BC hydro

Integrated Resource Plan

Appendix 3A-33

2013 Resource Options Report Update

Ocean Renewable Energy Group Submission

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Nanaimo BC
V9R 6H1

BC Hydro
Long-Term Transmission Inquiry Team

August 14, 2009

Re: Response to "Resource Options Workshop". Vancouver, July 23, 2009.
Attention: Cam Matheson and Nadja Holwowaty

We have reviewed the feedback questionnaire and find it too project-oriented to serve the resource development possibilities for wave, tidal and in-stream that need to be discussed.

This submission is on behalf of OREG's members. OREG is Canada's renewable wave, tidal and in-stream energy development association. OREG members include technology developers, power project developers, utilities, Provincial and Federal government departments, and marine sector members. The association is heavily engaged with the international developments in this emerging energy sector, and many of the leading international technology developers are active members.

OREG is regularly asked to lead discussions at international events on promoting the enabling pathway to accelerate the renewable resource diversification and the new industrial opportunity that these three resources can offer. OREG has provided significant input into Provincial energy policy and planning initiatives across Canada, resulting in developments such as the tidal demonstration site now underway in Nova Scotia.

We hope to contribute significantly to the exploration of the BC ocean energy resource opportunities as the Inquiry looks into the next 30 years, as there is an emerging worldwide conviction that competitive renewable wave, tidal and in-stream energy will be widely adopted well within this timeframe. The implications of the geography of that adoption in BC (largely Vancouver Island and Haida Gwaii) can clearly change the importance of these regions in any long-term planning, and might even support discussion of grid vs. point-to-point planning concepts.

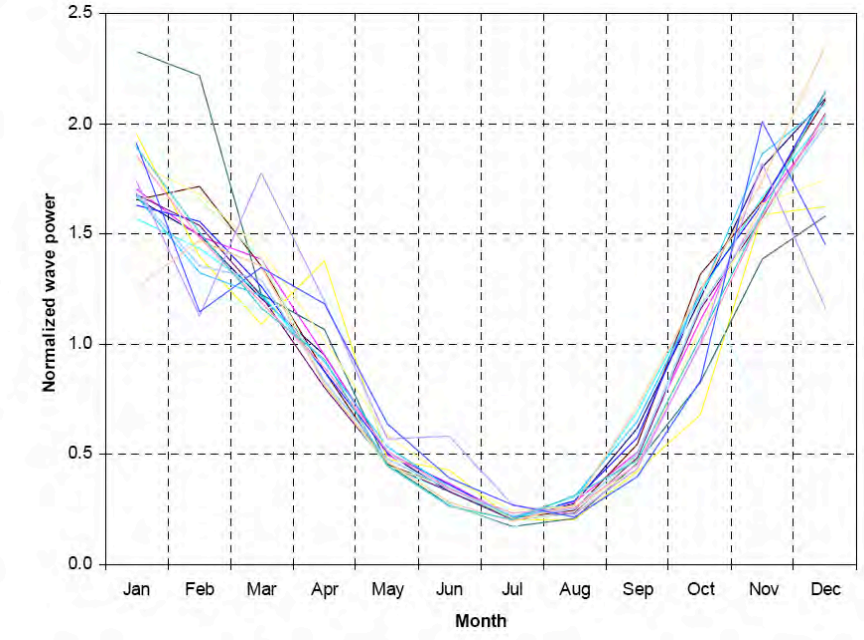
We are pleased to see your serious, but conservative, estimation of wave and tidal resources that might be accessed in the next 30 years. We would like to comment on how you might make these options most effective as BCTC takes up your resource options analysis and BCUC is asked to look at integrated conservation, generation and transmission options. We would also like to address the acknowledged lack of resource estimates for in-situ generation using in-stream hydrokinetic energy in rivers and in association with existing hydro facilities.

We believe it important that in their submission to BCTC and the BCUC, BC Hydro present their assumptions and make the case that:

- the energy option described represents only a conservative estimate of what may become available;
- that experience is expected to refine positive assessments of dependability, effective load carrying and firm characteristics, and,
- that de-selection on the basis of pioneer electricity costs might put the development of the long-term resource opportunity at risk.

My notes on the arguments for the resource potential for wave and tidal are as follows:

- Characterisation of wave resources near the coast will need to be refined and a recently launched West Coast Wave Collaborative will bring forward new knowledge in the next couple of years. Absent the sub-regional or site data, and a clear understanding of the amount of in-place resource that can be harvested without adverse impacts, the conservative approach of assuming only a small fraction of the coastline is developed and a small fraction of the incident energy within that is actually harvested has given you a safe conservative estimate of energy production potential.
- The initial interest by BC Hydro and recently by potential project developers provides guidance on the areas of likely greatest interest (probable resource, access to site and likely access to distribution or transmission interconnection).
- The significant winter peaking, the persistence of wave events (that may deliver energy from multiple wave events over large ocean areas) and the forecastability of wave power need to be considered in evaluating dependability, effective load carrying capacity and firm power potential. The following graphic of measurements at BC offshore sites shows the dramatic intra-annual variability. Inter-annual variability can be expected to be similar or better than offshore wind.



