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MEMORANDUM

To: Jim Quail
From: Marvin Shaffer
Date: November 15, 2017
Re: BCUC Site C Report

The terms of reference for the review of the Site C project called on the BC Utilities Commission (BCUC) to advise on whether the project is on time and on budget, what would be the costs to ratepayers of suspending or terminating the project, and whether there are alternative portfolios of projects and measures that could provide similar benefits at similar or lower cost.

Project Schedule

The BCUC agreed that Site C is currently on schedule to be completed by November 2024 but found that there are tension crack, river diversion and other risks that could result in delay. It concluded the November 2024 in-service date will most likely not be achieved.

A delay in the in-service date will pose no operational problem for BC Hydro. Even under BC Hydro's medium requirements forecast (which the BCUC concluded is too high), BC Hydro will not need any of the 5100 Gwh of energy Site C will produce until 2028. It is forecasting a shortfall of peak generating capacity by 2023, but BC Hydro has access to the downstream benefits under the Columbia River Treaty and other contingency resources that it could use to meet peak capacity requirements until Site C comes on stream.

The main issue with delay is that it adds to the installed cost of completing the project and delays the recovery of any of those costs through surplus sales.

Project Cost

Deloitte Management (technical consultants to the BCUC) estimated that a one year delay in the schedule would increase the cost of Site C to between \$9.1 and \$10 billion. Based on its expectation of some delay plus consideration of other uncertainties in the work remaining to be done, the BCUC concluded that the total cost of Site C will increase from the current estimate of \$8.9 billion to \$10 billion or more.

The BCUC used \$10 billion in its analysis comparing the present value costs of Site C with its illustrative alternative portfolio of projects. This presumably reflects a P90 value, which the BCUC said is an appropriate basis to estimate costs. A P90 value is the estimate which there is a 90% probability of achieving.

It is important to note that the arguably very appropriate use of a conservative P90 value for Site C cost was not followed even in an approximate way for the alternative portfolio of projects BCUC used to compare to Site C.

- *DSM:- Demand side management measures are a major component of BCUC's alternative portfolio. However, BCUC did not undertake any assessment of the uncertainty and risks this resource entails and range of costs that could result. It certainly did not provide any P90 estimates comparable to what BCUC recommended for Site C.*

This is not just a general methodological concern. In its assessment of BC Hydro's load forecast, the BCUC commented on the confounding of the impact of rising prices on electricity requirements versus the impact of DSM programs. Given that BCUC concluded that a low load forecast should be assumed in part because of the effect of rising prices, it is not clear to what extent the price-induced reductions in demand will diminish what can further be achieved with DSM programs. Moreover, there are well documented econometric and other studies that suggest the costs of DSM programs per MWh of demand actually reduced are much higher than the estimates utilities typically calculate based on program participation rates. A key issue is distinguishing program impacts from what would otherwise be done at some point even without the program.

With respect to peak requirements, the Commission noted in its report that a major difference between its illustrative portfolio analysis and the portfolio modelling done by BC Hydro and its own technical consultants was the reliance to a very large degree on capacity-targeted DSM to meet shortfalls. Despite the concerns BC Hydro raised about the effectiveness of those programs, and in some cases the absence of a policy framework at this time that would be needed to implement the measures, the BCUC again provided no assessment of the uncertainty and risks, the range of costs these measures could entail and what P90-comparable estimates should be used.

The DSM estimates are not comparable to what the BCUC estimated for Site C in another very important respect. The BCUC only included the costs it estimated BC Hydro would incur to encourage customers to conserve energy or shift demand to off-peak periods. It did not include the often much larger costs that customers themselves would incur. Its analysis would include, for example, the cost of incentives BC Hydro might offer to encourage customers to purchase more efficient lighting or other electric appliances, but not the amount customers would still have to pay themselves to purchase the more efficient lights or appliances.

The BCUC justified this saying it only included costs that would impact revenue requirements and be recovered in rates. But that is clearly incorrect when trying to assess and compare the full consequences for customers of demand versus supply side measures. It is not only impacts on revenue requirements but also on other expenditures customers incur that must be taken into account.

