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October 2, 2017

BCUC INQUIRY RESPECTING SITE C	A-17

Sent via eFile

Re: British Columbia Hydro and Power Authority – British Columbia Utilities Commission Inquiry Respecting Site C – Project No. 1598922

On September 8, 2017, the British Columbia Utilities Commission (Commission) posted on its Site C Inquiry website two independent reports prepared by the consulting firm Deloitte LLP (documents A-8 and A-9). The Commission engaged Deloitte LLP to produce independent reports on the questions posed in section 3(b) of the terms of reference of Order in Council (OIC) No. 244.

On September 22, 2017, British Columbia Hydro and Power Authority (BC Hydro) filed a letter with the Commission stating that it is seeking clarity on some aspects of the Deloitte LLP report entitled "Site C – Alternative Resource Options and Load Forecast Assessment" (document A-9). BC Hydro identified four specific instances in the report with which it seeks clarification from Deloitte LLP. BC Hydro's September 22, 2017 letter is provided as document F1-3 in the Site C Inquiry.

On September 29, 2017, Deloitte LLP provided the attached response to BC Hydro's clarification request.

Sincerely,

Original signed by:

Patrick Wruck
Commission Secretary

Enclosure

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September 29, 2017

Mr. David Morton
Chair and CEO
British Columbia Utilities Commission
Suite 410, 900 Howe Street
Vancouver BC V6Z 2N3

Dear Mr. Morton

Subject: Response to questions posed by BC Hydro on September 22, 2017

The following response has been prepared by Deloitte LLP to questions posed by BC Hydro in a letter to Mr. Patrick Wruck of the Commission dated September 22, 2017.

Question 1 - The Deloitte report appears to overstate the upstream gas impacts in the event no LNG projects proceed. Specifically, some upstream gas production and processing facilities identified as LNG-dependent in BC Hydro's load forecast have been in operation for a number of years already and are expected to continue regardless of whether the downstream LNG export projects materialize. This results in an overstatement of the impact of a "no LNG" scenario by approximately 276 GWh/35 MW. We are wondering why Deloitte is assuming that the facilities would shut down after having been in operation independent of LNG development for some time, or whether this is an error?

Answer 1 - In projecting load requirements in the event that LNG Canada and Pacific NorthWest LNG are subtracted from the 2016 load forecast, Deloitte used estimates provided by BC Hydro on page 4 of its response number 141 to questions asked by Deloitte. Specifically, this response lists the upstream impacts associated with LNG Canada as 708 GWh in F2026 and 1,032 GWh in F2036. The upstream impacts associated with Pacific NorthWest LNG are listed as 84 GWh in F2026 and 89 GWh in F2036. The direct impacts associated with LNG Canada according to this response are 946 GWh in both F2026 and F2036.

Question 2 - We are unable to replicate both the capital and operating costs of alternative resources in Tables 1 and 2 of Appendix E of Deloitte Report No. 2 (pages 107-108) using Deloitte's stated assumptions for all of the resources listed except for hydro (note that costs of hydro updgrades *included are addressed in No. 4 below). For example, Figure 3 of Appendix E to Deloitte Report No. 2 shows geothermal capacity additions of ~95MW in 2028. Table 1 of Appendix E shows capital additions of $496 million. Based on Deloitte's figures, BC Hydro calculates the capacity cost of this year's additions to be $5,200/kW, which is substantially below Deloittes stated assumptions of $7,300/kW to $8,800/kW. Overall, Deloitte's capital and operating and maintenance expenditure figures appear to be roughly 25 per cent or more lower for each of these resources than when we calculated them using Deloitte's stated assumptions. The effect of this discrepancy to Deloitte's overall calculations of the cost of alternative resources appears to significantly understate the cost of alternative resources that BC Hydro would have to obtain in the event of termination of Site C by almost 25 per cent.*

Answer 2 - In reviewing the referenced Table 1, Table 2 and Figure 3 from Appendix E and comparing to the spreadsheets used to compile the results, the main driver of the difference of approximately 25% as identified by BC Hydro is due to a currency conversion issue. While labeled and intended to be in CAD, the reported numbers are actually USD. The core model is in USD and the inputs assumptions were converted from CAD to USD when setup. The output in the case of the two tables appears to have been taken in USD. Given the assumptions used, the conversion is 0.75 USD per CAD, so the values would be approximately 25% lower. There is also, in some cases, the contribution of declining capital costs over time which reflects an assumption about improving technology, etc. For example, geothermal capital costs for both tiers decline slightly each year resulting in about a 5% reduction by 2028 from the $7300 CAD/kW level.