- Characterisation of the tidal in-stream resources has focused on the high resource sites identified by Triton Consultants for BC Hydro[1] and later in the Canadian Ocean Energy Atlas[2]. Assumption of a conservative harvest rate of 15% of energy in-place is typical, but recent analyses have suggested that higher harvest rates (ca 30%) may be possible with minimal impacts (5% change in tidal variation in some areas)[3]
- The tidal cycles are entirely predictable but vary on a 28 day cycle and seasonally. Tidal current prediction is based on modeling, maritime operating experience validating slack water forecasts. Field observations and site characterisation may identify higher power opportunities than modeling average high flows might predict.
- The differentiation oftidal cycles at different locations, even within a cluster, may offset each other. This reduces hour to hour variability in aggregate, making consideration of dependability, effective load carrying capacity and firm power potential unique to the tidal resource.
- Being a gravitational force induced current, tidal energy will not be impacted by any climate change alterations.

Regarding the absence of any resource assessment for in-situ, in-stream energy extraction from the resources in river flows and those associated with hydroelectric facilities:

- There have been no assessments for British Columbia, though developers have expressed interest in a number of individual sites.
- The sites of interest could include major and minor rivers and flow structures associated with hydro and other industrial operations.
- Some of these resources may have strategic priority because of their adjacency to existing generation and transmission infrastructure, remote communities or in providing regional economic development opportunities.
- Several "tidal" technologies have already been deployed in fresh-water in-stream applications. This experience in a less-extreme environment, together with less conflicted regulatory processes, will enable a more rapid integration of this resource than their ocean applications.
- An in-stream resource assessment methodology has been proposed by the Canadian Hydraulics Centre[4].
- We believe that BC Hydro should incorporate at least an initial assessment into their cluster definition efforts; or focus an analysis on whether addition of the in-stream resource changes the value of any critical clusters. This work would set the scope for inclusion of in-stream in the next LTAP.
- We see the lack of these data as a serious gap in the resource options. We have ensured that BCUC has included this consideration *in scope* and will ask that they ensure this is a resource options considered in any transmission planning scenarios.

[1] http://www.oreg.ca/docs/Tidal%202002.pdf
[2] http://www.oreg.ca/docs/Atlas/CHC-TR-041.pdf
[3] Karsten, Energy Ocean 2009 – attached.
[4] http://www.oreg.ca/docs/2008_Spring_Symposium/Faure.pdf

Concerning the availability of wave, tidal and in-stream energy

- Single and multiple generator wave or tidal demonstrations could likely be permitted (BC and Canada are working on permitting procedures, one BC ocean energy project is currently beginning Canadian Environmental Assessment) within 2 years if a market for pioneer electricity production (an enhanced Standing Offer or a Feed in Tariff) was available. Without such market acceleration mechanisms, larger scale developments in BC will lag the rest of the world, compete for devices and capital, and may be delayed to 2020 and beyond. Most likely, higher capacity factors, lower capital, operating and interconnection costs for in-stream energy will mean that this resource development will happen earlier and can be accelerated more easily.
- A technology roadmap for Canada will be available in 2011/12. OREG was involved in development of the UK roadmap that suggested the UK could develop 2GW of ocean energy capacity by 2020 and at that time the proven generators would be competitive with onshore wind.[5]

OREG believes that in short-term resource-stack comparisons BC Hydro will need to address the challenge in appropriately evaluating longer-term resource opportunities while faced with early pioneer costs and risks:

- This includes the value from the addition of wave and tidal energy to a diversified renewable portfolio. For example, the New Brunswick System Operator is evaluating the concept of creating premium values for tidal integration into their system. A recent study for British Wind Energy Association[6] concluded that: "…diversifying the renewable energy mix by including a greater proportion of wave and tidal stream energy would reduce requirements for back-up and reserve capacity, lower carbon emissions and save fuel. This could lead to cost savings of as much as 3.3% of the annual wholesale cost of electricity due to the increased mix diversity." We believe that growing demand for renewables will be accompanied by a growing avoidance of reliance on a narrow resource mix. We would expect this as a reliability requirement, particularly in regard to mitigation of potential climate change impacts, and as support for a system optimization that exploits rather than *fights* daily, seasonal and annual variability. We would propose that BC Hydro ensure that an analysis of the value in this kind of resource diversification be supplied to BCTC and BCUC.
- Scenarios may need to be forced and sensitivity analyses may be required to test whether assignment of a value to energy characteristics would influence the timing and geography of integrating emerging energy resources. For example, the consideration of inherent values such as predictability and winter peaking. "On average wave power delivers over five times as much energy during periods of peak electricity demand than it does in periods of low demand. Developing around 10% of the UK tidal current resource at a range of sites would result in

[5] http://www.oreg.ca/docs/UKERC_MRMReport_FINAL.pdf
[6] http://www.bwea.com/pdf/marine/Redpoint_Report.pdf

low daily variability."7 Beyond this, modeling should address the potential added-value inherent in a basket of resources within the likely energy zones.