- *Wind:- Wind is the main supply side alternative in the BCUC's alternative portfolio. The estimates BCUC used are very rough, extrapolating from experience in other jurisdictions and making a number of at best uncertain and in some cases very optimistic assumptions. As with DSM, no risk analysis and range or P90-comparable estimate was provided.*

In its modelling, the BCUC effectively assumed all of the wind projects would be developed by BC Hydro. The costs are developed from capital and operating cost estimates under the assumption the required capital would be financed 100% at BC Hydro's borrowing rate. It did not make any effort to estimate what bid prices would be if, as is quite likely, the wind projects were developed by independent power producers (IPPs).¹

IPP bid prices would incorporate the higher cost of capital private developers face. As well one could not assume, as the BCUC did, that wind projects could be refurbished and available to BC Hydro in the future at 30% less than the cost of a new project. The price BC Hydro would pay for contract renewals at refurbished sites would depend on competitive market conditions at that time.

The BCUC also took a very rough and optimistic approach in its estimate of wind integration costs, the cost of the back-up BC Hydro must provide because of the intermittent nature of wind supply. The BCUC assumed an integration cost of \$1/MWh seemingly based on one outlier estimate in a range of costs provided for other jurisdictions. This cost estimate was one-fifth of what BC Hydro submitted and 60% less than the Commission staff itself had put forward for comment.

- *Geothermal:- When analyzing medium and high load growth cases, BCUC includes 81 MW of geothermal capacity. It explicitly recognized that geothermal may not be commercially viable in British Columbia, but justified its inclusion of geothermal supply saying; "on the balance of probabilities there is a likelihood that some commercial viability may be obtained".² That may be*

¹ The BCUC effectively assumed all wind would be developed by BC Hydro to provide what it considered to be an 'apples to apples' comparison to Site C. Aside from the fact it made no effort to provide comparable ('apples to apples') quality of estimates, the point is that assuming BC Hydro development and financing of all wind projects does not indicate what BCUC was asked to advise on – the likely impacts on ratepayers.

² BCUC Final Report, Appendix A, p.19.

true, but it is important to recognize the speculative nature of this alternative and its cost as compared to what is known and what the BCUC has conservatively assumed about Site C.

Load Forecast and Value of Surplus Sales

The BCUC analyzed BC Hydro's load forecast and resource balance to assess the timing of the need for more resources in the province. Whereas BC Hydro submitted that it would need additional peak capacity by 2023 and additional energy by 2028 based on its mid-range load forecast, the Commission concluded that additional capacity and energy would not be needed for many years after that. It concluded that BC Hydro's mid range forecast was too optimistic and that its low forecast should be used in comparing Site C to alternative portfolios. It also decided that Revelstoke 6 should be assumed to be developed in the mid 2020's so as not to exaggerate the shortfall of capacity BC Hydro would have without Site C.

As for electrification policies and trends in response to aggressive GHG reduction targets, the BCUC took a conservative stance: "Given the uncertainty, the Panel finds additional load required for potential electrification initiatives should not be included in BC Hydro's load forecast for the purpose of resource planning".³

The BCUC's load forecast and resource balance assumptions result in Site C being surplus to requirements for many years after its 2024 or even delayed in-service date. A critically important issue for ratepayer impact is consequently what revenues BC Hydro can realize from surplus sales. Consistent with its other assumptions about Site C, BCUC took a very conservative approach.

The panel rejected the spot market price forecast trading experts from BC Hydro provided and the even higher forecast of its own technical consultants (Deloitte). Based on low current prices it adopted a lower price forecast over the entire period there would be surplus from Site C available for sale. It also decided not to assign any premium to the market value in light of the dispatchability of Site C power, the storage-related trading potential it offers in conjunction with the upstream Williston reservoir and the surplus dependable peak capacity it would have. The only premium the BCUC included for Site C surplus over its conservative spot market price was a \$1/MWh charge for wind integration services it assumed BC Hydro could sell if not needed in British Columbia, a premium that would yield some \$3 million per year.

Taken together, the BCUC's findings on load growth and the value of surplus sales serve to minimize the value of proceeding with Site C and therefore to maximize the rate impact it will have. While there is undoubtedly considerable uncertainty about future load growth, the assumptions BCUC made about the value of surplus sales are contrary to the advice of trading experts and its own consultants, and completely ignore the strategic value of a dispatchable hydro resource like Site C, something most

³ BCUC Final Report, p.81

experts forecast will be increasingly important the more intermittent resources are added in neighbouring jurisdictions.

