SUMMARY NOTES Resource Options Update: Solar

June 29, 2015
11:00 – 12:00
BC Hydro Dunsmuir

TYPE OF MEETING	Technical Engagement – Solar Meeting #2
ATTENDEES	Ron Hankewich (Mirastar Energy), Mike Hopkins (FortisBC); David Kelly (SkyFire Energy); Peter Leighton (CEBC); Avis Peterson (EcoSmart Foundation); Nguyen Pham (FortisBC); Ron Zielstra (FortisBC)
BC HYDRO	Edmund Lai, Edlira Gjoshe, Anne Wilson, Alex Tu
OBJECTIVES	Present Results Gather input from industry
AGENDA	1. Scope and Methodology of Study 2. Presentation of Results 3. Comments/Q&A 4. Close
MATERIALS	BC Hydro / FortisBC Presentation Slides

MEETING SUMMARY

BC Hydro welcomed people and began the engagement session with a roundtable of introductions. Edmund walked through the objectives of the meeting, and the slides. The following summarizes questions and comments related to the slides.

Slide 3

It was clarified that a single axis tracking with no tilt was used as an assumption for all sites. The ideal capture for Canada would be a double axis tilt; to date those have only been built in Ontario on farmland, and to date no one has been able to obtain financing. It was recognized that SunMine is dual axis tilt.

Going forward will likely be single axis tracking; as it is too costly for dual axis. It was mentioned that single axis tracking is about 20% more expensive than fixed tilt, but get about 25% more energy. Operations and maintenance (O&M) may be a bit more expensive (more moving parts).

The tracking systems have a big impact on capacity factor. BC Hydro clarified the capacity factor was taken from the NRCan data. This is mostly valley bottoms (as a data site collected from airports). Not necessarily on higher ground.

Slide 5

It was clarified that these numbers are the solar potential numbers that the consultant uses in their report, which already takes into consideration weather.

Slide 7

Edmund went through table and asked participants for their feedback on the numbers. It was thought the numbers are probably about right. Single axis tracking systems are installed today in low cost jurisdictions like California at under $1.60/Watt. It is $1.88 now in New England, which may be a comparable price jurisdiction to B.C. $1.88 may be in the ballpark even for small residential systems.

There was a question as to where the 1.88 was from. It is an average across the states.

Relative to the consultant's U.S.-based cost assessment, there are two areas where B.C. costs may be higher. Labour is probably more expensive. Permitting may also be more expensive, specifically for environmental monitoring systems, as experience by SunMine's obligations for meeting its environmental assessment.

Currently there is no large competitive market for installations – the margins may be higher. It was mentioned by a

participant that of all of the technologies in the resource options update, solar may be the simplest. The challenge in B.C. is that there is so much rock that it is difficult to put in piling. Generally don't see installation a big challenge; it is anticipated the talent from more experienced jurisdictions will be here to manage the installation process and accelerate B.C.'s learning curve.

A participant suggested that the biggest single cost in B.C. would be transmission and interconnection costs. It was suggested that given the cost for interconnection cited by the consultant based on U.S. experience was low relative to the expected interconnection costs in B.C.

A participant suggested that $1.88 is not unreasonable. May want to do a sensitivity analysis with $1.60.

It was suggested that the capital cost for SunMine is estimated at $5.5 million (1 MW in size).

Slide 8

Variable O&M is just fuel.

There was a question as to what comprised the fixed O&M Solar PV cost (included a footnote but was not clear on what it included). A participant wanted to be clear about using the same assumptions across resource options.

$10 per kWdc works out to about $6.85/MWh. So if 15 capacity factor then it would be $10.94/MWh, this is in Canadian dollars, then US$11 may be too expensive. It was suggested that this looked about right in Canadian dollars. This is straight O&M costs, not replacement costs.

Fixed O&M needs to include property taxes. Depends – suspect the 11$ is not all inclusive. An old model a participant was using would have included about $40-50/MWh so it was suggested this number seems pretty low.

