## INTRODUCTION

As part of the Clean Energy Strategy in the November 2013 Integrated Resource Plan (IRP), BC Hydro committed to regularly updating its inventory of resource options in B.C. With respect to engagement, BC Hydro committed to working with IPPs and industry experts on resource pricing and updating the Resource Options Inventory starting in 2014.

## ISSUES SCOPING MEETINGS

From May to July of 2014, BC Hydro carried out individual scoping meetings with representatives of the Clean Energy Association of BC (**CEBC**), the Canadian Wind Energy Association (**CanWEA**), and Canadian Geothermal Energy Association (**CanGEA**) of BC. The purpose of these meetings was to understand the issues and concerns with respect to how BC Hydro characterized resource options (i.e., resource potential, prices and technical capabilities) within the 2013 IRP and to gather input into what should be included in the resource options update being undertaken in advance of the fall 2015 IRP review.

## 2014-2015 RESOURCE OPTIONS UPDATE

BC Hydro developed a list of Resource Options to be updated based in part on feedback received during the issue scoping meetings. Starting in the fall of 2014, BC Hydro will be updating the characterization of a number of resources. This list of updates can be found at BC Hydro's Power Generation Options Updates webpage. In response to feedback received, in 2015 BC Hydro will also hold targeted, topic-specific meetings with representatives of CEBC to discuss select resource valuation (data analysis) issues, and as this stage gets underway updates will be provided on BC Hydro's Power Generation Options Updates webpage.

This document provides the scoping meeting summaries that occurred with industry associations from May to July 2014. Meeting summaries, in chronological order, are attached as follows:

- CanGEA, May 23, 2014
- CEBC, May 26, 2014
- CanWEA, June 3, 2014
- CEBC (follow-up meeting), July 2, 2014
- CanGEA (follow-up meeting), July 18, 2014

# SUMMARY NOTES Resource Options Update: Issue Scoping Meeting with CanGEA

May 23, 2014
3:30 – 4:30
BC Hydro Dunsmuir

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|---|---|
| TYPE OF MEETING | Engagement Scoping Meeting |
| ATTENDEES | Attendees: Steve Davis (CanGEA), Anders Kruus (Borealis/CanGEA) |
| BC HYDRO | Randy Reimann, Alex Tu, Anne Wilson, Nan Dai, Kathy Lee |
| OBJECTIVES | Gather input regarding BC Hydro's characterization of the geothermal resource |

MEETING SUMMARY

**Main issues expressed by CanGEA:**

A. Geothermal developers face more challenging permitting, process and higher fuel uncertainties than other renewables developers, especially at the early stage of development.

i. Geothermal's permitting process is not as well set up as for wind and hydro.

ii. Evaluating the potential energy for a geothermal site requires more time and money than for a wind or hydro site.

B. BC Hydro needs to better signal specific system needs to attract the resource options that fit those needs

i. Now that the system needs capacity (vs energy), projects that deliver dependable capacity should be paid for it

ii. As the system is increasingly supplied by intermittent resources (eg. wind, RoR and solar) the need for generators that can firm them increases. Projects that generate electricity with the qualities that can perform firming functions (i.e. fast ramping) should be paid for them.

iii. In locations where new generation can deliver network improvements like deferring transmission investment or improving local service quality and reliability BC Hydro should pay a higher price to bidders that can generate electricity with the qualities that can enable those savings or service improvements. (i.e. projects that can provide voltage regulation, load following, and spinning reserve)

C. BC Hydro needs more flexible call terms to accommodate geothermal development (e.g., longer COD date)

**Discussion Item #1**

Further detail on CanGEA's submissions to IRP, Site C and SOP feedback processes

**Description of Item #1**

CanGEA has provided comments regarding the geothermal resource and potential for its development in B.C. through the IRP review last October, the Site C EIS process, and then most recently during the Standing Offer Program review. In general, CanGEA believes there are changes in the IRP and the SOP that can be made to support geothermal development.

In the near term (tactical) timeframe, CanGEA believes changes to the SOP to reward the desirable characteristics of geothermal (e.g., can provide dependable capacity, may be located at the end of a long feeder, can support local economic development, or has extra value from waste heat by-product) would facilitate geothermal projects applying for the SOP, including the two near-term SOP projects

Borealis is working on.

In the long-term (strategic) timeframe, CanGEA believes BC Hydro can help diminish policy and resource risk barriers so that large-scale geothermal may bid into the next large scale call for power. One way to reduce policy risk is to improve the permitting and tenuring processes for geothermal projects. One way to reduce resource risk barriers is to allow longer COD dates since geothermal projects require more time to determine resource availability.