It is also important to note that the BCUC did not consider the market potential in Alberta, which in the short term will need energy to replace coal-fired generation and in the medium term will need dependable peak generating capacity to complement its planned expansion of wind and other intermittent renewable sources of supply.

Finally and very importantly, the BCUC completely ignored the impact that Site C surplus would have in reducing GHG emissions from thermal power production in Alberta or elsewhere – the most likely source of supply it would displace. Depending on emerging carbon tax or equivalent policies, that could directly increase the value of surplus sales exports. A \$50/tonne tax could add \$20-\$45/Mwh to surplus sales prices – almost equal to or more than the total price BCUC assumed for surplus sales. At a minimum, the impact of Site C surplus on thermal power production and GHG emissions is a critically important social value the BCUC’s report did not take into account.

Rate Impact Analysis

In order to assess whether there is an alternative portfolio of projects that could meet BC Hydro requirements at similar or lower cost for ratepayers, BCUC calculated the present value costs (the revenue requirements that must be recovered from customers) associated with the development of Site C as compared to the present value costs of its illustrative alternative portfolio of DSM, wind and geothermal resources (the latter in the mid and high load growth cases only). The present value costs are the discounted sum of BCUC’s assumed capital plus operating expenses less surplus sales revenues in both development scenarios.

The results, based on a ‘Commission set of assumptions’ are shown in Tables 39 and 40 of the report (p.167). These assumptions include: BC Hydro’s low load forecast; the Panel’s low surplus sales price forecast; Site C costs rising to \$10 billion; termination costs of \$1.8 billion; and BC Hydro financing for all wind or and other resources in the alternative portfolio. With these assumptions the present value costs [shown in the Final Report](#), excluding sunk costs in both cases, are roughly the same: \$3.188 billion for completion of Site C and \$46 million more -- \$3.234 billion -- for the illustrative scenario. [After correcting for errors in the surplus sales calculations, the BCUC reported a somewhat larger difference \(\\$295 million\) favouring Site C.](#)⁴

A number of sensitivity test results are shown in Table 43 (p.170). All but one of the results (correcting for the errors in the numbers shown for the alternative portfolio in the high load growth case) show a greater cost advantage for Site C (most notably assuming anything higher than BC Hydro’s low load growth). The only case where the alternative

⁴ [BCUC, Report Errata, November 16, 2017, p.2.](#)

portfolio exhibits lower costs is if Site C costs rise to \$12.5 billion and the load growth remains at the low forecast.

Based on its assumptions and calculations the Commission concluded that the costs of completing Site C or pursuing its alternative portfolio are roughly the same. There would be a cost advantage to completion of Site C if load grows more rapidly than the Commission assumed and a cost advantage to the alternative portfolio if Site C costs escalate higher than \$10 billion.

It is important to note, however, that BCUC reached this conclusion based on a manifestly unbalanced set of assumption and an incomplete assessment of costs for its alternative portfolio. It also failed to address the markedly different timing and more immediate challenge of the rate impacts in its alternative portfolio as compared to the completion of Site C.

- ***Lack of balance in assumptions:*** *BCUC concluded that conservative assumptions should be made in respect of the Site C completion scenario. As discussed above, it concluded that a P90 estimate of the remaining costs to complete Site C -- \$10 billion – should be used, adding over \$1 billion to BC Hydro’s latest cost estimate. It concluded it should adopt a low load growth forecast and ignored electricification policies and trends due to the uncertainty surrounding them at this time. It then assigned a lower value to Site C surplus sales than trading experts and its own technical consultants forecast. Further, it ignored the value that Site C can realize from storage and the dispatchability of its production, and it ignored the important social and potential market value surplus sales from Site C will realize by displacing thermal power production and reducing GHG emissions in other jurisdictions.*

At the same time, while BCUC utilized a P90 estimate in respect of termination costs, it made a number of very questionable and arguably optimistic assumptions about the costs of the measures in its alternative portfolio. It did not address or make any adjustment for the uncertainty in impacts and per unit costs of DSM measures; it did not attempt to estimate the bid prices that BC Hydro would face if it acquired wind energy from IPPs; it used a very low estimate of wind integration costs; and it incorporated geothermal resources in the mid and high load growth cases even though it acknowledged that it is not certain this resource will in fact be commercially viable in BC.

