Site C Inquiry: Presentation to Commission Panel

Chris O’Riley, Randy Reimann, Tom Bechard, Andrew Watson, Mike Savidant

October 14, 2017
Introduction
Presentation Agenda

- Introduction (Chris O’Riley)
- Current Status of Site C (Chris O’Riley)
- Load Forecast (Randy Reimann)
- Site C Is the Least Cost Option in Every Scenario (Randy Reimann)
- Opportunities to Sell Energy and Capacity (Tom Bechard)
- Concluding Remarks (Chris O’Riley)
Completing Site C is Best for Ratepayers

• Site C is unmatched by any other portfolio of resource alternatives in terms of cost, risk and promoting a clean energy future:
  • Provides a long-term source of energy and dependable capacity
  • Is progressively cheaper for ratepayers over time
  • Has the lowest GHG emissions, facilitates the integration of intermittent renewables, and supports low carbon electrification
Completing Site C is Best for Ratepayers

1. Site C is the Lowest Cost Option

• Ratepayers are $7 billion (PV) better off completing Site C than terminating:
  • terminating means ratepayers would pay $3.2 billion with no electricity to show for it
  • alternative resources to replace Site C are higher cost
• Ratepayers are still better off with Site C under all 60+ different scenarios provided in our materials.
Completing Site C is Best for Ratepayers

2. Site C is the Lowest Risk Option

- Alternative resource projects would face risks that have already been addressed for Site C.
- Deloitte and BC Hydro termination / suspension cost estimates exceed $1 billion with an estimating range of -35%/+100% (meaning costs could be much higher).
- The alternative resource portfolios in the Preliminary Report and October 11th Letter rely on low probability / high risk assumptions.
Completing Site C is Best for Ratepayers

3. Site C Delivers a Clean Future

- We need clean energy and capacity to serve our customers.
- Site C supplies firm energy and dependable capacity and facilitates integration of intermittent clean and renewable resources.
- The move to a low carbon economy will require Site C and other clean resources.
- Site C has the lowest GHG emissions per unit of energy of any generation resource option.
Site C: Progress to Date Has Reduced Ratepayer Risk

- We are two years into construction and will have spent $2.1 billion by December 2017.

- Milestones reached have reduced many project risks:
  - Environmental assessment approvals and other key permits are in place and upheld by courts
  - Lengthy and meaningful consultation with Aboriginal groups also upheld by courts
  - Many key contracts in place
  - Construction is well underway
Site C Schedule and Costs

Site C remains on schedule for 2024, at additional cost

- We have postponed river diversion to 2020.
- We remain on schedule to complete Site C by November 2024.
  - Having one year of schedule “float” allows us to accommodate postponement of river diversion.
- We estimate the cost impact of river diversion postponement to be $610 million, an increase of 7.3% of project costs.
- There are residual Project risks, but we have resources and processes in place to manage them, including available contingency.
## Site C: Postponement Implications

<table>
<thead>
<tr>
<th>Scope of Work</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCW River Diversion</td>
<td>Delay one year to Sept 2020</td>
</tr>
<tr>
<td>Stage 1 cofferdam</td>
<td>No change – Right-bank complete, left-bank expected completion by end of October 2017</td>
</tr>
<tr>
<td>Left Bank MCW challenges</td>
<td>Postponement of diversion reduces schedule pressure</td>
</tr>
<tr>
<td>Right Bank MCW challenges</td>
<td>Postponement of diversion reduces schedule pressure</td>
</tr>
<tr>
<td>Construction Bridges, Worker Accommodation, Site Preparation</td>
<td>No change – work complete</td>
</tr>
<tr>
<td>Turbines &amp; Generator, Generating Station and Spillways, Transmission, Site C Substation</td>
<td>Project milestones will be adjusted to match revisions to overall project schedule.</td>
</tr>
<tr>
<td>Highway 29 realignment</td>
<td>MoTI action to develop alternative to new highway by 2019</td>
</tr>
</tbody>
</table>
Load Forecast
We Need Site C Under Each Load Scenario
Load Forecast context

Historic load (not weather adjusted)
Our Load Forecast Is Robust and Well-Supported

- Our Residential, Commercial and Light Industrial Sectors – two-thirds of our load – are steady and increasing.
- Large industrial is the major source of variance.
Low Carbon Electrification is a Fundamental Change

![Graph showing energy usage over fiscal years]

- **Load Forecast Range**
- **BC Hydro Current Forecast**
- **Deloitte Load Forecast**
- **Electrification**

**Fiscal Year**
(year ending Mar 31)
Site C Is Least Cost Option in Every Scenario
Scenario Analysis: Key Findings

- We ran 60+ scenarios in our materials, including in response to Commission requests.

