Applying Energy & Planning Objectives When Creating & Comparing Options

OVERVIEW

This summary brief builds on the following materials provided at the Integrated Resource Plan (IRP) Technical Advisory Committee (TAC) Meeting #2: Comparing Policy Options Summary Brief and Comparing Portfolios Presentation. This brief is intended to bring greater clarity to the five market price scenarios used in the IRP modelling.

Generating and transporting electricity creates a large footprint in B.C., a footprint that includes financial, social, and environmental impacts. BC Hydro has committed to understanding what the implications of its policy recommendations are, and communicating these to its stakeholders, First Nations, and to government.

This note will lay out the basis for considering these impacts, will present a draft list of the measures compiled by BC Hydro, and will suggest a way in which this large amount of information can be used to help inform decisions. In addition, this note will clarify the link between the energy objectives in the Clean Energy Act and the way in which policy alternatives will be created and compared.

Why Is BC Hydro Considering More Than Just Financial Implications?
There are several reasons why BC Hydro has committed to consider broad impacts. First, the government laid out explicitly a number of energy objectives in the Clean Energy Act that BC Hydro is to pursue through this IRP. These objectives include a mix of financial and non-financial interests.

PURPOSE

Within the IRP, different policy options will be tested through portfolio modeling. Comparing outputs to help inform a policy recommendation, however, is not straightforward as the impacts of the portfolios include financial and non-financial data, more certain and less certain impacts. This note will lay out a framework and method that will be used to set up these comparisons.

Secondly, the Clean Energy Act stipulates that BC Hydro carry out the IRP consistent with good utility practice. It is BC Hydro's belief that good utility practices include understanding the broader implications of its planning questions and actions.

Finally, the Clean Energy Act states that the IRP is to provide a vehicle for consultation with First Nations and the public around long term electricity planning issues. Through past experience, BC Hydro fully anticipates that these groups will be interested in more than just financial impacts.

How Will BC Hydro Reflect These Objectives And Interests When Comparing Portfolios?
In the second meeting with the IRP Technical Advisory Committee, a presentation was given that described how BC Hydro translated the Clean Energy Act objectives, the desire for good utility practice, and the need for broad consultation into portfolio design constraints and criteria for comparing portfolios. The table below summarizes that information. Table 1 also extends this in an additional way by considering which of the objectives will be used to create options. As an example, one objective of the Clean Energy Act is that at least 66% of the incremental load growth must be met through energy conservation. This will be taken as a design constraint when creating all portfolios, and so this is checked in the first column. Moreover, the IRP team will purposefully vary the level of demand-side management (DSM) in order to explore the policy question regarding the best level of DSM going forward. So this is checked in the third column as well.

Table 1: Constraints And Criteria For Creating And Comparing Policy Options

Energy & Planning Objectives [source]	Modelling constraint? (will not be violated in creating policy options)	Criteria for comparing options? (allowed to vary in order to pursue other objectives)	Varied in order to create different policy choices?
Self sufficiency by 2016 (plus 3000 GWh insurance by 2020) [CEA]	✓		
No energy from Burrard (once ILM, Mica 5/6 and Meridian transformer are all in place) [CEA]	✓		
Energy conservation target of 66% by 2020 [CEA]	✓	✓	✓
Generate 93% of electricity from clean or renewable resources [CEA]	✓	✓	✓
Ensure ratepayers receive benefits of heritage assets [CEA]	✓		
No nuclear [CEA]	✓		
BCUC continues to regulate rates but not expenditures for export [CEA]	✓		
Ensure utility rates remain competitive with public utilities in North America [CEA]		✓	
Reduce B.C.'s GHG emissions [CEA]		✓	✓
Reduce waste by use of waste heat / bio-energy [CEA]	✓		
Maximize value of generation & transmission assets for benefits of B.C. [CEA]	✓	✓	
Be a net exporter of clean electricity [CEA]	✓		
Encourage economic development and job creation / retention [CEA]		✓	
Obligation to supply customer's requirements [good utility practice]	✓		
Meet reliability criteria [good utility practice]	✓		
Minimize ratepayer costs [good utility practice]		✓	
Minimize environmental footprint [good utility practice]		✓	
Must explore and understand a broad range of impacts (economic and non-economic impacts) [input from stakeholder and First Nation consultation]		✓	

Note: CEA = Clean Energy Act, ILM = Interior to Lower Mainland, GHG = Greenhouse Gas.

What Is A Consequence Table?

Figure 1 (attached at the end of the document) is an excerpt from a consequence table that will be used in the IRP process. Please note that the data within the table is fictional. When it is completed it will have the full list of objectives and measures used to compare options. The column headings will be portfolio descriptors used to explore a particular policy question. This example shows a mix of portfolios to illustrate the types of questions that could be addressed: Site C as an option or not? What level of DSM best? etc.

A different consequence table will be required for each set of policy questions considered.

How Will Uncertainty Be Expressed In The Consequence Table?

