low LF - Site C		
A	Sunk Costs (F\$18)	\$ 2,100 million
B	Site C Cost to Complete (F\$18)	\$ 4,391 million
C	Flexibility Credit (F\$18)	\$ (66) million
D	Surplus Energy Sales (F\$18)	\$ (1,473) million
E	Total Rate Impact (B+C+D)	\$ 2,852 million
F	Volume (F18)	98,993
G	UEC (F\$18) (B/F)	\$ 44.35 per MWh

Finding: The Panel confirms that the paragraph below Table 40 should read: “The comparison in the tables above show that the cost to ratepayers Illustrative Alternative Portfolio has a lower UEC than Site C (~~\$31.64~~30.67/MWh compared to \$44.35/MWh) but a cost to ratepayers slightly higher (~~\$3.234~~\$3.147 billion compared to ~~\$3.188~~ \$2.852 billion for Site C).”

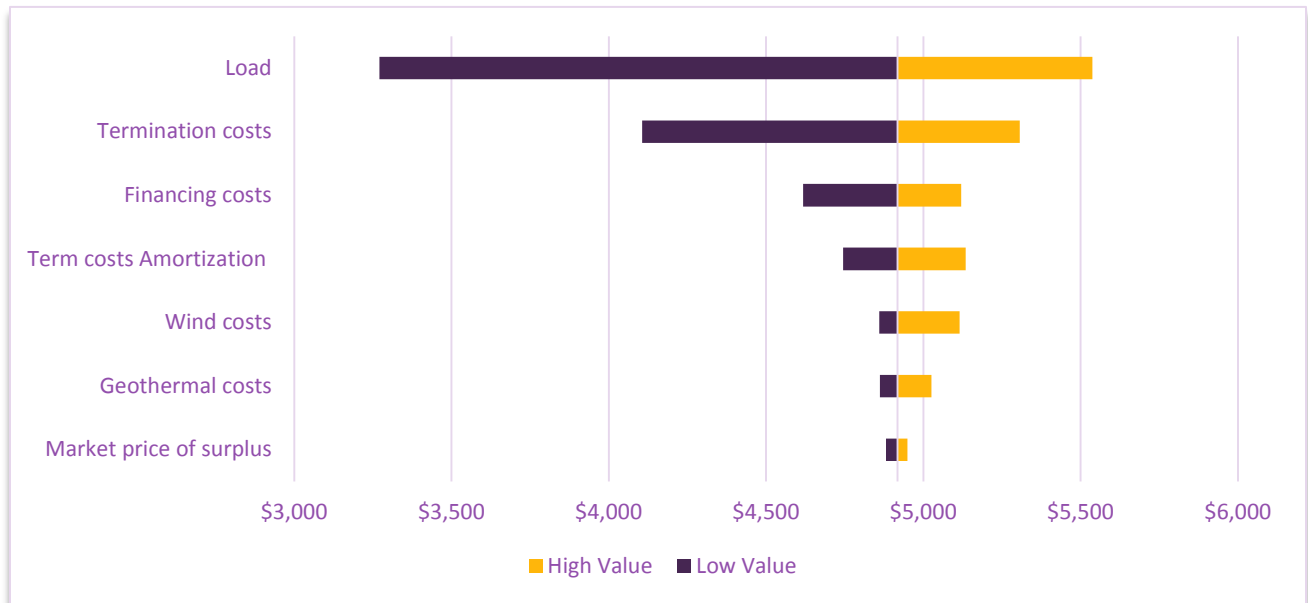
Corrected Table 41: Sensitivity Analysis of Illustrative Alternative Portfolio (p. 168)

Illustrative Alternative Portfolio Base Case Rate Impact: \$4,918 million

Input Variable	Low Value	Difference from Base Case	High Value	Difference from Base Case	Low Value	Base Case	High Value
Load	3,271	\$ (1,647)	5,537	619	Low LF	Med LF	High LF
Termination costs	4,106	\$ (812)	5,306	388	\$750 M	\$1,800 M	\$2,300 M
Financing costs	4,618	\$ (300)	5,120	202	BCH Financing for wind-geo, 3.4%	IPP Financing for wind-geo, 6.4%	IPP Financing for wind-geo, 8.4%
Termination costs amortization	4,745	\$ (173)	5,134	216	70 years	30 year	10 years
Wind costs	4,860	\$ (58)	5,115	197	Base case less 5.9% (CanWEA/CEAB C F104-3)	A-22 Assumption No. 13	Base case plus 20%
Geothermal costs	4,862	\$ (56)	5,025	107	CanGEA (F66-4)	NREL flash	NREL binary
Market price of surplus	4,881	\$ (37)	4,949	31	BC Hydro RRA	Panel Mid C	Panel Mid C ABBLow

Finding: The Panel confirms that the paragraph below Table 41 should read: “For example, if the Load is changed to Low instead of Medium, the cost to ratepayers would be reduced by ~~\$1.558~~\$1.647 billion from \$4.918 billion to ~~\$3.360~~\$3.271 billion, while all the other inputs remained as defined in the Base Case. This estimate of ~~\$3.360~~\$3.271 billion is higher than the Illustrative Alternative Portfolio result of ~~\$3.234~~\$3.147 billion as the base case in the table above uses IPP financing costs rather than BC Hydro financing costs. However, this analysis serves to illustrate how sensitive the PV cost to ratepayers analysis is to changes in key input assumptions.”