In addition, how BC Hydro characterized the geothermal resource as "non-viable" in the latest resource option report is not helping the promotion of the industry or development of the resource in B.C.

**ACTION 1:** BC Hydro to explore the SOP terms and comments CanGEA submitted during the SOP review process, and to follow up internally to consider how BC Hydro can better signal specific system needs that geothermal can respond to. (i.e. See the 3 examples listed in Issue B)

**ACTION 2:** BC Hydro to consider what it would take to change the characterization of geothermal from 'non-viable' to 'viable' (see CanGEA's involvement in the next Resource Options Report).

**ACTION 3:** BC Hydro to review the outcome of the BC Favourability Map and to consider further steps to reduce the resource risk.

**ACTION 4:** BC Hydro to engage the Ministry of Energy to discuss the permitting and tenure process.

**Discussion Item #2**

How to advance a geothermal demo/pilot project to show the viability of the resource

**Description of Item #2**

Borealis is currently working on two SOP-scale projects (Terrace and Canoe Reach) in B.C. Both projects have some merit from a demonstration point of view. As they come from 2 different types of resources, volcanic (like California), and extensional (or Basin and Range like Nevada).

**ACTION 5:** Borealis to provide a 'wish list' of things BC Hydro can do to support both Terrace and Canoe Reach projects.

**Discussion Item #3**

CanGEA's involvement in the next iteration of the Resource Options Report

**Description of Item #3**

The last ROR characterized the geothermal resource in B.C. as approximately 700 MW (excluding any potential in the Northeast Sedimentary Basin) and having an at-gate cost between $90-140/MWh.

Over the course of this fiscal year, BC Hydro is undertaking a review of the characterization of the geothermal resource and would welcome input from CanGEA.

**ACTION 6:** BC Hydro to ensure CanGEA is engaged in the ROR process. Once BC Hydro receives and reviews the outcome of the BC Favorability Map (expected next month), BC Hydro will set up another meeting to discuss geothermal characterization updates with CanGEA.

**Thanks and meeting close.**

# SUMMARY NOTES Resource Options Update: Issue Scoping Meeting with CEBC

May 26, 2014
9:00 – 10:30
BC Hydro Dunsmuir

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|---|---|
| TYPE OF MEETING | Engagement Scoping Meeting |
| ATTENDEES | Ministry of Energy: Paul Wieringa, Julie Chace<br>CEBC: Paul Kariya, Colleen Giroux-Schmidt (Innergex/CEBC); Paul Rapp (Alterra); Frankie Nash (CEBC); Stephen Cheeseman (Chinook Power); Fred Scott (Bastion Power); Resja Campfens (Sea Breeze/CEBC); Sara Van Milligan (Sea Breeze); Johnny Casana (EDP Renewables) |
| BC HYDRO | Randy Reimann, Anne Wilson, Nan Dai, Kathy Lee, Magdalena Rucker |
| OBJECTIVES | Gather input from Clean Energy Association of BC regarding issues with resource options and discuss working together on the update going forward |

## MEETING HIGHLIGHTS AND ACTIONS

- Concerns were raised from CEBC members that the markets and technologies are advancing rapidly and the ROR is no longer current. This is seen in particular with respect to wind, and gas also mentioned.
- Recent advances in storage were also raised, in connection with battery technology with wind but also the idea of looking at storage with small hydro in BC (may help with the system freshet issue). There may be opportunities for development of hydro with storage in some circumstances in B.C.
- There is potential for geothermal in BC. There is a screening study being undertaken by Geoscience BC, but also needs an influx of money to move beyond the academic.
- CEBC members expressed an interest for BC Hydro to collect information on near term projects ready for development, i.e. those "next in the hopper". And there was interest on collecting this information through a "request for information" with CEBC helping to manage expectations. BC Hydro has concerns about raising expectations but will consider how to collect short term project information, perhaps through a technology specific approach.
- Other suggestions were also raised, such as cutting off including information from some of hard to reach sites (for example with the KWL study on run of river… results show all potential which increases into the hundreds of dollars) along with ground truthing this information through this request for information suggested above; and looking at the components of resource costs that are variable that may inform costing information and analysis looking forward.
- In terms of work plan, CEBC and BC Hydro will collate these notes, perhaps gather additional issue areas from CEBC and a smaller joint group will develop a draft work plan. BC Hydro will also be collecting information from meetings with additional groups and will fold into the work plan to share with CEBC. The next meeting for this group will be sometime in June, before the summer.
- The ministry has an objective that this resource options update be transparent, and engages CEBC and its members.
- **ACTION** – CEBC to send BC Hydro draft notes.
- **ACTION** – CEBC and BCH to work in small group to develop a work plan