The following tables with the currency conversion should replace those provided Appendix E:

Table 1: Capital costs (mn $CAD) by alternative resource type by year (2018-2036)

Year	Biogas	Biomass	Cogen-eration	Geo-thermal	Hydro	MSW	Gas	Solar	Wind	Total
2018	-	-	-	-	-	-	-	-	-	-
2019	-	-	-	-	8	-	-	-	-	8
2020	-	-	-	-	-	-	-	-	-	-
2021	-	-	-	-	51	-	-	-	-	51
2022	-	-	-	-	45	-	-	-	-	45
2023	-	-	-	-	52	-	-	-	-	52
2024	-	-	-	-	65	-	-	-	-	65
2025	-	-	-	-	-	-	-	-	-	-
2026	-	-	-	-	-	-	-	-	-	-
2027	-	-	-	244	96	-	-	-	-	339
2028	-	-	-	661	-	-	-	-	-	661
2029	27	-	-	836	-	-	-	-	-	863
2030	-	-	-	778	-	-	-	-	-	778
2031	-	-	-	593	-	-	-	-	-	593
2032	22	-	-	646	-	-	-	-	-	668
2033	-	-	-	806	-	-	-	-	-	806
2034	-	-	-	999	-	-	-	-	62	1,061
2035	-	-	-	1,101	-	-	-	-	160	1,261

2036	-	-	-	1,057	-	-	-	-	212	1,269

Table 2: O&M costs (mn $CAD) for new endogenous by resource type by year (2018-2036)

	Biogas New	Geothermal New	Hydro Expansions New	Onshore Wind Vancouver Island New	Total
2018	-	-	-	-	-
2019	-	-	1	-	1
2020	-	-	1	-	1
2021	-	-	1	-	1
2022	-	-	1	-	1
2023	-	-	2	-	2
2024	-	-	4	-	4
2025	-	-	4	-	4
2026	-	-	4	-	4
2027	-	7	14	-	21
2028	-	26	14	-	40
2029	1	50	14	-	65
2030	1	72	14	-	87
2031	1	89	14	-	104
2032	3	106	14	-	123
2033	3	126	14	-	143
2034	3	150	14	2	169
2035	3	177	14	9	203
2036	3	203	14	17	237

In addition, the last sentence in the opening paragraph in section 5.5.3. in Appendix E should be replaced with: Total annual capital costs from the development of new biogas, geothermal, hydroelectric, and wind facilities reach $1,269,000 by 2036, with annual O&M costs of $237,000.

Question 3 - The costs of alternative resources in Tables 1 and 2, Appendix E do not appear to include transmission, road and similar costs for capital costs (Table 1), and do not appear to include trade impacts or carbon tax in operations (Table 2). The significance of this issue is that, if these costs are omitted from the cost of alternative resources, the cost of alternative resources would be materially understated given these costs are reflected in the Site C project costs. This would materially affect the implications of termination of Site C, in terms of the additional resource costs BC Hydro would have to incur and makes for an apples-to-oranges comparison.

Answer 3 - While we don’t have explicit cost adders across the board (these are often extremely project-specific), we do incorporate some representation through tiering of costs. Our Tier 1 capacity uses “base” capital costs that were selected from a range of costs we identified for each technology.

The range depends on various things including what it might cost in one region vs. another. So the Tier 1 cost assumptions can be thought of as a generalized BC cost including that level of interconnection cost. The Tier 2 capacity (deployable after the Tier 1 limit is reached) faces a higher capital cost reflective of increasing costs for land access, interconnection, etc. This is also not perfect since the costs are still very project-specific, but it tries to address the issue to some extent. We don't think it is the case that NO interconnect costs are included unless one thinks the "base" capital cost is already very low for the technology itself.