All of this served to maximize the BCUC’s cost estimate for Site C and minimize its cost estimate for the alternative portfolio.

- ***Incomplete assessment of costs:*** *The BCUC did not include all of the costs customers and BC Hydro would incur with its alternative portfolio. As noted earlier in this memo, it improperly excluded what in many cases can be the largest component of DSM costs – the costs that customers themselves incur to reduce requirements or to shift demand to off-peak periods.*

Also, in determining the shortfalls in peak generation capacity BC Hydro would face without Site C, the BCUC assumed that Revelstoke 6 would be developed in the mid 2020's. However, nowhere in its spreadsheets does it report the costs of developing Revelstoke 6 – a project that would cost some \$500 million – more in 2018\$. The availability of Revelstoke reduces the need for other capacity oriented measures in alternative portfolio. The BCUC analysis captures the benefit of Revelstoke 6 for this portfolio but not the costs.

- ***Timing of rate impacts:*** *The BCUC relied on its calculation of present value costs over a 70 year period to assess the consequences for customers of completing Site C versus pursuing its alternative portfolio. While this is an appropriate criterion to compare long term consequences, it says nothing about the different timing of the costs (BC Hydro revenue requirements) and rate impacts.*

There are in fact major differences in the timing of the costs and rate impacts in the Site C completion versus alternative portfolio scenarios, but the BCUC did not address them. Most importantly, it did not address the timeframe over which the some \$4 billion of sunk and termination costs would be recovered.

If Site C is completed there would be no termination costs and the sunk costs would properly be recovered over the expected economic life of the asset. Distant future as well as current customers would share in this cost because they share in the benefits it offers. If Site C is abandoned, however, there would be no justification for recovering the termination and sunk costs over anything other than a short period. Deferring cost recovery would simply add to (almost double) the rate smoothing and other regulatory accounts that most analysts believe are already far too high. It would impose an unfair burden on future customers.

An analysis of the annual cost and rate impacts in both scenarios, assuming cost recovery in accordance with standard utility regulation principles, is missing from the BCUC report. If done it would point to a very significant and immediate adverse consequence of terminating the project at this time.⁵

⁵ It would also increase the present value advantage of completing Site C as compared to the alternative portfolio. As shown in Figure 26, p.164, the present value cost of the recovery of sunk (and termination) costs is higher the shorter the amortization period.

The BCUC noted one could argue that perhaps government should absorb these costs. But even if that were done it would not change the magnitude of the impact, just the manner in which BC residents would be affected. It would shift the burden of the recovery of the termination and sunk costs to taxpayers as opposed to ratepayers. There would be differences in the extent to which individual families and businesses would be affected but the impact overall would be the same.

Concluding Comments

The main issue with Site C has never been whether it is an attractive electricity supply resource. Operating in conjunction with the upstream Williston reservoir, it is a cost-effective and strategically valuable resource. As the Joint Review Panel concluded:

Despite high initial costs and some uncertainty about when the power would be needed, the Project would provide a large and long-term increment of firm energy and capacity at a price that would benefit future generations ... and provide a foundation for the integration of other renewable low carbon sources as the need arises.⁶

From an electricity resource planning perspective, the issue with Site C hasn't been whether, but when.

It is widely recognized that Site C should not have been started when it was. With considerable uncertainty over the load growth forecast, and DSM opportunities that could further delay the need for Site C energy and capacity, the start of construction on Site C could and likely should have been delayed a number of years. But circumstances are different now that over \$2 billion has been spent and another near \$2 billion would have to be spent to terminate the project at this time.

There is no case in the BCUC report that ratepayers would be better off to abandon the Site C project at this time. One needs an unbalanced and incomplete costing of the alternatives just to conclude an alternative portfolio would be close in cost. And as for suspending and restarting at a time that would have been more attractive before construction had commenced, the BCUC is very clear. It is the worst of the options available to the government.

Unless the government takes the position that Site C should be abandoned now and forever for environmental, First Nations or other such reasons, the best course of action at this time is to continue to complete the project, taking whatever steps are necessary to minimize remaining costs, maximize the value of the surplus Site C will inevitably produce and address as best as possible the issues that First

⁶ Report of the Joint Review Panel, Site C Clean Energy Project, May 1, p.(iv).

Nations and local residents have in respect of the unavoidable impacts the project will have.