Summary of TAC Member Feedback On The IRP Planning Assumptions & Analysis In 2011 And BC Hydro's Consideration Of This Feedback

1.0 Introduction

The BC Hydro IRP Technical Advisory Committee (TAC) is a committee established to assist BC Hydro in creating a well-considered plan by providing detailed technical input and feedback to BC Hydro on development of its Integrated Resource Plan (IRP) as per the IRP TAC Terms of Reference. The TAC had four committee meetings and one sub-group meeting from December 2010 to April 2011.

This paper summarizes feedback received by the TAC on the IRP planning assumptions and analysis and documents how this feedback was considered by the BC Hydro planning team. The feedback is also documented in summary meeting notes that were posted on BC Hydro's website after each TAC meeting. Note that in addition to feedback on BC Hydro's planning assumptions and analysis, TAC members provided written submissions on public consultation questions in May 2011.

These comments on BC Hydro's planning assumptions and analysis do not represent a consensus of TAC members; rather, they are individual comments for BC Hydro's consideration during the development of the IRP. Specific comments have been summarized into general feedback points and include both comments from discussions as well as written comments. Written comments are attached in Section 4.0.

BC Hydro considered the TAC members' input during and after each meeting as it developed the technical inputs and analysis required to construct the IRP; so that consideration of the TAC's technical input was ongoing. Members' feedback included the desire for more information as to how their input was being considered by BC Hydro. This report responds to that request by presenting a summary of feedback received and subsequent consideration.

The report is separated into two sections: Feedback on Planning Inputs and Feedback on Portfolio Analysis.

2.0 Feedback on Planning Inputs

Topic	Feedback Received	BC Hydro Consideration of Feedback
Load Forecast	There is a desire to see that climate change is considered within the load forecast.	The BC Hydro load forecasting team has considered how a specific increase in temperature (one degree) would affect BC Hydro's 20 Year Load Forecast. The overall net effect was very small, and resulted in a less conservative (lower) load forecast. Therefore, there is no current plan to adjust the load forecast based on climate change expectations.
	The magnitude of uptake of electric vehicles in the latter half of the load forecast period is overly optimistic.	BC Hydro includes electric vehicle loads in its base forecast, with assumptions unchanged from the 2010 Forecast. Due to assumed vehicle availability constraints, the impacts of electric vehicles are constrained in the first ten years, resulting in an increase of only 38 GWh in F2017, but rising to 2,120 GWh by F2031. Electric vehicle uptake assumptions are being regularly reviewed, and will be revisited in future load forecasts.
	There is a need to improve the methodology of integrating demand-side management (DSM) savings into the load forecast to reduce the concern that double counting is overstating DSM savings.	BC Hydro recognizes that the potential double counting of DSM savings in the load forecast is an issue. BC Hydro first identified the potential for this problem in 2008. In its 2010 Load Forecast, BC Hydro corrected areas of DSM double-counting/overlap. The potential for overlap is continuously being reviewed and adjustments are made to both the DSM plan and the load forecast as necessary.
	BC Hydro should include how uncertainty will be addressed regarding the large oil and gas contribution to the load forecast this year, and how any uncertainty can be handled in BC Hydro's acquisition policy.	BC Hydro is considering uncertainties regarding the oil and gas contribution to load by building this into the analysis and considering how to address this in the IRP.
	BC Hydro should update the load forecast with the most recent long-term rate forecast.	When load forecasts are produced, the most current long-term rate forecast is used to adjust the forecast due to rate impacts. The latest load forecast (2011 load forecast) uses the most recent long-term rate forecast.

Topic	Feedback Received	BC Hydro Consideration of Feedback
Long-Term Rate Forecast	The long-term rate forecast, particularly in the second 10 years of the 20-year rate forecast, appears low and there are concerns that this forecast is understated.	BC Hydro believes the long-term rate forecast used in the load forecast is adequate for planning purposes. The rate increases in the second 10 years may seem low, but as total revenue requirements have increased over the first ten years, further incremental increases in required revenue can be met with lower percentage rate increases.
Load Resource Balance	With respect to how the gap is communicated, BC Hydro should think about changing the Y-axis on the load resource balance to start at 0 rather than 50000 GWh so that the gap is not overstated.	As a result of this input, BC Hydro changed the graph axis for the public consultation workbook to start at 0 for the March/April 2011 consultation period.
	BC Hydro needs to reconcile the provincial electricity import/export statistics produced by BC Hydro and by the NEB/StatsCan.	BC Hydro distributed background information from 2008 LTAP Information Requests that discussed this issue. Given the differing assumptions used by StatsCan and BC Hydro, BC Hydro will not further attempt to reconcile these differences.
Risk Framework: Market Price Scenarios	Members questioned the rationale of choosing five market price scenarios out of a combination of nine market scenarios developed by Black and Veatch. Members' inquired whether there is a combination that is being missed that would have either a reasonable expectation of occurring, and/or lead to substantially different results in terms of price outputs compared with the other chosen scenarios.	Given the timelines and resources, BC Hydro was not able to model a larger number of market price scenarios. Given that, BC Hydro believes these five market price scenarios strike the best balance between being likely and "covering the waterfront" in terms of the ranges of inputs and outputs. And so the analysis will go forward with these on a modelling basis. BC Hydro recognizes the quantitative modelling won't capture the full range of uncertainty and will consider this when drafting the IRP.
	Concern that there are inconsistencies with the way the market price scenarios were put together.	BC Hydro planners have attempted to provide internal consistency; however, they will continue to consider this issue in future IRPs.
	Comments raised the question as to whether the assumption may be false that the market and gap are independent and what might be the implications to the analysis.	BC Hydro believes that the analysis methodology is adequate for this planning exercise, and will continue to consider this issue in future IRPs.
	Suggestions were made to improve the way the market scenarios are presented so they are more easily understood. As well, the scenarios presented as the way the world will unfold is very encompassing. Suggest BC Hydro be more specific with the scenario description.	As a result of this input, a summary brief was developed, *Market Price Scenarios: Further Description & Considerations,* which provides a more detailed description of the purpose of the market price scenarios and their limitations. As well, attention will be devoted to providing clear descriptions of the market price scenarios in the draft IRP.

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Risk Framework: Other Potentially Consequential Scenarios	There are external variables that could significantly impact the IRP that haven't been considered in BC Hydro's market price scenario approach. Currently the five market price scenarios, rather than being five different worlds, are looking out from one perspective. Examples of other variables that could change the nature of the plan included: • Technology evolution • Substantial rate changes that will affect load • Widespread distributed generation • Carbon capture	As a result of this input, a TAC sub-group was established to discuss further potential scenarios, how other variables may affect the plan, and how they may be considered within the IRP. The results of this discussion are found as input in this table below.
	Suggestion to include a scenario where customers can directly access non-firm market power.	As a result of this input, BC Hydro will consider including a section within the IRP will qualitatively address this issue.
	Suggestion to examine scenarios which look at potential technological evolution in the following areas: • Carbon capture and storage (CCS) in gas processing. • Concentrated solar technology that would compete with B.C. electricity exports. • Battery technology on electric vehicles. • Ocean renewables. For these potential changes in technology it would be useful for BC Hydro at a minimum, to explore them qualitatively to understand potentially important gaps.	BC Hydro updated its resource option inventory for this IRP analysis and maintains the work is suitable for the current planning analysis and will continue to consider this issue in future IRPs.
Risk Framework: Future Flexibility	BC Hydro is treating DSM resources as fixed block items, and there are actions BC Hydro should be taking to prepare and create future flexibility, such as securing right-of-ways to give BC Hydro ability to move on short notice. As well, there was a suggestion to redesign the modelling process from static to dynamic which would include learning as the program progresses.	Increasing the ability, in cost effective ways, to respond to uncertain events is being addressed as part of the IRP contingency resource plan. At this point, there are no plans to redesign the modelling program, however will continue to consider this issue in future IRPs.
Market Assessment	Regarding export assessment, concerns were expressed as to the ability to determine who is responsible for various portions of new transmission based on contracts for export.	BC Hydro will consider this input if the outcome of the initial assessment is favorable for BC Hydro to pursue exports.