- Site C is lowest cost in each of, and all combinations of, scenarios with:
  
  (i) cost overruns on Site C;

  (ii) low load growth; and

  (iii) highly optimistic cost assumptions regarding alternatives.
Portfolios vs. UECs & Double Counting

- BC Hydro believes that full portfolio analysis must be used to account for resource timing, characteristics, surpluses and market value.
- UECs are limited in their ability to accurately reflect future costs.
- The issue of adjustments only arises out of an attempt to overcome UEC shortcomings.
- There is no double counting of capacity with the UEC adjusters.
- BC Hydro has provided portfolio UECs to be responsive to the Commission.
Site C Still Better in Low Probability, High Risk Scenario

- Site C is still the most cost-effective option by a wide margin even in the unlikely scenario of
  - +50% Project cost overrun scenario, plus
  - Low load growth
  - Highly optimistic assumptions of the future cost of alternative resource options
- Given Site C’s long life, mix of energy and capacity, and the substantial sunk and termination costs, we are unable to find a credible scenario in which termination makes sense.
**Site C Net Benefits**

Every scenario shows Site C is the least cost option.
Why are Site C portfolios consistently better for ratepayers?

Key factors favouring Site C:

- Site C is a long life asset whose value increases over time.
- Ratepayers would incur $3.2 billion just to stop the Project and render the site safe and environmentally sound.
- Alternative resources are more expensive.

In this context, finding a scenario where Site C no longer makes sense would require assumptions with low probability of occurrence and ignoring the longer-term benefits of Site C.
Commission Sensitivities Are Low Probability, High Risk

• Resource planning should be done based on reasonable assumptions about what ratepayers will actually pay.

• Relying on low probability assumptions in system planning is bad practice and imposes cost risk on ratepayers.
### Commission Portfolio Sensitivities Are Low Probability, High Risk

Making planning decisions based on these assumptions would impose significant cost risk.

<table>
<thead>
<tr>
<th>Assumption</th>
<th>In other words...</th>
<th>Probability/Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assume BC Hydro cost of debt for all projects</td>
<td>BCH, not IPPs, builds all resources</td>
<td>Low probability / high cost risk. At odds with current model</td>
</tr>
<tr>
<td>Assume 200MW of geothermal by 2036</td>
<td>Assume that BCH (not IPP) exploration is successful, despite previous costly failures by BCH and others</td>
<td>Low probability / high availability risk</td>
</tr>
<tr>
<td>50% cost overrun on Site C</td>
<td>Deloitte’s high cost scenario (miss river diversion plus extensive other major issues)</td>
<td>Low probability</td>
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**Commission Portfolio Sensitivities Are Low Probability, High Risk**

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<td>Wind cost declines of 30% by 2030, 45% by 2045</td>
<td>These declines are below the forecast median price reduction</td>
<td>Significant uncertainty /higher ratepayer costs</td>
</tr>
<tr>
<td>Solar cost declines of 60% by 2040</td>
<td>These declines are below the forecast median price reduction</td>
<td>Significant uncertainty /higher ratepayer costs</td>
</tr>
<tr>
<td>Battery declines of 50% by 2040</td>
<td>Assume a largely speculative cost decline for new technology</td>
<td>Significant uncertainty /higher ratepayer costs</td>
</tr>
<tr>
<td>Upgrades to BC Hydro facilities</td>
<td>Advancing facility refurbishments ahead of plan</td>
<td>System outage planning and cost risks</td>
</tr>
<tr>
<td>Biomass increased availability</td>
<td>Assuming more low-cost fibre is available</td>
<td>Cost and capacity shortfall risks</td>
</tr>
</tbody>
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## Risk Assessment

The Commission Portfolio Sensitivities have significant relative risks

<table>
<thead>
<tr>
<th>Portfolio</th>
<th>Site C Portfolio</th>
<th>BC Hydro Alternatives (Wind, Pumped Storage)</th>
<th>Commission Portfolio Sensitivities (Wind, biomass, pumped storage with larger cost declines)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developer/Finance</td>
<td>BC Hydro builds and finances Site C</td>
<td>IPPs build and finance alternative resources (excl. BCH upgrades)</td>
<td>BC Hydro builds and finances all alternative resources</td>
</tr>
</tbody>
</table>