## MEETING SUMMARY

CEBC began the meeting by stating that they thought of this meeting as the start of a longer process, and envisions there being perhaps issue teams, where one member would be tasked as the issues lead; and these team leads would be accountable to their members. CEBC is also hoping that today we can discuss scope and develop a process to getting to the next Resource Options Report and the next IRP. The resource options review is a good beginning to the next IRP. A key question is how we get accurate pricing, such as having an indicative call.

BC Hydro mentioned that if a call is out there, it raises expectations. It is a good question about how do we get an

accurate price signal.

Wind was brought up as an example, if we took the price of wind five years ago and assumed the forward price, we would have been completely inaccurate. Specifically in the mid and low speed wind. Technology is evolving rapidly and we can forecast wind regimes much more accurately, which lowers wind unit costs. Solar is another example that, 5 or 10 years ago we would have not been able to forecast what is available today. It was mentioned that small hydro and geothermal somewhat more stable in terms of forecasting prices and technology. It was further brought up that gas technologies are also changing pretty quickly, with the shale gas. For example GE has a new gas turbine unit with above 63% efficiency; as well the ramp up time has been decreasing. Thinking about process, and one aim for CEBC would be to come to a common understanding.

BC Hydro mentioned that we could go through this exercise technology by technology. In terms of wind costs for example, we didn't want to take the price from the bottom of the cycle, and presumably at some point prices will rise again. BC Hydro is also interested in hearing from people about how to deal with what BC Hydro has in its system; for instance the freshet is becoming a concern and can we include this issue as part of the discussion.

It may be worth taking costs of a general database and ground truthing to BC. For example wind costs in Texas are coming in much lower and it is a different environment, the terrain and permitting issues in BC is different. The Ministry representative mentioned that it would be good to note the factors that are causing higher costs in B.C. and lower costs in other jurisdictions. BC Hydro mentioned that staff in the contract management department could talk about contractual terms.

CEBC representative mentioned that storage is an area that is seeing a lot of innovation and is growing fast.

The group started a round table by technology type to bring up issues as follows:

***Biomass and Gas*** – nothing further to add

***Wind*** –

- There is a need to understand the technology and what is coming on line in 5 years
- Storage is a fast growing area – with freshet and batteries. Wind and hydrogen fuel cells are a combination being used in northern Quebec.
- There are other areas where battery technology exists. It turns non-firm power to firm.
- Raglan Mine – a nickel mine in Quebec; uses three types of storage (flywheel, hydrogen and combustion). Demonstration project for battery components. Would like to explore this with off grid communities in B.C.
- There are wind cost differences between BC and Alberta
- Need to set a real cost expectation, there can be savings depending on where it is put in the system (on the Island versus the Lower Mainland)

***Storage and Hydro***

- Have been participating in Wendy Palin's work
- So far have not spent much time on small storage hydro, however can we capture some of the freshet, draw in First Nations as well, get the mapping right and carry out some storage hydro.
- Regarding the KWL study, are there areas that we can let go off, those hard to reach areas and those at the high price level? And focus instead on the near term resources?

***Geothermal***

- With respect to geothermal, the costs are relatively well known… what is needed is certainty about getting a PPA.
- It was mentioned that Geoscience BC is doing some work with exploring geothermal potential. Regional screening is good, but at some point we need money to do more, example drilling

It was questioned whether BC Hydro should look more realistically about what is in the queue, say for the next 6-8 years. The idea of an indicative power call was raised. It was added that if there was a process that was transparent and confidential, that would be helpful. CEBC member mentioned that the price that you get would not necessarily be the price that would show up in a bid… you could get a range, and it would be a broad range. CEBC could help to manage industry expectations if there was a call of information, could call it a request for information. BC Hydro mentioned that if developers felt comfortable about providing information of what is in the hopper that is good, not comfortable with having a broad call.

Could also look at getting information on the physical attributes; maybe get a list together of 15 or 50 projects that would potentially be available for development. BC Hydro would still look at overall potential but could consider having

both, longer term potential and more near term of what is available. CEBC still understands the need to have a planning process, almost a nested planning process within a process. The market is moving very quickly now and may need to rethink the current planning framework.