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	If the conclusion of the export market assessment is that BC Hydro should be generating for export, then BC Hydro should be prepared to provide full details.	BC Hydro notes the request for full detail if the outcome of the assessment is for BC Hydro to pursue exports and will consider this input at that time.
Resource Options: Demand-Side Management (DSM) Options and Uncertainty Assessment	There is a desire for verification of actual DSM savings being achieved through these programs.	BC Hydro undertakes a comprehensive approach to confirming the electricity savings that result from DSM initiatives, which includes site inspections, measurement and verification and evaluation. BC Hydro's DSM verification and impact evaluation activities align with industry best practices and are among the most comprehensive efforts in the DSM industry.
	Feedback suggested that BC Hydro not defer to 2018 the introduction of a conservation-orientated rate structure for the small commercial customer class.	At present, a review of the rate structure for small commercial customers will continue to be planned in the timeframe indicated, in order to be informed by the experience of Medium General Service customers as they transition onto their conservation rate structure from Fiscal 2013 to Fiscal 2015 as approved by the BCUC. The timing indicated reflects subsequent work to develop, file and have BCUC regulatory review of a rate design application, and subsequent implementation of BCUC-approved rates.
	It was suggested that mandatory time-of-use rates should be considered in the IRP analysis.	Mandatory time-of-use rates are not being considered in this IRP.
	Feedback on Option 5: Concern that BC Hydro has designed an option (5) that it will not likely support because of its uncertainty; and that BC Hydro should adjust Option 5 to make it more realistic, which would maintain the programs as a fallback if more ambitious savings do not occur.	As a result of this input, a new Option 5 was created, along with its associated uncertainty assessment, and included into the portfolio analysis.
	Comments included how the DSM Options were communicated in the TAC materials/summary brief was overly pessimistic.	BC Hydro recognizes that the wording could be improved and as a result of this input, BC Hydro will include neutral wording in future materials.
	Suggestion to look at "in-between" options on DSM, e.g., Option 3.5 or Option 4.5, and that the options come across as mutually exclusive when they are not.	BC Hydro recognizes that these options are not mutually exclusive and that the resulting IRP actions could be a combination of initiatives from different options.

Topic	Feedback Received	BC Hydro Consideration of Feedback
Resource Options: Supply-Side Options and Uncertainty Assessment	Currently biomass is listed as having a higher dependable generating capacity than combined cycle natural gas, which doesn't make sense.	The biomass dependable generating capacity is assumed to be slightly higher than the dependable capacity for the combined cycle natural gas resource option due to differing assumptions regarding wear and tear. These assumptions will be revisited in future IRPs.
	For gas (and coal) it is not an accurate inventory as the Resource Options Update (ROU) only shows a small number of potential locations.	BC Hydro recognizes the natural gas and coal projects identified in ROU do not represent full potential but are proxies developed within existing potential supply and infrastructure requirements. BC Hydro will not restrict modelling other option locations as needed.
	BC Hydro should report out on its study of climate change effects on generation resources.	The report "Climate Change Signal Detection in BC Hydro Reservoir Inflows" published in December 2010 is a public document and will be made available to TAC members. Considering the report, at this time it was concluded no significant trend resulting in material change in long-term planning.
	BC Hydro should include updated Site C costs in portfolio analysis, noting that the portfolio analysis will be greatly influenced if, for example, Site C is $85 or $150.	BC Hydro included updated Site C updated costs as they became available.
	Regarding wind, there was an interest in seeing the wind integration cost change as a function of the penetration level of wind within the system.	The IRP analysis tool cannot easily create portfolios while taking this change function into account. As such, the base IRP analysis doesn't include a change to the wind integration costs based on penetration level. However, sensitivity tests assuming differing integration costs are done.
	Feedback regarding wind included whether a portfolio of wind generation that optimizes 'economic dispatch' and 'diversification' would allow a reduction in the $10 wind adder. This would be based on the premise that moving from a 25 to a 35 per cent wind penetration would introduce wind generation from outside of the Peace region.	The wind integration study demonstrates benefit of geographical diversity. However, the IRP analysis tool does not have a feedback loop ability to recognize diversity benefits while creating portfolios. Sensitivity tests assuming differing integration costs are done.

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	Regarding understanding uncertainty, the IRP does not currently account for any uncertainty in supply-side options apart from an assumed attrition rate. Supply-side options should undertake a similar approach to uncertainty as was taken with demand side management options; including questions such as (1) how might costs vary from values provided in the ROU; and (2) how might the deliverability impact the overall analysis?	As part of this IRP, BC Hydro is undertaking a high level assessment of uncertainty with regards to DSM, supply-side resources and forecasted load. A more comprehensive uncertainty assessment is being conducted for DSM given its greater contribution to reducing incremental load and its relatively novel performance characteristics with regards to deliverability risk and performance assessment.
Electrification	Concern expressed about making the assumption that electricity would be chosen over gas in the Fort Nelson area, particularly given rate forecasts and the price of gas.	BC Hydro is considering options including gas for the Fort Nelson area.
	A suggestion to clarify what emissions sources would be included in the reporting of greenhouse gas (GHG) emissions reductions achieved in the electrification scenarios, and to what degree those would be comparable with the province's climate action plan.	The emission sources undergoing emission reductions in the electrification scenarios are identified in the report "Greenhouse Gas Reduction Scenarios for the Western Interconnection" found in the Document Centre of the www.bchydro.com/irp. The comparison with the province's Climate Action Plan will not be undertaken during this planning exercise.
	Suggestion to report the GHG emissions in each sector where electrification is being considered. Reporting should include the emissions for scenarios with and without emissions forecast in the province's climate Action Plan. This would allow BC Hydro to provide good advice and input to the provincial government regarding the degree to which various options contribute to GHG reduction objectives.	BC Hydro plans to report GHG emissions reduction estimates for key electrification sectors/decisions where information is readily available.
	For the increased load with electrification, the assumption for associated DSM does not include efficiencies in transportation through reductions in miles driven.	At this time, the IRP analysis does not include a level of detail that allows the inclusion of this variable.
	BC Hydro's IRP should examine the sources of GHG emissions in B.C., identify the opportunities for 'GHG-reduction electrification', articulate a methodology for prioritizing the most cost-effective opportunities, and select portfolios of 'GHG-reduction electrification' programs for inclusion in the main portfolio analysis.	BC Hydro is currently working with the provincial government to address this issue of whether and if so, how, BC Hydro will actively promote GHG emission reductions. The IRP analysis looks at electrification sensitivities to determine implications on the integrated system.

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	There would be a need for BC Hydro to look at what incentives would be required to achieve electrification (in the home heating and transportation sectors).	At this time, BC Hydro is not accounting for incentives in the scenario analyses; however, BC Hydro recognizes it would require consideration at some point.
	BC Hydro should project the GHG emissions if the north east is not electrified and if the production was electrified using clean energy resources.	BC Hydro will be undertaking this analysis.
	The prospect of connecting the potential Fort Nelson load is more than a contingency scenario. The IRP should show this as a probable scenario. It would be prudent for BC Hydro to include the potential load in the Fort Nelson areas as a dotted line shown above the current load forecast.	BC Hydro recognizes the connection of Fort Nelson load to the integrated system as an option, and it is being analyzed.