Corrected Figure 28: Illustrative Alternative Portfolio Cost to ratepayers Sensitivity (p. 169)



Finding: The Panel confirms that there is no change to its finding: “As can be seen in the graph above, the inputs and assumptions that have the greatest impact on the cost to ratepayers in the Illustrative Alternative Portfolio are the magnitude of the load and Site C termination costs. These are followed by the assumption regarding the financing of IPP projects and the length of the amortization period for the Site C termination

costs. The wind and geothermal energy capital and O&M costs, as well as the market price of surplus energy have the least impact on the results.”

Corrected Table 42: Sensitivity Analysis of Site C (p. 169)

Site C							
Base Case Rate Impact		\$ 3,901 million					
Input Variable	Low Value	Difference from Base Case	High Value	Difference from Base Case	Low Value	Base Case	High Value
Total Site C costs	\$ 3,383	\$ (518)	\$ 4,842	\$ 941	\$8,900 M	\$10,000 M	\$12,000 M
Load	\$ 2,852	\$ (1,049)	\$ 4,325	\$ 424	Low LF	Med LF	High LF
Market price of surplus	\$ 3,835	\$ (66)	\$ 3,962	\$ 61	BC Hydro RRA	Panel Mid C	Panel Mid C ABBLow

Corrected Figure 29: Site C Cost to ratepayers Sensitivity (p. 169)



Finding: The Panel confirms there is no change to its finding that: “For Site C, the inputs and assumptions that have the greatest impact on rates are the Site C total costs and the magnitude of the load. As with the Illustrative Alternative Portfolio, the market price of surplus energy has much less impact on the costs to ratepayers.”

Corrected Table 43: Summary of Sample Scenarios (p. 170)

Scenarios	Rate Impact (\$'m)			Unit energy cost (\$/MWh)	
	A. Revised Illustrative Alternative Portfolio ⁸	B. Site C ⁹	Difference (A - B)	Revised Illustrative Alternative Portfolio	Site C
Commission Assumptions ¹⁰	\$3,234 \$3,147	\$3,188 \$2,852	\$46 \$295	\$32 \$31	\$44
Scenarios¹¹					
Medium load forecast	\$4,618	\$3,969 \$3,901	\$649 \$717	\$34	\$44
Medium load forecast + \$12 billion Site C cost	\$4,618	\$4,129 \$4,842	\$489 (\$224)	\$34	\$54
Low load forecast, \$12 billion Site C cost	\$3,234 \$3,147	\$4,129 \$3,793	(\$895) (\$646)	\$32 \$31	\$54
Low load forecast + higher wind-geothermal financing	\$3,360 \$3,271	\$3,188 \$2,852	\$172 \$419	\$33 \$32	\$44
High load forecast	\$5,121	\$4,325	\$796	\$31	\$44
High load forecast, \$12 billion Site C cost	\$5,121	\$5,266	(\$145)	\$31	\$54

Finding: The Panel confirms that there is no change to the paragraph introducing the sensitivity analysis: “A summary of some sample scenarios is shown below.”

Corrected Figure 32: Cost of Site C to Ratepayers of a Zero-Load Growth (p. 172)

Output		
A	Sunk Costs (F\$18)	\$ 2,100 million
B	Site C Cost to Complete (F\$18)	\$ 4,391 million
C	Flexibility Credit (F\$18)	\$ (66) million
D	Surplus Energy Sales (F\$18)	\$ (3,861) million
E	Total Rate Impact (B+C+D)	\$ 464 million
F	Volume (F18)	98,993
G	UEC (F\$18) (B/F)	\$ 44.35 per MWh

⁸ Revised Illustrative Alternative Portfolio cost plus Site C termination costs minus exports revenues.

⁹ Site C cost to complete less flexibility credit and export revenues.

¹⁰ Low Load Forecast, Panel Mid C market electricity price forecast, Site C total costs of \$10 billion, \$1.8 billion in termination costs amortized over 30 years, and BC Hydro financing for all resources in the Revised Illustrative Alternative Portfolio.

¹¹ The ~~five-six~~ scenarios presented in this table start with using the “Commission Assumptions” and modifying one or two variables as described therein.

Finding: The Panel confirms that there is no change to the finding that “This illustrates that under current market value assumptions, not all of the costs of Site C would be recovered and that the surplus energy is therefore being sold “below cost.” However, if ratepayers need Site C energy, but don’t need it immediately, as with the low load forecast scenario and higher, surplus sales actually lower the cost to ratepayers of Site C.”