A suggestion was also made that may be useful to look at the components of projects that are the most variable in terms of cost.

BC Hydro provided a reminder that our studies look 20 years out, but list steps to be taken now so we do keep short term in mind. Our contingency plans are pretty broad, and right now we are concerned about capacity so we have REV 6 and are getting a handle on thinking through gas options.

In terms of process, CEBC could put a table together and go chapter by chapter in the ROR and indicate where we would like more information; write up these notes, and then meet again. BC Hydro suggested in terms of next steps and process, it may make sense to take these thoughts away and think about it, we are also meeting with other groups – CanWEA and CanGEA – and can work with CEBC about chunking these issues down into a work plan. In terms of timing, we are working towards completing the pieces of the RO update by March 2015 so that we can undertake an IRP review in the fall of 2015.

It was suggested to have a meeting again before the summer – sometime in June. CEBC has been taking notes and will write them up and send them to BC Hydro.

There was some discussion as to whether BC Hydro will send the ROR for Ministry approval, and whether CEBC will be signing off on the report. Concerned about transparency. BC Hydro did not believe the ROR would be submitted for approval, and as BC Hydro is ultimately responsible for the report and IRP may not be looking for another group to sign off. BC Hydro further suggested that it is looking for comments from CEBC and can also be clear and transparent on areas of disagreement. BC Hydro suggested further discussion with the Ministry.

In terms of next steps, CEBC and BC Hydro will collate these notes, perhaps gather additional issue areas from CEBC and a smaller joint group will develop a draft work plan. BC Hydro will also be collecting information from meetings with additional groups and will fold into the work plan to share with CEBC. The next meeting for this group will be sometime in June, before the summer.

Thanks and end of Meeting

Post meeting note: additional procurement-related issues were submitted as input for BC Hydro's planning process by CEBC which included using the Merrimack Energy Group report on BC Hydro's procurement practices as a starting point to jointly review each of the recommended actions in an effort to identify further actions (such as risk allocation and timing that may be seen when reviewing call structure and contract terms).

# SUMMARY NOTES Resource Options Update: Issue Scoping Meeting with CanWEA

June 3, 2014
10:30 – 12:30
BC Hydro Dunmsuir

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| TYPE OF MEETING | Engagement Scoping Meeting |
| ATTENDEES | Ministry of Energy: Heather Johnstone<br>Attendees: Nicholas Heap (CanWEA); John Partyka (Aeolis Wind); David Warner (EDF); Johnny Casana (EDPR); James Griffiths (SeaBreeze); Maike Althaus (Senvion); Vicaas Karulkar (Senvion); Ron Percival (Avro Wind) |
| BC HYDRO | Randy Reimann, Anne Wilson, Nan Dai, Kathy Lee, Magdalena Rucker |
| OBJECTIVES | Gather input from wind industry experts regarding BC Hydro's wind resource option technical update and process. |

## MEETING HIGHLIGHTS AND ACTIONS

- CanWEA walked through a number of items related to the wind resource that they would like to see reviewed in the wind resource options update, including:
    - Location of new demand in NC and NE and how line losses and CIFT adders should be adjusted down for those resources, such as wind, located in the north.
    - Turbine life assumption (e.g. move from 20 to 25 years)
    - Include residual value post-EPA
    - Lower WACC for 'de-risked' projects; want to dialogue about this topic with BCH
    - Clarification on interconnection costs and policies
    - Wind integration costs – CanWEA has started looking at this, and BC Hydro is also preparing to update integration costs
    - Soft cost adder of 5%: it was suggested that it may not be necessary
    - Firm capacity adder
    - Value of wind farms providing ancilliary services
    - Turbine costs and other hard costs to make sure they are up to date
    - Wind resource modelling data
- CanWEA and BC Hydro both see this as an ongoing process with a number of meetings. CanWEA also has national experience and expertise to draw from.
- **ACTION** – BC Hydro to consider input and come back with a draft proposal

## MEETING SUMMARY

BC Hydro start the meeting by welcoming people and stating this was a chance to hear from others about BC Hydro's characterization of the wind resource in BC, and what issues and information they may have as BC Hydro is considering work to update the wind resource. It was mentioned that summary notes of this meeting would be produced.

CanWEA prepared 9 slides to help walk through the issues, which were reviewed with CanWEA delegates beforehand. The following provides a summary of discussion for each of the slides.