3.0 Feedback on Portfolio Analysis

Topic	Feedback Received	BC Hydro Consideration of Feedback
Portfolio Analysis Methodology	BC Hydro should look at GHG emissions outputs in the north east under various portfolio analysis, including a comparison between carbon reductions and cost.	The IRP is undertaking this analysis.
	BC Hydro needs to understand the high end of the probability curve in terms of transmission adequacy of surplus power; BC Hydro will need at least 1500 MW of transmission to handle the high end probability case.	The IRP analysis is addressing transmission adequacy under high surplus levels.
	With respect to the Horn River Basin development, it seems like the province will not meet established GHG targets. BC Hydro should acknowledge that there is a reasonable chance of missing government established GHG targets.	BC Hydro recognizes the potential GHG emissions from the Horn River Basin development; however, BC Hydro does not have a full picture on the provincial GHG emission and reduction strategy. As such, BC Hydro will not comment on the achievability of overall provincial targets in the IRP, nor is it within the scope of the IRP.
	BC Hydro should look at region specific transmission planning issues that would impact a long-term resource plan. An example is the future refurbishment or replacement of the Cheekeye/Dunsmuir Transmission line, not currently considered within the IRP. If it was included it may influence options.	BC Hydro will be undertaking a high level assessment to determine any material upgrades that may need to be considered within this IRP. This will be undertaken within time and resource constraints. More fine grained (regional) analysis occurs on an ongoing basis.
	BC Hydro should consider possible future changes to the Columbia River Treaty in the IRP analysis.	For this IRP analysis, it is assumed that there is no change to the treaty during the timelines modeled. BC Hydro recognizes any future changes to the CRT may impact the planning analysis, and will continue to consider this issue in future IRPs.
	The possible range of costs can be significantly higher than anticipated over the next 20 years, for instance, including First Nations accommodation or other unforeseen costs. BC Hydro should address this in the IRP.	BC Hydro believes the existing cost estimates are adequate for the planning exercise and additional cost ranges or sensitivity analyses will not be run.
	A qualitative analysis is missing, e.g. utilizing results of quantitative analysis but discussing driving forces, regional (within B.C.) factors, and alternate future 20- and 30- year visions.	BC Hydro recognizes future uncertainty in the IRP through addressing the need to maintain flexibility, developing a risk framework and various market scenarios in the analysis. At this point BC Hydro feels a further visioning is outside the scope of this IRP.

Topic	Feedback Received	BC Hydro Consideration of Feedback
	BC Hydro should include rate impacts on more than a few selected portfolios.	As a result of this input, BC Hydro will calculate incremental rate impacts for an increased number of portfolios. Due to time and resource constraints, it will not calculate incremental rate impacts for all portfolios.
	Want to know how job retention was being tracked in IRP.	Employment is being tracked using person years of temporary construction jobs and long-term permanent jobs arising from new projects brought on to meet increasing demand. Job retention related to existing projects and programs are outside the scope of this analysis.
	There was an interest in seeing whether it was possible to choose resources based on lowest environmental impact.	Most portfolios are created using clean resources (i.e. no GHG emissions). Given this environmental focus, the optimization model then chooses least-cost resources given further specified constraints. Portfolio alternatives are then compared in a number of ways such as the environmental footprints.
Base Analysis	Suggestions were made in terms of how the analysis is communicated, for example: • Being clear on what small, mid, and large gap means, • In the modelling map, change the size of the bubbles to represent the size of the probability	BC Hydro recognizes the need to communicate clearly will consider this input for the IRP write up and analysis presentations.
	Concerned with analyzing the combination of large gap which equates to high load and low DSM; and equally suspect of small gap having a combination of low load and high DSM both of which combinations are not likely. The large and small gap likelihood of 10 per cent seems overstated.	As a result of this input, two additional portfolios were run in addition to the three base portfolios (mid load, mid DSM; large load, low DSM; and small load, large DSM) which included mid load, large DSM; mid load, low DSM) to reduce the percentage likelihood of the extreme cases (to bring the percentage from 10 to 4) and provide an adjusted weighted average.
Sample Portfolios and Comparing Options	Following a discussion of the environmental attributes, a number of general suggestions were made: • Don't skimp on explanations • Ensure a good rationalization for the choice of presentation • Keep the data behind the analysis for people to see if needed. • It does make sense to reduce the amount of information • Document trade-offs of interest.	BC Hydro will consider this input for the IRP write up.

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	For the net primary productivity measure, total hectares are a more appropriate measure than weighted average. Other suggestions include the possibility of looking at total grams of carbon; and keeping the classes.	Total hectares will be calculated.
	For the next IRP, think about a more detailed description and analysis of GHG contributions of various portfolios (for example, explore GHG impacts beyond just direct emissions).	BC Hydro did consider second order impacts within this IRP and determined, given the scale and scope of the IRP, that a higher level assessment was most appropriate; however, BC Hydro will continue to consider the appropriate level of detail for future IRPs.
	For the Economic Development attributes discussion, general suggestions included: • Be clear on the measure (person years versus FTE) • Be clear on indirect versus induced impacts.	BC Hydro will consider this input for the IRP write up.
	It was noted that GDP, employment, and government revenue are not independent, so by showing all three is like showing the same metric over and over and there may be a perception that it carries more weight than it actually does – GDP is the most comprehensive.	BC Hydro will consider this input when comparing portfolios and addressing how to present the data.
	The economic development measures are such that more is better – this misses the concept of sustainable economic development. BC Hydro should be considering the concept of sustainable economic development.	BC Hydro maintains that the analysis is adequate for this planning exercise and recognizes that improvements could be made with more resources.
	There was a request to have a measure that looks at flexibility and plan adaptiveness.	BC Hydro is taking steps to ensure flexibility and adaptiveness within the plan; however, specific criteria will not be developed.
DSM Draft Analysis	BC Hydro should use firm energy and not average energy to calculate incremental costs of supply (as compared to incremental cost of DSM savings).	Firm and average metrics are only partial characteristics of resources. As such, they can tell some, but not all, of the comparison story. The only way to truly compare resources is through portfolio modelling, which is being done in this IRP.
Resource Acquisitions Draft Analysis	Currently technology is fixed during the planning period. There is a lot of information in the analysis; however, a 20 to 30 percentage change in technology may have a bigger influence than some of the variables in this analysis.	BC Hydro will continue with its current assumptions. BC Hydro recognizes technology change and advancement can have big influence on resource acquisition decisions. However, it can only plan on what it currently knows and try to keep plan flexible.

Topic	Feedback Received	BC Hydro Consideration of Feedback
	Suggestion to run the analysis and allow run-of-river to be renewable energy credit (REC) compliant.	Upon further consideration, BC Hydro is less optimistic about renewables penetration into the California market. As a result, running additional portfolios allowing run of river resources to be REC compliant is not a priority at this time.
	The run-of-river costs and wind resources are low as analysis uses 'at plant gate' costs.	The 'at plant gate' costs were presented to the Technical Advisory Committee; however, the portfolio analysis does include transmission costs.
	The wind penetration limit of 3000 MW used in the analysis seems low.	The wind penetration limit of 3000 MW was identified in a preliminary analysis. A more detailed study is being undertaken, but is not yet complete. Until this more detailed study is completed, the wind penetration level of 3000 MW will be used for IRP planning purposes.
Natural-Gas Fired Generation	Suggestion to make the language consistent and accurate (role of thermal versus role of gas).	As a result of this input, BC Hydro made the description more specific to the role of natural gas fired generation.
	Using 17.5 per cent annual minimum running for gas in the analysis seems a bit high, although understand if it is needed for modelling.	BC Hydro considers it reasonable to assume a gas unit built for capacity will be able to run through a couple months in the winter.
	There is a suggestion to include a discussion on the province's ability to meeting GHG emission reductions targets when testing the role of natural gas fired generation.	BC Hydro's discussion is guided by the 93 per cent clean requirement. Relevant information including GHG emission reductions will be provided to the government to inform a larger provincial GHG discussion.
Capacity Needs	Suggest calling Mica seasonal pumped storage.	As a result of this input, seasonal storage will be used as part of the description of Mica's longer term capacity storage contribution.