As for the trade and carbon costs, we are not sure exactly what is meant by the trade costs. Carbon costs are included in the modeling, though the costs are not included in the O&M numbers. Just as some generation options are considered clean and others are not (and limited in total supply), the options are also considered emitters of GHGs or not. Those that are do face the carbon fee, though the amount added is not shown in the O&M numbers.

Question 4 - While we were able to replicate the costs in Table 1 of Deloitte's Appendix E for hydro upgrades using Deloitte's assumptions, when we looked at whether the attributed capacity (MW) and estimated costs were supported by the source documents, it appears Deloitte is relying on out-of-date or incorrect information. In essence, the use of this information resulted in Deloitte incorrectly concluding that (i) certain amounts of additional alternative capacity resources were available from existing facilities that are in fact not available based on more refined engineering work, and (ii) the cost of the capacity resources that are available being much cheaper than they actually are. In light of these issues, Deloitte's alternative portfolio would only provide 60 per cent of the hydro capacity identified in the first ten years of the forecast period (to 2027), and the cost of replacing this capacity would be higher. Specifically:

#	*BC Hydro's Response*	Deloitte response
1	*GM Shrum upgrades are included at 220MW and $71 million. Current studies put the potential output at 100MW and around $105 million, equivalent to a unit capacity cost of $66/kW-year (see page 45 of Appendix L of our Filing, for more information). As noted in our Filing, there are significant reliability risks associated for the outages that would be needed for this project.*	Submission date of the BC Hydro filling was August 30th (i.e., after our analysis was completed). We can revise these numbers if directed by BCUC to so.
2	*Seven Mile upgrades are included at 32MW and $100 million. This appears to utilize outdated information for capacity, and cost data for a different project. Our current studies put the potential output at 48MW for $137 million (see page 499 Appendix L of our Filing).*	Submission date of the BC Hydro filling was August 30th (i.e., after our analysis was completed). We can revise these numbers if directed by BCUC to so.
3	*While not included in the list of BC Hydro upgrades, based on the total cost and capacity of hydro upgrades in Deloitte's portfolio, it appears that the Strathcona project has been included in Deloitte's*	The Strathcona project is identified as a Resource Smart project in the Integrated Resource Plan (Table 3-25). Further the Facility Asset Plan identifies a potential rebuild of the Strathcona powerhouse to address seismic

	portfolio of alternatives. There are dam safety concerns at Strathcona that are expected to require relocating the existing powerhouse, which would make the option of adding an extra unit to the existing powerhouse no longer feasible. As such, the inclusion of Strathcona and further, the use of Revelstoke 6 unit cost as a proxy for Strathcona unit additions, is inappropriate.	concerns. Our analysis assume that additional capacity will be available in both situation if the existing powerhouse is expanded or if it is rebuilt. Where costs have not been estimated by BC Hydro, Deloitte has provided order of magnitude cost estimates using BC Hydro's historic Projects. These order of magnitude estimates are of the AACE Class 5 range (+100% to -30%).
4	*The use of the $/MW cost from Reveltstoke 6 to estimate the cost of Ladore is also inappropriate. Hydro upgrades are site specific, and Revelstoke 6 is the cheapest non-Site C capacity option available (on a unit cost basis). Assuming this unit cost will apply to other projects would incorrectly understate costs of those other projects.*	Where costs have not been estimated by BC Hydro Deloitte has provided order of magnitude cost estimates using BC Hydro's historic Projects. These order of magnitude estimates are of the AACE Class 5 range (+100% to -30%).
5	*Similarly, the use of the $/MW cost from Ash River to estimate the cost of Shuswap is inappropriate. Hydro upgrades are site specific, and what applies at Ash River may not apply at Shuswap. In addition, Deloitte states in its report that costs at Ash River are, in-turn, based on the costs at Strathcona. As mentioned above, there are dam concerns about Strathcona project which would impact the resulting project costs.*	Where costs have not been estimated by BC Hydro Deloitte has provided order of magnitude cost estimates using BC Hydro's historic Projects. These order of magnitude estimates are of the AACE Class 5 range (+100% to -30%).

Please advise the Deloitte point of contact for the Site C Review Team should any further clarification be necessary.

Again, we would like to express our appreciation for the cooperation and assistance provided by BCUC, and BC Hydro during this review.

Yours sincerely,

Deloitte LLP

Deloitte LLP