BC Hydro was asked what they would choose if they had to set a number for today. SunMine used about $20 for O&M and that included taxes, but did not include inverter replacement costs.

Slide 9

It was pointed out by BC Hydro that the Osoyoos number is high due to the fact of it being connected to a 500 kV line instead of a 69 kV line. This number will be adjusted down.

There was a question as to whether it was unusual that Vanderhoof would have no incremental cost for transmission?

BC Hydro asked whether these unit energy costs (UECs) were reasonable. A comment by participants was made that the belief that the numbers should fall to about $150 – so the numbers here are slightly inflated. SunMine is willing to go to the next installment at the Standing Offer Program rates.

It was clarified that the discount rate that was used is 7%.

On residential sites putting in 19 cents a kWh.

There was some discussion as to where the logic of the inputs may be off. Participants felt the inputs were reasonable, but that the UECs were high. If O&M is going up, then capital will go down.

It feels high to participants, for example, one participant mentioned that if the price was $188, then developers would be lined up.

It was suggested that capital cost and capacity factor are off – need to go back to those factors. There has been a general ramp down of capital costs – look pretty good here. It was suggested to do some sensitivity analysis.

There was some discussion about the capacity factor, where currently it is estimated at 14% to 17%. A range of 17% to 21% was suggested, and that levelized cost should come in at $140 to $150 MWh.

It was suggested that the capital costs are right. Somehow we have paid for extra infrastructure, but haven't got the extra energy – energy seems low. <***See post-meeting note below***>

One participant stated that they could go back to their model and pick a site such as Kamloops and provide fixed energy of fixed tilt; single axis and double axis tracking with a fixed tilt, and send the model on.

It was clarified by BC Hydro that for a four-year development cycle, most of the costs come into year 4.

In terms of a recap, general inputs of capital costs were good, O&M was underestimated and could be higher, and the capacity factor looked low and could be higher. There is a lack of data, but a sense from developers that the UEC is high. BC Hydro will consider this feedback as it completes the update.

Attendees were thanked for their participation.

Meeting close.

Post-Meeting Note & Revised UEC's

BC Hydro reviewed the energy production based on this feedback and noticed a mistake in the energy production calculations.

Updated capacity factors based on the revised productivity assumptions are shown in the following table.

Location	# of Project	Installed Capacity (MW)	Annual Energy (GWh/yr)	Capacity Factor
Vanderhoof	1	5	6	17%
Fort St. John	1	5	7	19%
Powell River	1	5	6	16%
Victoria	1	5	7	18%
Kamloops	1	5	7	19%
Osoyoos	1	5	7	18%
Elkford	1	5	8	20%
Chase	1	5	7	18%
Vernon	1	5	7	18%
Horsefly	1	5	7	18%
Kelowna	1	5	7	18%
Trail	1	5	7	18%
Cranbrook	1	5	8	20%
Total	13	65	90	16-20%

Revising Inputs – O&M

Based on feedback from the meeting we are revising our costs to use $20/MWh.

BC Hydro proceeded to update UEC calculations, based on revised productivity and O&M assumptions. Updated resulting UECs are shown in the following table.

Location	UEC/UCC at Gate @ 5%	UEC/UCC at Gate @ 7%	UEC/UCC at POI @ 5%	UEC/UCC at POI @ 7%
Vanderhoof	152	180	152	180
Fort St. John	138	163	148	174
Powell River	154	183	158	187
Victoria	146	172	186	220
Kamloops	138	163	152	179
Osoyoos	141	166	183	216
Elkford	131	154	138	162
Chase	141	167	162	192
Vernon	141	167	163	193
Horsefly	143	169	180	213
Kelowna	141	166	151	179
Trail	142	168	156	184
Cranbrook	132	155	144	170
Total	131-154	154-183	138-183	162-220

Note: UECs at point of interconnection (POI) are draft pending confirmation of transmission and road access costs. Final UECs at POI will be posted in the summary results document at www.bchydro.com/generationoptions.