4.0 TAC Member Comments Received as Written Submissions Regarding IRP Planning Assumptions & Analysis

Four organizations submitted to BC Hydro written comments on the IRP planning assumptions and analysis. These submissions are provided in the following pages.

- **Clean Energy BC:** IRP December 14th Meeting Review and Comments (January 11, 2011)
- **BC Sustainable Energy (BCSEA):** Comments on IRP TAC Meeting #2 (February 2, 2011)
- **The Pembina Institute:** Advice to BC Hydro Regarding Integrated Resource Plan Analysis (February 23, 2011)
- **Energy Conservation & Efficiency (EC&E) Committee:** Preliminary Advice on the IRP (April 29, 2011)

Clean Energy BC

IRP December 14th Meeting Review and Comments (January 11, 2011)

Clean Energy | Association Of British Columbia

January 11th, 2011

BC Hydro
333 Dunsmuir Street
Vancouver, BC
V6B 5R3

Attention: Anne Wilson

Dear Anne:

Re: IRP December 14th Meeting Review and Comments

We thank you for the well structured and concise presentations made at the inaugural IRP Technical Advisory Committee (TAC) on December 14th. Our team reviewed the materials presented and has the following questions and comments.

Load Forecast by David Ince

1. Should Clean Energy BC be circulating this commentary to all participants or will that be done by BC Hydro? Will BC Hydro be circulating all participants' commentaries to all TAC members? What review process will be followed at subsequent TAC meetings to address issues brought forward by TAC contributors?

2. We are grateful if the presentation print outs could please have one slide per page.

3. Slide 29: With significant rate increases being implemented the importance of rate price elasticity becomes increasingly important. How much analysis has been undertaken to differentiate both short and long term elasticity effects on consumption behaviour – will that analysis be shared with the TAC? How much analysis has been done in differentiating price elasticity effects compared to other DSM programs? Might BC Hydro make available to the TAC the report (and any updates based on recent experiences) prepared by Dr. Ren Orans for the 2008 LTAP?

4. Slides 30 – 36: In order to present an accurate historical perspective it would be beneficial to separately present both charts and graphs (including the zero points) for the previous decade.

5. Slides 32, 33, 34: Residential, Commercial and Industrial General Sales
   More details are needed to understand the components that are driving these forecasts. We assume that the detailed Load Forecast document will provide these details – such as what parameters are used to drive each forecast, how the parameters themselves are

forecast, and how the regression coefficients are determined that ultimately forecast the electricity load. The comment was made during the presentation that these forecasts are based on regression analyses. The usual procedure would be to use historical relationships to determine the regression coefficients. However, since all of the available history includes the presence of strong DSM programs, can BC Hydro please explain exactly how the impact of these DSM programs was eliminated from the history in order to determine the coefficients for forecasting the pre-DSM load?

There is a very important potential risk of double counting and we wish to make certain the TAC understands exactly how BC Hydro proposes to eliminate it this risk. To make no adjustment for the presence of historical DSM programs would, in effect, assert that those DSM programs have had no influence on the consumer demand being observed. We realize that this is a very difficult analysis to perfect. However, if the influence of the historical DSM programs is not eliminated from the regression coefficients, then there is a significant possibility for the double-counting of efficiency savings. (i.e. some of the savings are already incorporated into the regression coefficients that produce the pre-DSM forecast, and then the savings are counted again when they are attributed to the DSM programs to produce the post-DSM forecast).

To help check for the presence of the possible double counting of energy savings, BC Hydro should calculate the implied energy efficiencies for each class and sub-class of customer in the same way as was done for the Conservation Potential Review (CPR; e.g. residential sales should be segregated by type of dwelling, commercial sales by type and size of business, etc.). What do the pre-DSM load forecasts for each customer type imply about the energy efficiency gains for that customer type over time? How do these implied pre-DSM efficiency gains compare to the efficiency potential for each customer type, as calculated in BC Hydro's latest Conservation Potential Review? In other words, what energy efficiency gains are being predicted to come from natural conservation plus rate-level impacts, and how does this compare to the total conservation potential identified in the CPR? And finally, the same implied efficiencies should be calculated for the post-DSM forecast for each customer type, and again compared to the efficiency potential identified by the Conservation Potential Review.

6. Slides 36 to 38: Industrial Sales Growth

There is some ambiguity as to exactly how these 3 slides relate to one another. Slide 36 is described as "Transmission Sales" which is presumably a subset of Industrial Sales. Slide 37 is described as "Total Area Sales" year-over-year growth, which includes Industrial, Commercial, and Residential. Slide 38 is "Industrial Load Growth", but only the "main sectors".

Tables showing the actual numbers that build up these forecasts would undoubtedly help to clarify the differences between them, and also explain why, for instance, Slide 38 shows 7,700 GWh of Industrial load growth between F2010 and F2016, yet Slide 37

appears to show only about 6,300 GWh of Industrial load growth – what is the difference between the loads represented in these two slides?

7. Slide 38: Industrial Load Explanation

   One concludes from this slide that three sectors are primarily responsible for the sharp increase in the forecast load, with Oil & Gas accounting for 4,000 GWh of the 7,700 GWh total load growth, mining for 2,600 GWh and Forestry for 1,100 GWh. Can BC Hydro please provide the backup information obtained from these industries being used as the basis for these forecasts? For instance, for the Mining Sector load growth, what are the specific mines being projected, and their locations and timing, and what are their estimated mine production and electricity loads over time? For the Oil & Gas Sector, please clarify if this forecast is confined to the Montney region near Dawson Creek and thereby confined to the integrated system area. Please provide whatever information has been obtained from the industry to support this forecast. Which producers are involved? What is the estimated timing of the gas production from each? What amount of extraction, processing, and transmission energy is required per unit of gas production, and what portion of this energy is assumed to be electrified. To help the IRP address the government's Clean Energy Act GHG reduction objectives, could BC Hydro please include estimates of the GHGs expected to be emitted by this gas production if it is left un-electrified? Alternatively what levels of GHG emissions are anticipated if the production can be electrified using clean, renewable energy resources? The GHG reduction objectives form and important part of the Clean Energy Act and should be strongly reflected in the IRP.

8. Slide 42: Transmission: Oil & Gas

   This chart appears to reflect a growth in the Oil & Gas sector from about 1,000 GWh in F2010 to about 5,000 GWh in F2016. This growth of 4,000 GWh is about the same as that reflected in Slide 38. Please confirm that this growth forecast is also confined to the Montney area, and does not include any forecast for the Horn River or other basins to the north around Ft. Nelson. We realize that until the decision is made to build a transmission line to connect the Ft. Nelson area to the grid, the will remain outside the integrated system. Nonetheless it is an area served by BC Hydro, and a very important area with respect to the government's GHG reduction targets. Accordingly, it would be prudent for the IRP to include the potential electrical energy load in the Ft. Nelson area as at least a dotted line shown above the current load forecast. This dotted line would at least serve as notice to all that, if the transmission line decision is made, and it could well be made before the IRP is even finalized, then all of that incremental load could suddenly augment the present forecast as early as F2017. The prospect of connecting the potential Ft. Nelson load is more than merely a contingency scenario. In fact, considering the amount of investment that the Oil & Gas industry is continuing to make in the area, the production potential should be considered highly likely, if not a virtual certainty to occur. The electrification of that areas oil and gas production is absolutely

essential if the province is to meet its GHG reduction targets. The IRP should clearly show this as a probable, rather than a possible scenario.