The Risk Framework's probability tree provides 15 different scenarios (3 gap scenarios, 5 market price scenarios, 3 x 5 = 15), against which any policy question can be stress-tested. This is of interest in terms of the financial indicators as these are sensitive to the different ways in which the scenarios have been created. As a result, it will be possible to express financial impacts both as an expected cost (that is, a probability weighted cost, calculated across all 15 scenarios) and as an extreme cost (showing the downside risk of each portfolio). The exact way in which this downside financial risk is shown will be presented for discussion at the next IRP TAC meeting. In Figure 1, a recommended measure of the 95 percentile of the portfolio costs is shown. This measure has its drawbacks, but it gives a rough idea of what extreme costs may look like, and it is easy to calculate.

The application of the probability tree to the non-financial indicators will not be of great interest – the comparisons of interest will be roughly the same regardless of which scenarios are used. Consequently, the approach being taken here will be that the non-financial indicators will be calculated based on a single measure, the probability weighted average of all 15 scenarios.

How Will Comparisons Be Made When There Is So Much Data?

It is generally true that when faced with an overwhelmingly large amount of data, deliberation is best served by working hard to discover the small number of key decision criteria. This, however, will require a great deal of winnowing down given the size of the consequence table. Fortunately, there are a number of steps that BC Hydro can take to simplify the data.

Rolling up detailed measures: Greenhouse gas emissions are actually a weighted aggregation of a number of emitted gases. The weights are applied, despite much uncertainty, to simplify the use of data. There are a number of measures here that are amenable to such treatment.

Remove measures that are insensitive across the range of options: For each set of comparisons, it is likely that some set of measures will be roughly tied across all of the options. If this is the case, then these will not be decision drivers, and so they can be removed from consideration. This will require some judgment from BC Hydro's consultants as to how precise these measures are (e.g., which differences are just noise and which differences signal significantly different levels of performance).

Remove redundant measures: It may be the case that several measures track each other. That is, they all 'tell the same story' when comparing portfolios. In such cases, it makes sense to focus on one measure and to remove the others. Again, this outcome may vary from question to question.

Use colour coding to show differences: A simple colour coding scheme can help identify what the overall comparison of interest is.

What About Impacts And Concerns That Can't Fit Into The Consequence Table?
Good practice around comparing options dictates that every effort should be made to capture key decision criteria in a consequence table. However, because of information gaps, time constraints, or modelling limitations, not all information used to compare options will be quantified and expressed in this way. BC Hydro will always apply its own discretion and professional judgment when moving from modelling results to making recommendations and this includes results contained within the IRP consequence tables.

Results And Discussion
PowerPoint presentations will be prepared on a measure-by-measure basis to allow for a detailed look at how the measures vary across different portfolios and whether each measure does an adequate job of conveying the differences across the options.

KEY REFERENCE DOCUMENTS

- Financial Measures PowerPoint Presentation
- Environmental Measures PowerPoint Presentation
- Economic Development Measures PowerPoint Presentation

Figure 1: Creating and Comparing Policy Options

Some objectives are used as design constraints when creating portfolios (e.g., Self Sufficiency by 2016)

Some objectives are varied in order to test policy options (e.g., DSM levels)

Some objectives are used to compare policy options

Objectives	Measures		Site C in (DSM Option 2)	Site C Forced in 2020 (DSM Option 2)	Site C Out (DSM Option 2)	Site C Out (DSM Option 3)	DSM Option 3	DSM Option 4
Atmosphere	GHG Equivalent Emissions	Emissions - (tonnes of CO2e per year)	3397	1539	1533	1539	1533	1539
	Air Contaminants	Sulphur Dioxide t/yr	0.6	0.3	0.3	0.3	0.3	0.3
		Oxides of Nitrogen t/yr	4.0	1.9	1.7	1.9	1.7	1.9
		Carbon Monoxide t/yr	3.9	1.9	1.5	1.9	1.5	1.9
		Volatile Organic Compounds t/yr	0.2	0.1	0.1	0.1	0.1	0.1
		Fine Particulates, PM Total t/yr	2.4	1.2	0.9	1.2	[illegible]	1.2
		Mercury kg/yr	0.0	0.0	0.0	0.0	[illegible]	0.0
Employment (person-year)	Construction	Direct	13969	7759	5870	[illegible]	5870	7759
		Indirect	34326	18378	14268	18378	14268	18378
		Induced	8317	4511	3475	4511	3475	4511
		Sub Total	56612	30649	23612	30649	23612	30649
	Operations	Direct	4146	2009	1782	2009	1782	2009
		Indirect	4199	2031	1794	2031	1794	2031
		Induced	1813	874	783	874	783	874
		Sub Total	10158	4914	4358	4914	4358	4914
		Total	66770	35562	27970	35562	27970	35562
Present Value (NPV M$)	$ 2014	G&T Resource cost	$15,124	$6,697	$6,391	$6,697	$6,391	$6,697
	$ 2014	Trade Revenue	($6,883)	($2,716)	($2,732)	($2,716)	($2,732)	($2,716)
	$ 2014	Total Portfolio Cost	$11,982	$5,280	$4,959	$5,280	$4,959	$5,280
	$ 2014	Total Portfolio Cost Risk (95%ile)	$14,345	$14,267	$13,401	$14,267	$13,401	$14,267
		Rate Impact I						

ILLUSTRATIVE

Market Price Scenarios used to generate probability weighted and risk measures

Colour codes used to highlight “better” (green), “worse” (red), or “roughly equal” (yellow) performance against a “base case” (blue).