***Slide 2 – CanWEA delegation objectives***

CanWEA's objective is to help BC Hydro create an accurate assessment of the wind resource in BC, and has technical

expertise available as well as national expertise.

***Slide 3 – Areas for Review***

Slide 3 outlined areas that CanWEA would like to see reviewed, including assumptions in the assessment model, WACC and project risk, cost adders, valuing wind energy services, and modelling wind energy resources.

Further comments included

- We have learned a lot in wind and our assumptions have changed over the years, there have been great advances in technology and there will continue to be advances. That may not be captured (less tangible), but it is worth considering.
- In terms of working through these areas of review – see this as a longer process
- Seeing improvements in wind assessments and resource assessments translates into better choices of turbines and so are seeing improvements in productivity and lower bid prices because of higher certainty.
- Hub heights are continuing to get higher
- We have seen 5-8% improvements in turbine efficiencies

Regarding these improvements, BC Hydro stated it would be interested if industry representatives have any journals or data, BC Hydro would be interested in seeing them. CanWEA could provide journal articles on learning efficiencies.

***Slide 4 – Assumptions in Assessment Model***

CanWEA wanted to see three areas of assumptions reviewed –

(1) assumptions in the source of new demand is currently the lower mainland, but need to more greatly consider the northwest and northeast and how wind can deliver to those areas. Need to recognize the north east as well, it is developing aggressively. How will that fit into the big picture is the question and will the incremental energy needed be delivered by local power.

BC Hydro mentioned that we are seeing an increase in demand on the industrial side in the north. We are not shifting away from the lower mainland being the key load centre, there still is an imbalance but it is worth understanding where they are located and cost through line losses. We are seeing changes in the north coast region with LNG and mining. Maybe we could consider a loss credit. There is some regional view that could be considered.

(2) Assumption regarding life of turbine, currently 20 years but would like to see a change to 25 years.

It was mentioned that Bear Mountain signed a 25 year EPA, and as well, it looks like financing is just on the cusp of transition to 25 years. In most cases banks will lend money for a couple of years shorter than EPA terms ie. 18 years for a 20 year EPA. The project life is longer than 20 years.

BC Hydro wondered if that meant higher maintenance costs with extending the end of life to 25 years. Senvion can bring a manufacturers perspective; and provided comments that gear boxes are more robust, and some turbine manufacturers are building gearless turbines. As well, 98% still run with 1$^{st}$ gear box. Over 20 years, however, will still have some replacement items. EDF can provide information about expected value; and we have expertise in 3$^{rd}$ party operations and maintenance.

(3) Currently, the residual value of a plant post-EPA is assumed to be $0. Should be greater than $0 (at least at salvage value).

Repowering is occurring, for example, in California, will provide more information. Once the cost and resources of permitting a plant is completed, the cost and risk will be lower to repower the same area/plant. Transmission and road cost should be less, and better understanding of the wind resources.

With repowering of wind farms – the spacing is becoming different, there will be a change in scale – but it won't be that much of a change. As well, the salvage value should not be negative – still get money for the metal

***Slide 5 – Weighted Average Cost of Capital and Project Risk***

It was thought that BC Hydro should review the financial assumptions. There are projects that should be shown to have a lower WACC. The WACC reflects the inherent risk of projects; need to recognize that there is a range of spectrum of where projects are at with regard to risk. It was also mentioned that industry would like to continue this discussion, and not provide a recommendation now, but ultimately does not want wind injured because a higher risk is assumed. Further, it takes about 3 years to permit a wind project at an expense of about $3M (includes FN consultation), which should help de-risk the project and lead to a lower WACC.

***Slide 6 – Cost Adders: Areas for Review***

CanWEA would like to review a number of cost adders, the first is **interconnection costs** which is a significant black box for developers (don't know what the cost will be). More clarity is needed. Also interested in sharing thoughts on interconnection and extension policies.

The second area for review is the **wind integration cost**. CanWEA is also looking at this. It was mentioned that wind forecasting has improved by BC Hydro. The wind industry is interested in the wind forecasting work that BC Hydro has been doing, such as the status of the ability to forecast and methodology. Companies would be interested in sharing resources. We have access to a national perspective and are interested in a two way conversation. BC Hydro mentioned it has some intentions to do some work on integration costs

The third area for review is the **soft cost adder**. CanWEA would like to see this removed as they do not see the need. One way to do this is to ensure there is a higher threshold to participate in calls for power; and so BCH is awarding EPAs to projects that have been 'de-risked'. BC Hydro mentioned there are real and substantial costs associated with FN and accommodation costs, and BC Hydro is willing to look at this.