9. Slides 45 and 46: Electric Vehicles Projection and Load

   It was stated in the presentation that the slow rate of growth for electric vehicles over the first decade of the forecast was principally constrained by the supply of vehicles. Is this not a very conservative and potentially risky view to take because manufacturers, when faced with wait-lists of unsatisfied demand for their products, will generally find a way to increase production? We welcome BC Hydro providing more detail as to how these projections were determined, and what information from the industry (as well as any 3rd party forecast) was used as the basis for these projections.

10. Slide 47: Load Forecast DSM Integration, Codes and Standards

    We would like to see a more detailed explanation for this slide. The topic of the double-counting of efficiency gains is a critical one in forecasting the pre and post-DSM efficiencies. The same comments apply here as were given under Slides 32-34. Can BC Hydro please show the implied efficiencies embedded within each forecast, and also show for comparison to the EIA efficiency projections, and also to the potential efficiency gains identified in BC Hydro's latest Conservation Potential Review?

Long Term Rate Forecast by Cheryl Yaremko

1. Slide 5: Chart of LTRF used for 2011 IRP

   This chart appears to show real price increases that will accumulate to roughly 60% by F2021 and this translates to roughly a 100% increase in nominal terms (adding 2% per year for inflation). Can BC Hydro provide a chart of this forecast in terms of the cumulative rate increase and the average rates that will apply over time for Residential, Commercial and Industrial ratepayers? For a comparative perspective we'd like to see how this LTRF compares to the forecast given in the 2008 LTAP and also to the forecast given in the F11 Revenue Requirements Application final settlement agreement – are these forecasts all the same, or have there been some changes in expectations since 2008?

Load Resource Balance by Lindsay Fane

1. Slides 69 to 78: Charts of Demand before/after DSM and Supply/Demand Balances

   None of these charts show the history or even the current year F2011, in which we know there is supply demand "gap" of 5,000 to 8,000 GWh. The charts need to show the history for the past decade in order to provide a perspective for the forecast.

   The charts should also be accompanied by the customary tables which give the detailed breakdown of the supply and demand components. These tables should be similar to those given in the 2008 LTAP but provide a bit more detail on the various components of

supply that are expected to come on line over the period (e.g. the tables should give the details of the energy and the capacity expected to be derived from each significant supplier, such as Resource Smart projects, Site C, Alcan, Island Cogen, McMahon, Williams Lake, Waneta (and the expansion), Brilliant, the Clean Power Call, the SOP, the Integrated Offer Program, the BioEnergy Calls, etc.).

In Slide 72, please explain the reason for the supply growth between F2012 and F2015 and then the decline thereafter. The charts are very useful to see the development of the supply and demand over time, but the provision of the detailed tables for energy and capacity will greatly clarify the picture regarding the exact size of the supply/demand gap and the sources of the anticipated supply.

Comment re Exports

We see the subject of Exports listed in the topics for discussion in Meeting #2 and wonder how this will be presented to the TAC. Is there a forecast for Export opportunities, and will that be issued to the TAC sometime prior to the next meeting so that we could come prepared to discuss it?

We look forward to your responses to the above and the January 27th/28th meeting.

Thank you.

Sincerely yours,

Paul Kariya
Executive Director

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BC Sustainable Energy (BCSEA)

Comments on IRP TAC Meeting #2 (February 2, 2011)

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MEMO

To: Anne Wilson, Moderator, BC Hydro IRP Technical Advisory Committee
Cc: TAC Members and distribution list
From: Bill Andrews
Date: February 3, 2011
Re: Comments on IRP TAC Meeting #2

One of the action items from the January 27-28, 2011 IRP TAC meeting was an invitation to committee members to provide written comments on the information received during the meeting. It is understood that such comments and other feedback will be discussed at the upcoming February 14, 2011 TAC meeting.

These are BCSEA comments, in order of the Meeting #2 agenda (not in order of importance.) References are to the Agenda topics, and slide numbers. No attempt is made to repeat comments made during the meeting.

Review Agenda, confirm terms of reference, review action items/areas of interest

getting BCOAPO et al to participate in the TAC

- important that BCH follow up
- funding is the problem
- BCSEA shares the funding concerns
- issues include: HST, expenses for travel from Victoria, prep time

TAC terms of reference

- awaiting BCH rewrite re committee objectives
- important to distinguish objectives of committee and objectives of IRP
- objectives of IRP (sources: good utility practice, CEA s.2, s.3) warrant more attention than has been brought to the committee so far (more below)

technology context missing

- Agree with CEC comment that technology developments over the life of the plan are not apparently addressed.
- Observation: the IRP methodology is highly oriented toward quantitative analysis (not inappropriately).
- Identification of emerging technology developments over 20- and 30-year horizon need not be mere ‘crystal ball gazing.’ As with financial forecasting, the point is to identify

reasonable possibilities so as to have a plan that is robust across all reasonable possibilities – not to predict a single future.

- (in addition to technology) Missing so far is a *qualitative* analysis, e.g., utilizing results of quantitative analysis but discussing driving forces, regional (within BC) factors, 20- and 30-year visions, etc.

Process Overview and Meeting Objectives

IRP objectives

- While the discussion focused on the committee terms of reference, the objectives of the IRP itself warrant more discussion.
- The "5 Key Issues" [slides 4, et seq.] need attention. Examples:

Electrification

- "Electrification" should be divided into electrification that will occur due to non-BCH policies (which appears to be the current meaning) and electrification due to BCH policies.
- There should be more attention given to the options for BCH programs to foster electrification (see next section)

Other CEA objectives

- The IRP should include substantive measures re:
    - GHG-oriented fuel switching [CEA s.2(h)],
    - community GHG reduction and energy efficiency [CEA s.2(i)],
    - use of waste heat, biogas and biomass [CEA s.2(j)],
    - development of First Nations and rural communities [CEA s.2(l)].
- The above examples are mentioned because they don't seem to be specifically addressed in the IRP; in comparison to the other CEA s.2 objectives that *are* addressed in the IRP.
- CEA s.2(g) (objective to reduce GHG emissions) warrants special attention. Yes, GHG emissions reductions come up in various aspects of the IRP (e.g., GHG prices). But what exactly is BC Hydro going to *do* (or options to be considered) to promote GHG emissions reductions (beyond passively providing low-carbon electricity in response to demand)?
- As but one example, what is BC Hydro going to do about imports of high-carbon electricity from Alberta?
- More generally, in order to contribute to the province-wide GHG emissions reduction objective [CEA s.2(g)], BC Hydro's IRP should examine the sources of GHG emissions in BC, identify the opportunities for 'GHG-reduction electrification,' articulate a methodology for prioritizing the most cost-effective opportunities, and select portfolios of 'GHG-reduction electrification' programs for inclusion in the main portfolio analysis.
- In the past, Hydro's DSM programs have focused exclusively on reduction of electrical load. In the 2008 LTAP proceeding, BC Hydro said or implied that it had no mandate to

pursue electrification in the absence of specific legal direction (such as the Remote Community Electrification Program.) BCSEA's view is that CEA constitutes a sea change in this respect. Now, Hydro's 2011 IRP must include measures to use B.C.'s low-carbon-intensity electricity (plus efficiency measures) to displace higher-carbon-intensity uses of energy in B.C.