### Risk Assessment

<table>
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<tr>
<th>Risk Category</th>
<th>Site C Portfolio</th>
<th>BC Hydro Alternatives (Wind, Pumped Storage)</th>
<th>Commission Portfolio Sensitivities (Wind, biomass, pumped storage with larger cost declines)</th>
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</thead>
<tbody>
<tr>
<td>Availability Risks</td>
<td>Very Low</td>
<td>Low to Moderate</td>
<td>Low to Moderate</td>
</tr>
<tr>
<td>Procurement Risks</td>
<td>Low</td>
<td>Moderate</td>
<td>High</td>
</tr>
<tr>
<td>Design/Permitting/Construction</td>
<td>Moderate</td>
<td>Low to Moderate</td>
<td>High</td>
</tr>
<tr>
<td>Operations</td>
<td>Very Low</td>
<td>Low</td>
<td>Low to Moderate</td>
</tr>
<tr>
<td>Expiry Risk</td>
<td>Very Low</td>
<td>Moderate</td>
<td>Undetermined</td>
</tr>
<tr>
<td>Impact of Load Variance</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
</tbody>
</table>
Review of October 11th BCUC Scenario

- The October 11th scenario makes implicit and explicit assumptions that are unrealistic, including:
  1. Treats DSM as an alternative when it is included in all portfolios (this effectively assumes we cease DSM if we build Site C)
  2. BC Hydro builds and finances all alternative resources
  3. Battery costs are low
  4. Optional time-of-use estimates are dated with significant deliverability risk
  5. Wind cost declines are optimistic
1a. Resources common to both portfolios are not alternatives

Site C only changes DSM timing – not whether it occurs

- October 11\textsuperscript{th} BCUC scenario does not recognize that some resources are acquired with or without Site C and are not alternatives.
  - BC Hydro expects to get to IRP DSM levels (Option 2) with or without Site C, only timing differs between portfolios.

- Accounting for resources that will be built anyway means that you need additional resources later to fill that gap.

- Not accounting for the cost of filling this gap understates the cost of the October 11\textsuperscript{th} BCUC scenario.

- This is a short-term view and Site C is a long-term asset.
1b. Resources common to both portfolios are not alternatives

Over 30 years the main difference between portfolios is IPPs and pumped storage

Site C Is Least Cost Option in Every Scenario
1c. BC Hydro is continuing with DSM

Oct 11 scenario assumes DSM is an alternative, when we are doing it with or without Site C.
2. IPPs will build alternative resources

It is not BC Hydro’s core competency to develop and finance alternative resources

- For decades, IPPs have been building run-of-river, wind and biomass resources in B.C. and worldwide.
- There is a reason for this:
  - Resource exploration and development is well-suited to their ability to finance and absorb risk.
  - This work is their specialty, not ours.
- If BC Hydro builds IPP resources, we will hold substantially greater risk associated with construction and operations.
- IPPs already own the rights to many resource sites, and are unlikely to sell these sites without some of their expected return on equity.
3. Battery costs are low

- Battery capital cost appears to have captured balance of system and is missing the battery costs and the power conversion system.
- Battery systems do have operating losses and BC Hydro understands this to be about 7% and these do not appear to have been included, and
- Cost declines of batteries are aggressive.
4. Optional time-of-use estimates are dated with significant deliverability risk

Unlikely to produce 430 MW of capacity

- 430 MW estimate from draft 2012 IRP is outdated
- Current assessment is ~120MW of savings from optional TOU rates
  - Included in the “BC Hydro Optimistic Portfolio Sensitivity”
- There is considerable uncertainty and delivery risk
4. Capacity resources are needed to provide a 10+ hour peak product.
5. Wind Cost Declines

October 11th BCUC Scenario assumptions are optimistic.
Forward Price is Not a Price Forecast

Our ABB market price forecast is a long term view on electricity spot market prices and is in the range of other long-term price forecasts.