The fourth adder industry would like reviewed is the **firm capacity** adder. Could look at peak loads.

BC Hydro mentioned that capacity is becoming a major issue for BC Hydro. The long term plan shows 78% of needs being met by DSM. Biggest constraint is the two week period in the cold snap. Then we can look at what we know about wind; and our data is not so certain. We need more information, and it is causing concern. BC Hydro welcomes the discussion about this topic.

***Slide 7 – Valuing Wind Energy Services: Areas for Review***

CanWEA would like to review value of RECs/GHG credits; and suggest that the market value of REC is higher than $3/MWh. As well, in some instances, some turbine models can now provide VAR support which is not currently factored in. Wind turbines also provide some additional ancillary services. An example is seen in Alberta – financed on the basis of REC value there.

BC Hydro stated the market value seems to be limited to California and that is when the electricity and RECs are bundled together, when it is not bundled the cost is much smaller and about what we have. When BC Hydro buys clean resources it is because we want clean and the attributes that go along with it; we are not looking to buy for export, and we are already paying a premium to get clean (the portion above the cost of thermal generation).

***Slide 8 – Modelling Wind Energy Resources: Areas for Review***

CanWEA mentioned improvements have been made to wind flow modelling… for example there is an AWS Truepower dashboard that is available on a 200 m grid; for Vancouver Island, the Okanagan, the Peace and the North Coast. We are also seeing trends in increasing efficiencies. It was mentioned that newer turbine models are more efficient at lower wind speed; as well, LiDAR technology can help improve with how a turbine cuts in by monitoring wind speeds from miles away. Industry would like to review the balance of plant costs (i.e. not including turbine acquisition) and would like that for all resource options. We need to remember that data is one piece, permitting is another.

***Slide 9 - Conclusion***

Overall, CanWEA would like to work with BC Hydro and assist with the review. BC Hydro mentioned there is tending to be a cross over with resource options update and acquisitions. It is a different process for resource options update where we need to do a broad assessment as an industry in order for a fair comparison with other resource options. Need to separate the call design issues from the resource options update.

Industry doesn't want to unfairly characterize the resource options to make wind less interesting to BC Hydro.

BC Hydro questioned how we get information as a broader assessment and validate this information. Have talked about having some project information as part of the contingency plans. BC Hydro needs to take this information away and consider it and develop a work plan and then come back to the group. Could start with that, and then perhaps separate out into a wind stream where other wind proponents could join in the review.

It was agreed that CanWEA and BC Hydro are both seeing this as a longer process with multiple meetings. BC Hydro will consider this input and come back with a proposal.

Thanks and meeting close.

# SUMMARY NOTES Resource Options Update: Proposed Work Plan Meeting with CEBC

July 2, 2014
1:30 – 3:00
BC Hydro Dunsmuir

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| TYPE OF MEETING | Follow up Meeting on Proposed Work Plan and Engagement |
| ATTENDEES | Ministry of Energy: Julie Chace<br>CEBC: Paul Kariya, Frankie Nash (CEBC); Resja Campfens (Sea Breeze/CEBC); Sara Van Milligan (Sea Breeze) |
| BC HYDRO | Randy Reimann, Anne Wilson, Nan Dai, Kathy Lee, Magdalena Rucker |
| OBJECTIVES | Discuss proposed Resource Options Update work plan with Clean Energy Association of BC |

MEETING SUMMARY

BC Hydro walked through the proposed work plan and engagement for updating the resource options information. BC Hydro used the presentation "BC Hydro's Resource Options Update: Proposed Work Plan and Engagement. 2 July 2014 – Draft for Discussion" document that outlined a plan which responded to issues raised by industry association representatives during the scoping meetings held in May and June 2014.