- It is an open question whether BC Hydro's GHG-reduction electrification programs should be organized as a separate portfolio or as a supplement to and modification of the DSM portfolio.
- In any event, Hydro's new mandate to promote GHG emissions reductions, in addition to continuation of its existing mandate to attempt to reduce electrical load, requires a reorientation of the objectives of Hydro's DSM portfolio. The overall objective is now the most cost-effective reduction of GHG emissions in B.C. And the scope now includes not only existing uses of electricity but also uses of other forms of energy for which electricity could be a cost-effective substitute.
- Among other things, this will require explicit introduction of the cost of carbon ("GHG prices") into the Total Resource Cost (TRC) analysis of Hydro's market intervention programs (using the phrase to include both traditional DSM programs and GHG-reduction electrification programs).
- As one example, the existing building stock in B.C. is a significant source of GHG emissions (about 13% according to Industry Canada figures). Most of the emissions stem from the use of oil and natural gas. Although there is substantial use of electricity, the GHG emissions from electricity use in existing buildings in B.C. is relatively small because B.C.'s electricity has low carbon intensity. BC Hydro should be examining programs, whether called DSM or electrification, that maximize the cost-effective reduction of GHG emissions through a combination of electrical efficiency measures (such as more-efficient electric motors), energy conservation measures (such as automatic controls to limit heat and light to times when needed, and building envelope improvements), and GHG-reduction fuel switching (such as electric heat pumps or electrically backed up heat exchange systems in place of oil or gas furnaces.)

FN claims settlement

- Settlement of First Nations claims. BCH has a huge financial contingency on the books for settlement of FN claims. Various recent claim settlement agreements have been announced. Presumably, 'good utility practice' requires addressing settlement of FN claims in the 20-year plan. What are the types of claims? Where? What process does Hydro have for (a) prioritizing entering negotiations and (b) negotiating such claims? What time frames are expected? Are there options for consideration?

DSM beyond 'how much'

- Three DSM issues, beyond 'how much':
    - transparency of verification;
    - accuracy of verification;
    - underspending of DSM budget.

Risk Framework

Assumption that higher rates of economic growth coincides with more-aggressive government policies on climate change and environment

- This is a widely acknowledged generalization; and not inappropriate at that level.
- But support inclusion of a low-growth, high-GHG action scenario.
- How can BCH promote GHG reduction within low-growth scenario?

Slide 14. Gap diagram. (presentation comment)

- It's unclear why the 3,000 GWh/y insurance isn't shown for the pre-DSM load forecast, as well as the with-DSM load forecast.
- The range shading should follow the 'with 3,000 GWh/y insurance' load forecast when insurance is included in the load forecast.

GHG Price Forecast

Slide 46, et seq (presentation comment)

- The terms need to be briefly defined. Examples:
    - Does "broad environmental regulation" refer to both GHG emissions reduction policy *and* environmental protection policies e.g. re CCGT air emissions, run of river siting requirements?
    - Does "Conservation/Efficiency" shown as going up mean the utility's own DSM spending goes up? Or an increase in electricity savings? (or both?) Does this include or exclude rate elasticity effects? Confirm this doesn't include pre-DSM load forecast impacted downward by low economic growth scenario.
    - "CCS costs" – means unit cost of CCS? Or total spending on CCS? Are any assumptions made about the correlation between between CCS costs/spending and actual GHG sequestration?

Natural Gas Price Forecast

Exchange rate forecast? Interest rate forecast?

- What assumptions are made about exchange rates and interest rates?

Presentation re change between 2008 and 2010

- In future iterations, it would be useful to have a text explanation of the effect of including GHG prices in the 2010 forecast on forecast spot electricity prices, compared to the 2008 assumption of no GHG price for this forecast.
- This comment applies to numerous observations that can be made (and were made during the oral presentation) about how changes in assumptions affect the modelled outcomes. The direction of these links isn't always intuitive (e.g., REC prices move opposite to GHG prices), and in any event could use reinforcement.

Exports

- Re the evaluation of whether generation for exports is in the public interest (see wording in CEA s.3), it would be very useful for BC Hydro to specify whether the analysis in the IRP is intended to be strictly neutral vis-à-vis non-financial factors (which BCSEA supports). If the evaluation is not intended to be strictly neutral, then the other factors/assumptions should be clearly stated.
- At face value, it is difficult to see how new 'generation for export' in B.C. at BCH's reference price ($124/MWh) could possibly support a viable export business taking into account transmission losses, spot market price forecasts, the value (cost) of firming, and any renewable (by customer's definition) price premium. It is recognized that the CEA requires BCH to carry out the evaluation. However, perhaps the comment here is that if the conclusion of the evaluation is that generation for export *is* in the public interest then Hydro should be prepared to provide the full details.

Day Two.

DSM

Small commercial conservation rate deferred

- BCSEA is disappointed to learn that Hydro intends to defer to 2018 the introduction of a conservation-oriented rate structure for the small commercial customer class (Small General Service, i.e., <35 kW). Deferral to 2018 compares with the possibility of a Fall 2012 SGS conservation rate proposal described by Hydro in the LGS proceeding. ["F2011 – F2014 Strawdog Conservation-Rate Regulatory Filing Schedule" which for F2013 (April 2012 - March 2013) includes "Fall: Time-differentiated rate application (potentially including a conservation rate for the SGS class)" [LGS proceeding, Exhibit B7, Terasen IR 2.3.1, pdf p.308 of 309.]]

DSM Option 5 "Major Shift to Market and Societal Tactics"

- DSM Option 5 has the lowest expected value for conservation savings as a percentage of pre-DSM load forecast of the five DSM Options.
- As a comment, this appears to reflect Hydro's view that aggressive DSM is necessarily substantially more uncertain than less-aggressive DSM. This view was contradicted by BCSEA-SCBC's expert John Plunkett in the 2008 LTAP proceeding.
- It appears that Option 5 is currently constructed in a manner that contributes directly to an especially low low-case outcome (and hence a low average savings outcome). For example, "most program incentives eliminated or diminished after 2-part rate in place" [slide 33]. Presumably, Option 5 would perform much better if most program incentives kept in place, and only removed as it became apparent that such removal would not result in lower DSM savings.
- Experience in the 2008 LTAP proceeding indicates that Hydro will not recommend a DSM option that has high perceived uncertainty even if the option provides the most cost-effective savings. A DSM option with high uncertainty is effectively 'non-compliant' because the option would apparently never receive Hydro's support.

- BCSEA strongly suggests that Hydro reconfigure DSM Option 5 so as to maximize the average electricity savings outcome and minimize the low-case outcome.

DSM options, unit cost

- Regardless of the arguable change in the legal status of "all cost-effective DSM," it's still a 'good idea' to get all cost-effective DSM.
- The unit utility cost (mid) of all five DSM options is at or below about $30/MWh [slide 42]. Even the total resource cost (mid) of all five DSM options is at or below about $60/MWh [slide 41]. This compares to a long run marginal cost or reference cost of new generation at $124/MWh.
- None of the DSM portfolios Hydro is considering costs even half as much as the cost of new generation.
- Does Hydro assert that the five DSM portfolio options capture all of the available savings, say, as identified in the Conservation Potential Review? It is difficult to imagine that there aren't more electricity savings that could be achieved (beyond the savings from Options 1-5 as currently defined) with the inclusion of more-expensive DSM programs that would still yield a total resource cost – let alone a utility cost -- less than $124/MWh.
- This is an important point. The credibility of the IRP will be undermined if it can't be said that Hydro examined all the options to be sure that the plan captures all cost-effective DSM before targeting new generation.