- Modeling is expected to pick resource options based on current generating and transmission costing. It is difficult to see how emerging carbon cost additions or reduced costs due to experience and technology development can be incorporated in these optimizations ("Marine renewable energy has the potential to become competitive with other generation forms in future."[8]). For emerging energy resources harvested with technology that has yet to mature (wave, tidal and in-stream etc.), scenarios may need to be tested using cost estimates based on mature technologies. At a minimum, this sensitivity analysis should be done to test whether assumptions on the role of any of the energy zones might be changed.
- Discussion around emerging renewable energy opportunities often mixes the challenge in technology development with those of resource development. OREG has consistently advanced the position that R&D and technology advancement will be driven by enabling resource project development, while the converse is by no means apparent. As BC Hydro advances its potential resource options to BCTC and the Transmission Inquiry, we urge you to focus on the resources in place and the potential resource harvestable. The development pathway to access that resource, and its timeframe are likely more constrained by the lack of a policy to create a market for the pioneer projects than they are by a lack of technical approaches, refinement or interest. A focus on the value in those resources may in turn influence development of transmission, market and other policy.
- Despite a lack of experience in permitting ocean energy projects, regulators have pointed to marine project permitting experience with other industries like aquaculture or ports. The British Columbia government has assured the sector that permitting mechanisms are extant, and specific ocean energy regulations are imminent. The Nova Scotia government has demonstrated use of a federal/provincial agency roundtable to facilitate permitting of their tidal project. NR Canada has been tasked with developing a federal approach to marine energy permitting(offshore wind, wave and tidal). While a challenge, as all marine projects are, regulators recognise that the early projects are the learning experience needed for the long term responsible development of the sector. It seems likely that all ocean energy projects will need Transport Canada or DFO permits which will trigger review under the Canadian Environmental Assessment Act. With the work we began with regulators in early 2006, we do not believe that permitting will emerge as a critical development risk.
- Concerns over environmental interactions and competition for space with existing fishing and transportation uses are being examined in all countries and regions with an interest in ocean energy[9][10][11]. Strategic Environmental Assessments in

[7] http://www.carbontrust.co.uk/NR/rdonlyres/EC293061-611D-4BC8-A75C-9F84138184D3/0/variability_uk_marine_energy_resources.pdf
[8]
[9] http://www.oreg.ca/docs/environmental-impact.pdf
[10] http://www.oreg.ca/docs/environmental_assessment_Makah_Bay.pdf
[11] http://www.oreg.ca/docs/wave_hub_docs/Environmental_Statement.pdf

Scotland[12] and Nova Scotia[13] have served to mobilise the sector. DFO has tasked its Centre for Offshore Oil and Gas Environmental Research with reviewing potential issues. Nova Scotia's energy research funds are about to grant projects in this area and the Oregon Wave Energy Trust has committed more than $3 million to research on potential wave impacts. OREG is compiling a review on the progress in thi area and will supply it to BC Hydro in due course. At this point we can assure BC Hydro that this is an active area of interest for governments, regulators, researchers and technology developers, and one that has not thrown up any clear impediments to progress.

In conclusion, we have asked BCTC, at either the market scenario or transmission modeling level, to consider a "made in BC" approach. This approach would be aimed at using the Province's domestic clean energy needs to demonstrate and drive the launch of a clean electricity sector as a critical part in the low-carbon economic strategy. Such a strategy would see small amounts of emerging clean energy resources mobilized through *carve-outs* or *feed-in-tariffs* creating demonstrations, cost reduction experience, and the ability to pursue business and economic opportunities in world markets. We urge BC Hydro to put forward an emerging energy pathway as a mechanism to ensure long-term access to these important resources. In the context of the Transmission Inquiry, part of that access would be ensuring that transmission plans include the potential addition of new resources over the longer-term.

Thank you for the opportunity to comment. We are ready to work with you in support of these directions at your convenience.

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[12] http://www.oreg.ca/docs/FinalScopingReportFeb06.pdf
[13] http://www.oreg.ca/docs/Fundy_SEA.pdf