Generally, CEBC members liked the approach and thought it reflected their input. A number of clarifications and additions arose, including the following:

- A discussion occurred as to how to capture the idea that the pace is such that assuming a cost or technology now may be outdated in 5 years. The question arose as to how to address this issue in the resource options update and long term planning more generally. BC Hydro invited CEBC to provide input into how this may be addressed. One example where this could occur includes the technological advances with battery storage options. CEBC to consider how the issue of pace of change may be addressed.
- CEBC members wanted to ensure transmission constraints is included as a resource valuation topic to be discussed. It was also clarified that CIFT means Cost of Incremental Firm Transmission and PLIL is Peak Load Incremental Losses.
- It was mentioned that CEBC will publish an independent review on the cost effectiveness of alternatives to Site C; and CEBC has internally generated a clean portfolio as an alternative to Site C which they will be sharing with the Minister. The review will also address resource valuation issues such as Weighted Average Cost of Capital (WACC) and as BC Hydro is suggesting having a focused meeting on the WACC, that perhaps CEBC could invite the consultant to present their findings to BC Hydro as well.
- CEBC members thought that it would be useful to start the topic specific meetings in the fall with one broader session where BC Hydro could talk about system needs. This would help industry as they are making investment decisions based on their own assumptions. BC Hydro agreed with this approach, and will plan to have a broader initial session.
- It was clarified that BC Hydro task leads who will be undertaking the resource characterization stream of the work plan would draw on contacts already part of the scoping process as well as additional contacts. It was also mentioned that this work stream would bring together all developers interested in participating under each respective resource. So for example, there would not be separate wind discussions with CEBC members and CanWEA members. The topic specific meetings in the fall covering broader resource valuation topics however, would be targeted to industry association representatives, with the meeting materials and discussions provided on the public website. This would be initiated with a broader 'system needs' forum to provide people with an overview of BC Hydro system needs and the framework for fall and winter work.
- CEBC would like to ensure it can report back to membership for items that are going up on the website. BC Hydro agreed that that made sense.
- It was clarified by the Ministry representative that BC Hydro owns the resource options update process and the Ministry appreciates staying informed of the process. It was also agreed by CEBC that they don't see their role as one of needing to endorse or sign off on BC Hydro's final report, but rather to provide input.
- The issue of pursuing an indicative call, or request for information raised by CEBC members was explored. BC Hydro reiterated that it did not want to raise expectations, and as well, the quality of the information was uncertain however if proponents wanted to provide information on a confidential basis then BC Hydro would consider that information and report out on an aggregate basis. CEBC also acknowledged that there is a risk of higher than or lower than actual costs. However, it was also acknowledged that the membership felt BC Hydro's costs were high and wanted to provide additional project information. It was also acknowledged that a driver from CEBC interest was also that if there is a signal that a new call is needed (or when a new call is

needed) that BC Hydro is prepared to acquire power in a timely manner. It is both about pricing as well as timing. It was agreed that is will be a topic at a fall meeting. BC Hydro to consider further the idea of gathering broad project information.

- It was mentioned that the procurement-related issues were discussed in the work plan document but did not show up in the notes. BC Hydro will go back to the notes to ensure they are included.

**Summary of Actions**

- ACTION: CEBC to consider how BC Hydro may incorporate the concept of transforming technology into its planning process (to be discussed at a topic specific meeting)
- ACTION: BC Hydro to ensure transmission constraints are included in a fall meeting.
- ACTION: CEBC to consider briefing BC Hydro on results of their independent review of alternatives to Site C.
- ACTION: BC Hydro to amend the work plan to include a broader session in the fall to discuss system needs. As well BC Hydro to finalize the work plan.
- ACTION: BC Hydro to further consider the idea of gathering project information from the broader membership and how that would be done would be part of a focused meeting in the fall.
- ACTION: BC Hydro to check the procurement related issue brought up by CEBC is reflected in the draft notes from May 26.

# SUMMARY NOTES Resource Options Update: Issue Scoping Follow-Up Meeting with CanGEA

July 18, 2014
1:00 – 2:00
BC Hydro Dunsmuir

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|---|---|
| TYPE OF MEETING | Engagement Scoping Follow Up Meeting |
| ATTENDEES | Attendees: Steve Davis (CanGEA), Alison Thompson (CanGEA) |
| BC HYDRO | Randy Reimann, Alex Tu, Anne Wilson, Nan Dai, Dina Matterson |
| OBJECTIVES | Gather input regarding BC Hydro's characterization of the geothermal resource |

MEETING SUMMARY

**Main issues expressed by CanGEA:**

A. CanGEA reiterates the idea that geothermal demonstration projects are important for confirmation of exploration and development costs in the BC context.

B. CanGEA is in favour of practical projects with lower relative exploration risk and fewer costs or impacts e.g. modest scale projects located near transmission and roads or in areas already disturbed by resource development

C. CanGEA supports BC Hydro's engagement in policy and regulation regarding government processes for site permitting and tenuring in order to reduce project development lead times for geothermal projects.