Wind integration

- Going from 25% to 35% wind penetration *reduces* the within-hour reserve cost for the economic dispatch case because this introduces wind generation from outside the Peace River region [slide 97]. Hydro indicated an intention to continue to use the $10/MWh wind adder in the 2011 IRP (as was used in the 2008 LTAP).
- Would a portfolio of wind generation that optimizes 'economic dispatch' and 'diversification' allow a reduction in the $10 wind adder?

Electrification

- "Electrification" includes "natural electrification" as well as "policy driven electrification."
- Comment: The analysis appears focused on forecasting the effect of "electrification" (of both types) on load, which is fine. However, there doesn't seem to be an analysis of BC Hydro's options for BC Hydro itself to promote energy efficiency and GHG-reduction oriented electrification. Examples would include distributed heat and power systems, electric heat pumps for space and water heating, EV recharging stations, etc.
- Terasen is actively pursuing natural gas load-building lines of business (natural gas vehicles, distributed heat and power) with asserted net GHG reduction benefits, even supported by DSM incentives (e.g., for the incremental cost of natural gas over diesel heavy duty vehicles). The electrical opportunities are obviously somewhat different than

the natural gas opportunities, and in some applications there may be direct competition between the two. BC Hydro should be exploring its options.

Unfinished business from Meeting #2

- BCSEA notes that its request for information re (a) reconciliation of import/export data between BC Hydro and NEB data and (b) Hydro's study of climate change effects on generation resources has yet to be discussed by the committee.
- Briefly, if BC Hydro ends up recommending generation for export in this IRP, and if it is approved and implemented, then Hydro's expenditures and revenues for generation for export will be closely scrutinized, both in the public arena and by the BCUC. [CEA s.4(5) requires the commission to ensure that Hydro's rates do not allow Hydro to recover expenditures for export (beyond 'natural export').]
- Hydro's own import/export data may be presumed to be accurate, but the NEB/Stats Can import/export data may be presumed to be accurate too. As long as the two data sets produce apparently differing results there will be confusion and disputes. Generation for export is a contentious topic on many levels. BCSEA believes the debate should be based on a solid foundation regarding the actual import/export data.
- Regarding climate change and generation resources, there are informal signals that BC Hydro considers that its generation resources will not be adversely affected. If that is what the science predicts, then good. But, with respect, the point here is transparency. In the 2006 IEP/LTAP proceeding presented no current analysis of the impact of climate change on its generation resources over the planning period, but said it was a partner in some ongoing research. What are the results? The whole IRP under the CEA is dominated by the need for action on climate change; it seems reasonable to address the potential impact of climate change on Hydro's generation resources.

Meeting #1 Meeting Summary Notes

- BCSEA reviewed the January 20, 2011 notes of the December 14, 2010 TAC meeting. Comments: the summary notes are useful; the format is an acceptable balance of brevity versus detail; don't feel a need to comment on specific wording.

The Pembina Institute

Advice to BC Hydro Regarding Integrated Resource Plan Analysis (February 23, 2011)

February 23, 2011

Advice to BC Hydro Regarding Integrated Resource Plan Analysis

by Matt Horne | 604.874.8558 x 223 | matth@pembina.org

Overview

The following document summarizes the Pembina Institute's perspective on several important issues that emerged from the January and February meeting of BC Hydro's Technical Advisory Committee for the Integrated Resource Planning process. The issues are:

- The approach to energy efficiency and conservation understates the potential and overstates the uncertainty.
- The approach to supply side options currently understates the uncertainty.
- The self-sufficienty requirements mandated in the Clean Energy Act could undermine support for the eventual plan because of the likelihood they will add unessesary economic and environmental costs.
- The resource planning analysis currently overlooks some important uncertainties that are outside of BC Hyro's control, which could lead to significant changes in BC Hydro's planning context.
- The intended approach to reporting greenhouse gas emissions needs greater clarity to ensure that the analysis being conducted is as informative as possible for B.C.'s climate change policy development.

It will be important for BC Hydro to decide and communicate how they plan to account for these concerns.

Energy Efficiency and Conservation – Understated Potential

- In general, the framework that BC Hydro has used to understand uncertainty in energy efficiency and conservation options is well designed and helpful to the overall analysis. The degree to which it is helpful is dependent on two caveats:
    - A consistent approach needs to be applied to supply side options (see the next section).
    - Several problems within the efficiency and conservation options need to be resolved (see the next bullet point).
- The following specific concerns about the way efficiency and conservation options have been characterized result in understated potential and overstated uncertainty:
    - The efficiency and conservation option that was supposed to yield the greatest levels of savings (option 5) has a flawed construction. The option

assumes BC Hydro will curtail effective incentive programs in favour of new approaches to conservation (e.g. community energy planning) even if those new options prove to be ineffective. The result is a big potential downside to conservtaion that is highly unlikely to exist in reality.
    - The previous concern is exacerbated because the unrealistic scenario dominates the high-level conclusions for the conservation options and gives a false impression that a more comprehensive approach to efficiency and conservation might achieve less than a less comprehensive approach.
    - The current characterization of efficiency and conservation options lumps all sources of uncertainty together, and although they are all factors outside of BC Hydro's control, many of the key uncertainties are within the B.C. government's control. For example, whether or not the government continues to advance energy efficiency regulations is uncertain from BC Hydro's perspective, but directly within the provincial government's control and something they should be aware of when deciding whether or not to approve the plan.

New Supply Options – Understated Uncertainty

- The Integrated Resource Planning analysis does not currently account for any uncertainty in supply side options apart from an assumed attrition rate for new projects that have been given contracts.
- The implications of this gap are unclear, but based on the relatively significant implications of assessing uncertainty in efficiency and conservation options, it would be prudent to apply a similar approach to supply side options.
- In thinking about uncertainty in supply side options, it would be useful to consider two questions:
    - How might the costs of supply side options vary from the values provided in the resource options database?
    - How might the deliverability of supply side options (i.e. the likelihood that an approved project is built) impact the overall analysis?
- Based on the information presented at the January and February meetings, this is a gap that BC Hydro plans to address, but details or timing were not available.

Surplus Requirements – Unessecary Costs

- The self-sufficient electricity requirements mandated in the Clean Energy Act will result in BC Hydro having an average surplus of approximately 8,000 gigawatt-hours of electricity per year (in the range of a 13% surplus).
- The economic and environmental costs associated with this surplus could be significant and they could undermine support for the eventual Integrated Resource Plan, regardless of how robust the rest of plan is.
- While BC Hydro does not have flexibility to not meet the surplus requirements prescribed in the Clean Energy Act, it would be prudent to use the Integrated

Resource Planning process to assess and communicate the economic and environmental costs of those requirements to the provincial government.