- A forward curve represents real short term transactions to lock in price
- Forward prices are not a long-term view on spot market value
- ABB produces our forecast with 100+ customers worldwide (17% are utilities)
- Models reflects interaction between natural gas supply and demand; new buildout (including renewables and pricing declines), and current policies
Site C – Peace System runs as a group

Williston is the world’s 7th largest reservoir with 4 years of storage

Site C is not a standalone facility on the Peace System

- Site C will be operated as a part of the Peace System
- High Demand – higher GMS flows produce more energy at Peace Canyon and Site C
- Low Demand – lower GMS flows reduce generation at Peace Canyon and Site C

- Flexibility refers to the ability to run the generation when you need it and shut it down and store the fuel when you do not
- Williston reservoir provides this flexibility for all 3 plants
Conclusions

- The portfolio PV comparison shows ratepayers are $7 billion (PV) better off completing Site C based on BC Hydro’s expected scenario of:
  - Updated project cost;
  - Mid load forecast; and,
  - Expected cost of next best portfolio (wind backed by pumped storage).
- We regard these assumptions as reasonable.
Trade Opportunities
Market Opportunities

- Site C is not being built for export, however, if temporary surplus is available:
  - Site C provides capacity, flexibility and positive environmental attributes.
  - These products are expected to be increasingly needed in western markets as renewable resources (wind and solar) replace base load resources.
Role of Powerex

- Powerex has contributed over $1.35 billion over the last 10 years from trade activity (on top of its direct payments for BC Hydro surplus).
- Powerex is a highly active market participant in western wholesale electricity markets (Yearly, Monthly, Daily, Hourly), serving over 100 customers in over 100 different locations.
- Powerex has an extensive portfolio of US long-term transmission rights, including 2,500 MW between the Pacific Northwest and California, enabling broad access to diverse customers and markets.
Any Site C Surplus Energy Can Be Sold at Most Attractive Times and Locations

- Demand for clean, surplus energy delivered in the right hours and right locations is expected to grow across the West.
- Both generation flexibility and transmission rights are essential to capturing long term and short term market opportunities as they arise.
- B.C. export transmission is not a barrier to selling Site C surplus:
  - Effective B.C. Export transmission capacity to US is about 2,500 MW
  - Effective B.C. Export transmission capacity to Alberta is about 500 MW
  - Together this supports up to 26,000 GWh of annual exports
    - Site C energy is only 5,286 GWh
Site C Adds More Than Just Energy to the BC Hydro System

Site C adds additional, valuable attributes

Flexibility

• Downstream from largest reservoir in western North America
• Rapidly growing demand for flexibility to integrate wind and solar

Capacity

• Coal generation retirements planned in Alberta, Pacific Northwest
• Nuclear, natural gas generation retirements expected in California

Environmental attributes

• Zero carbon resource has additional value in California (Cap and Trade)
• May have value in the future in other geographic markets
External Markets for Flexibility are Growing Rapidly

Increased renewables in California require flexible capacity to respond to changes in need

- California law: 33% of demand met by renewables by 2020, 50% by 2030
- Flexibility is required for solar: For example, when the sun goes down, load goes up – amplifying the need for capacity that can come online quickly
- Need for flexibility could double again by 2030 as California meets 50% target
- Powerex can provide up to 2,500 MW of this need using its transmission to California and its sources of flexible generation, including Site C

Note 2012 data is not net of renewable generation.
External Markets for Capacity are Emerging

- Baseload capacity resources are retiring across the West
  - Pacific Northwest: over 2,500 MW of coal shut down by 2025
  - Alberta: over two-thirds (>6,000 MW) of coal generation shut down by 2030
  - California: 7,500 MW of nuclear and natural gas generation shut down by 2025
- Much of this generation will be replaced with renewable resources which provide limited capacity
- This is likely to increase the demand for capacity:
  - Alberta capacity market is an example
  - California is developing flexibility markets
Customers have limited options for capacity-rich resources in future years

- Natural gas generation:
  - growing environmental concerns
  - siting poses challenges
  - not as suitable for fast ramping and frequent stop/start
- Large storage hydro projects: very limited new sites available
- Pumped-storage hydro: limited new sites available, costly
- Battery technologies: very costly
Concluding Remarks
Site C Should Be Completed

Site C is by far the best option for ratepayers.

- Upon termination, ratepayers would have to pay $3.2 billion with nothing to show for it.
- Suspension would costs even more than termination, with significant risk.
- By proceeding with Site C, ratepayers will benefit from a unique resource:
  - Provides a long-term source of energy and dependable capacity.
  - Is progressively more cost-effective for ratepayers over time.
  - Has the lowest GHG emissions, facilitates the integration of intermittent renewables, and supports low carbon electrification.
Thank you.