**Discussion Item #1**
CanGEA's perspective on the function and value of multiple geothermal demonstration projects to confirm the cost of geothermal projects in the BC context.

**Description of Item #1**
CanGEA described some of the different challenges of geothermal project development in the various geothermal resource types in B.C. Geothermal systems are classified in four main categories:

a. volcanic geothermal systems with the heat source being hot intrusions or magma chambers in the crust

b. convective systems (also called Extensional or Rift) with deep water circulation in tectonically active areas preferably of high geothermal gradient

c. sedimentary systems with permeable layers at great depth (2-5 km), including geo-pressured systems often found in conjunction with oil resources.

d. Enhanced Geothermal System (EGS), which lacks one of the following: a natural fluid source for heat transfer, sufficient permeability/porosity of the hot rock, and sufficient heat at depth (thus deeper drilling than conventional systems is required). CanGEA does not support significant efforts towards EGS at this time, although notes that some "EGS" techniques can be used in the first three geothermal types to make them even more productive.

Volcanic resources have specific exploration and development challenges that in general make these projects less favourable if looked at through a lens of practicality or risk, however sedimentary basins, including NE BC Dawson Creek and Fort Nelson areas; as well as convective system resources, like Canoe Reach and Lakelse Lake, are appropriate for investigation through demonstration projects.

In general, the cost of geothermal development in BC may not be in line with published costs around the world due to local factors such as drill rig rental rates, terrain, remoteness and regulatory uncertainty. (To be clear, this statement does not necessarily mean costs in B.C. will be higher. For example, due to the availability of drilling rigs, the costs, may in fact, be lower. The abundance of hot springs and surface manifestations of a geothermal resource can also decrease exploration costs as "blind systems" are not needed to be targeted. More geothermally mature countries are now targeting "blind systems"). Further, the costs of development of one specific geothermal type may not be indicative of development costs of another type. To determine the cost of developing geothermal resources in B.C. CanGEA stated a demonstration project in each of the 3 different (non EGS) types of relevant resources is necessary. Further, projects of the same resource type, but in vastly different regions of the province may affect development costs and could be considered as additional demonstration sites.

The issue of how BC Hydro has characterized geothermal in the 2013 resource options report as non-viable was reiterated as an issue and may be leading to unintended consequences, particularly with respect to discouraging investors who look at how government (or government entities) views the resource. BC Hydro confirmed that was not the intent and is revisiting this labelling characterization as part of the resource options update to better reflect its use with respect to long term planning analysis.

**Discussion Item #2**

The estimated 7 – 9 year development timeline for current geothermal projects in BC is longer than the global norm and is partially attributable to regulatory or procedural challenges, especially on site tenuring and permitting.

**Description of Item #2**

CanGEA cited the Consequential Amendment to the Geothermal Resources Act (2008) and the current implementation plan to bring them in to force as an additional barrier to geothermal development due to the Oil and Gas Commission's oversight of geothermal drilling operations. CanGEA suggested that BC Hydro could choose to play a role in minimizing the regulatory challenges by engaging in this implementation process. As an additional note, CanGEA recommends that it and someone with direct experience developing IPP projects should also play a role in revising the regulations.

**Discussion Item #3**

Further detail on CanGEA's submission to the micro-SOP development process

**Description of Item #3**

CanGEA believes the micro-SOP as currently proposed (for on-grid projects only) is not practically applicable to geothermal resources, which suffer from high costs of development at small <1MW scale. For small geothermal projects it may be worth looking at non-integrated areas where they can provide firm power at a cost potentially less than the cost of avoided diesel fuel. CanGEA recommended the micro-SOP be applied to non-integrated areas and provide an appropriate price more in line with the

avoided cost of diesel and further reflecting geothermal's other benefits (environmental, building community capacity via jobs and economic diversity with heat projects).

BC Hydro mentioned that the remote community electrification program has been discontinued; but that it may be possible to discuss possibilities as part of the non-integrated areas.

The US experience was also brought up whereby governments helped with costs to collect data with the stipulation that, although the companies conducted the drilling, geothermal potential data collected would become public. The analogy was drawn to the BC experience about 10 years ago where wind monitoring data that was originally collected by BC Hydro became public. Although it was highlighted the cost difference between collecting drilling and wind data is great, it remained an example of a workable approach done in B.C.

CanGEA also noted that funding is an issue for the association in terms of participating in review of materials when it comes to the resource options update. Their resources are limited.

Thanks and meeting close.