Factors Outside of BC Hydro's Control – Understated Uncertainty

- BC Hydro's risk framework focuses on characterizing the range of ways that the prices for electricity, natural gas, greenhouse gas, and renewable energy certificates could evolve in the future. Within this framework, the range of uncertainty is potentially understated:
    - Focusing on the high and low values of the four price variables BC Hydro is considering, there are 16 potential combinations. Given BC Hydro is using market scenarios to explore five potential combinations, there are nine combinations not being considered. It would be prudent to look at the nine combinations currently out of scope to see if they would lead to significantly different scenarios for BC Hydro to respond to, and to test if there are foreseeble futures in which those combinations would occur. If the answer is yes to both of these questions for any of the combinations, then it would be justifiable to expand the analysis.
- There are at least two other areas where BC Hydro may be understating the sources of uncertainty (beyond market prices) that they will need to be in a position to respond to over the coming decades. The two areas listed below are being discussed at a March 10 sub-group meeting of the Technical Advisory Committee.
    - *Provincial energy and climate policy:* BC Hydro has started to look at some of these variables (e.g. government support for electrification, and efficiency and conservation), but many others are considered fixed (e.g. self-sufficiency requirements, potential regional planning approaches for new projects, and changes to water allocation practices in a new Water Act). While B.C. Hydro needs a plan that complies with provincial government policy, that plan should also have some understanding of how constraints might change over time and how those changes might impact BC Hydro.
    - *Changes in technology*: The supply and demand side options give some consideration to new and emerging technologies, but there are other potential shifts that BC Hydro should be considering in its planning process because of their potential to increase or decrease future demands and costs. Examples include: the feasibility of carbon capture and storage for coal and natural gas generation, the feasibility of carbon capture and storage in gas processing, the costs and performance of batteries for electric vehicles, and the costs of large scale solar generation that would compete with B.C. electricity exports.
- While an attempt to quantify all of these additional areas is probably beyond the analytical capacity of the planning process, it would be useful at a minimum to explore them qualitatively to understand potentially important gaps.

Greenhouse Gas Emissions – Lack of Clarity on Scope

- Based on the January and February advisory committee meetings, BC Hydro intends to report on some of the greenhouse gas emissions reductions achieved through different electrification scenarios. There was a lack of clarity of exactly what emissions sources would be included in the reporting, and to what degree those would be comparable with the province's Climate Action Plan. There is a risk that the greenhouse gas emissions reductions from any electrification plans could be under- or overstated if the reporting effort isn't robust and comprehensive.
- To maximize the benefit of the analysis, it would be helpful to report the greenhouse gas emissions in each sector where electrification is being considered. The reporting should include the emissions for scenarios with and without electrification, and be done in a way that facilitates comparison with the emissions forecast in the province's Climate Action Plan. Taking this approach would allow BC Hydro to provide good advice and input to the provincial government regarding the degree to which various options contribute to Clean Energy Action greenhouse gas reduction objectives.

Energy Conservation & Efficiency (EC&E) Committee

Preliminary Advice on the IRP (April 29, 2011)

EC&E Committee
Preliminary Advice on the IRP
April 29, 2011

Background

Given the relationship between BC Hydro's Integrated Resource Plan (IRP) and the Mandate of the ECE (i.e. those aspects of the IRP that either impact on or are impacted by DSM), the ECE concluded at its December 2, 2010 meeting it wished to periodically provide BC Hydro with advice and recommendations regarding both the IRP and the planning process being used to develop the IRP. The ECE acknowledged that its direct input/advice to BC Hydro on the IRP would be restricted to advice from the committee as a whole and that any input/advice from individual members of the committee would be provided by those members through the formal IRP consultation process established by BC Hydro.

Subsequent to the December 2, 2010 ECE Meeting, the ECE met by conference call twice to discuss a number of areas related to DSM and the IRP. The second of these discussions (February 9, 2011) was supported by a discussion paper drafted by the three EC&E Committee members who are also members of the IRP Technical Advisory Committee (the "TAC"). A summary of these discussions were prepared for review at the March 8-9, 2011 meeting.

In its feedback to BC Hydro on its DSM Options, the EC&E identified several limitations to BC Hydro's original DSM Option 5. More specifically DSM Option 5 does not present a realistic view of program implementation. In Option 5, DSM programs with lower uncertainty are replaced with market and societal initiatives that have higher uncertainty. When adjusted for uncertainty relative to the other options, this results in Option 5 having the lowest expected value for DSM savings. This outcome has a significant influence on the high-level conclusions about the DSM options. However, a more realistic path would have BC Hydro pursuing staged adoption of market and societal tactics and modifying the plan with new information to minimize failures and maximize successes (i.e. adaptive management) or, alternatively, aggressively implementing market and societal tactics coupled with a staged curtailment of individual level tactics. These paths should lead to Option 5 having a higher expected value for DSM savings.

Based on the feedback received from the EC&E Committee and the TAC on its original DSM Option 5, BC Hydro has revised its DSM Option 5 to address these limitations. BC Hydro's revised DSM Option 5 was presented at the March 8-9 ECE meeting.

The following represents preliminary advice to BC Hydro in relation to the IRP and DSM. This advice is effective as of the March 8-9, 2011 ECE meeting. Further input may follow at a later date based on subsequent developments and new information provided in relation to the development and finalization of both the IRP and the DSM Plan.

Recommendation 1 - Limitations with DSM Options in the IRP

The ECE believes the following limitations exist regarding the development and uncertainty assessment of the DSM options fed into the IRP and should be addressed by BC Hydro and

where this is not possible due to IRP timelines, at a minimum these limitations should be noted in the IRP report:

a) The electrification sensitivities presented in the IRP underestimate the potential of DSM to reduce additional load predicted to occur with electrification (particularly with respect to transportation demands);

b) Given BC Hydro's new Option 5, which now includes programs as well as a high emphasis on market and societal tactics, BC Hydro should consider how the addition of programs could result in additional savings in low, mid and high scenarios beyond those savings identified in BC Hydro's original scenarios.

c) By their very nature, DSM initiatives can be adjusted and managed as they are implemented to improve performance over time (e.g. if codes and standards don't perform as expected, programs may be expanded to make up some or all of the shortfall). BC Hydro's DSM options in the IRP and uncertainty assessment only minimally account for the value of the potential flexibility of DSM. For example, a comparable approach on the supply side is the way that BC Hydro incorporates a 'dynamic' deliver of supply side power, where if one project fails, another is expected to take its place.

d) The uncertainty assessments for DSM and supply-side options should be undertaken with a consistent level of rigour. Efforts to understand uncertainty provide greater insight into the risks inherent in different resource options and how those risks can be mitigated. It is important to note that a consistent approach does not imply the detailed analyses or results will be identical, because the specific sources and magnitudes of uncertainty will differ between DSM and supply-side options.

Recommendation 2 - **Communication Regarding of DSM Options in the IRP**

For the purposes of making decisions on the IRP, it is important that the public, BC Hydro senior executives, and government have information on DSM options that is objective and balanced relative to supply side options:

a) At present, BC Hydro's presentation materials on DSM risk and uncertainty negatively frame DSM, potentially causing biases for decision-makers – BC Hydro presentation materials on DSM risk and uncertainty needs to be reframed in neutral language;

b) In its communication material, BC Hydro should present both the upside and downside of DSM and refrain from potentially pejorative language such as "speculative" and "no key breakthroughs" unless it is appropriate; and

c) Where BC Hydro identifies uncertainty with respect to a particular DSM option or program, BC Hydro should identify and communicate to governments and others the extent to which such uncertainty either flows from existing government policy, or could be addressed or mitigated though government policy or initiatives (e.g. codes and standards, LiveSmartBC, taxation policy).

Recommendation 3 - Informing the DSM Implementation Plan

In putting together that part of the IRP dealing with implementation of the DSM option selected for the IRP:

a) The development of the DSM implementation plan should not be limited by how the discrete DSM options have been put together (i.e. elements of each of all of the DSM options should be able to inform and, where appropriate, be incorporated into the DSM implementation plan)

b) The implementation plan should be developed such that BC Hydro maintains the opportunity to leverage the value of DSM flexibility as we learn more and avoid committing to supply side resources prematurely.