Renewable Energy Credit (REC) Price Forecast
(Preliminary Results)

PURPOSE

The REC price forecast projects future financial costs of Renewable Energy Credits (RECs) under a range of policy scenarios that may unfold over the IRP planning horizon. By characterizing the price risks and opportunities associated with clean or renewable resources, the REC price forecast facilitates the evaluation of various portfolio options.

OVERVIEW

What is a REC price forecast and why is it needed?

Interest in renewable energy has increased worldwide in response to concerns about greenhouse gas (GHG) emissions, other environmental issues such as nitrogen oxides, particulate matter and other regional air emissions, energy security and economic development. Many US states have established mandatory Renewable Portfolio Standards (RPS) to require certain electricity utilities to include renewable energy in their energy supply mix. These requirements have created a market for the clean or renewable energy attributes associated with renewable energy generation.

BC Hydro retained Black and Veatch (B&V) to conduct a review of existing renewable energy-related policy in North America, with a view to estimating the impacts on the future price of RECs – the market instrument used for the trade of renewable energy attributes.

At the time of writing, BC Hydro's REC price forecast is in the early stages. Therefore this Summary Brief provides a high-level overview of the objectives, method and directional results. More detail will be provided following the finalization of the forecast.

What are RECs and what influences REC price?

As indicated above, RECs are the market instrument used to represent the renewable energy attributes associated with renewable electricity generation – one REC represents the generation of one MWh of qualifying renewable electricity. Utilities purchase and surrender RECs to demonstrate compliance with RPS requirements, which is verified by regulators. RECs may be sold bundled or unbundled from the underlying electricity. "Bundled" RECs represent the sale of the renewable attribute along with the underlying commodity power, while "unbundled" RECs (also known as "tradable" RECs) are credits that are sold as a separate product disassociated from the underlying power. State delivery requirements for bundled RECs and eligibility rules for unbundled RECs to provide regulated entities with some level of compliance flexibility, vary. In addition, state RPS vary as to which renewable resources are eligible, and sometime contain additional rules for out of state renewable resources. For example, wind is typically eligible (whether in or out of state), while run-of-river is not currently eligible in some state RPS.

A number of factors influence the market price of RECs. To forecast REC prices, B&V's "Renewable Energy Model" (REM) first calculates the premium required to cover the costs of developing renewable energy projects (20-year levelized calculations) based on different resource classes, existing mapping of resource availability, and premiums for delivery of the project energy to each delivery load zone in the WECC:

RE Premium = (Levelized Cost of Energy + Transmission + Losses) - (Energy Value + Capacity Value)

This formula is calculating the difference between the market value of electricity and the cost of producing renewable energy. Stated simply, the premium is the amount that would make a renewable energy source competitive in the electricity market.

REC Prices are based on the REC Premiums of marginal units that satisfy each state's RPS requirement. Supply curves are developed by rank ordering the REC Premiums for all projects from lowest to highest, and then the supply curves are cleared annually based on the annual incremental RPS demand for the state. The RPS demand determines the marginal unit and therefore, the "clearing" price for that year.

Given the above estimation method, the main factors that influence REC prices, and utilized in B&V's forecast assessment are:

- RPS demand
- Capital cost and change in technology over time
- Availability of tax incentives (investment tax credits (ITC) and production tax credits (PTC)
- Forecasted energy and capacity value

Policy Framework

Among the number of objectives of policies that support renewable energy development, the three main drivers are:

- Economic development – the benefits associated with renewable energy include the creation of construction, operation and indirect jobs, local economy improvement, local taxation and the price suppression effect of having low variable cost renewable energy.
- Environmental interest – renewable energy typically has low GHG and regional air emissions. Renewable energy will likely play a significant role in national and state GHG reduction strategies; the lower air emissions have positive benefits on local air quality and health.
- Energy security – these benefits are typically related to energy independence (the ability of a nation to be more self-sufficient in energy supply). However, given that this issue is primarily focused on oil supply, which is not a predominant fuel for electricity generation, this may be a less significant point.

Because BC Hydro's electricity grid is interconnected to that of the western US, renewable energy policy and requirements in the Western Electricity Coordinating Council (WECC) and nationally in the US, are the main areas of interest for this forecast.

In the 2009-2010 timeframe, interest in national renewable energy requirements in the US was high, most notably through the *American Clean Energy and Security Act of 2009* (H.R.2454) and the *Renewable Energy Promotion Act of 2010* (S.3813). These two bills had several common themes with respect to requirements, as shown in Table 1 below. However, recent changes in House of Representative leadership priorities in late 2010 suggest that the chance of success of national RPS legislation in the near future is low.

Table 1: United States Federal RPS Policies[1]

Bill	Target	Compliance Waivers?	Alternative Compliance Payment	Energy Efficiency Allowance
S. 3813	15% by 2021 (1)	Yes (2)	2.1 ¢/ kWh	26.67%
H.R. 2454	20% by 2020 (3)	Very Limited	2.5 ¢/ kWh	20% (4)

Notes:
[1] Interim goals: 3% by 2012, 6% by 2014, 9% by 2017, and 12% by 2019
[2] Compliance wavers include a rate impact limit of less than 4 % per year, transmission constraints, or force majeure
[3] Interim goals: 6% by 2012, 9.5% by 2014, 13% by 2016, 16.5% by 2018
[4] Could be raise to up to 40 % with state requests and federal approval.

At the state level, RPS requirements have been a major driver in the development of renewable energy projects, and B&V estimate that roughly 50 percent of total US load is now subject to some sort of renewable mandate.

RPS rules vary from state to state, primarily in areas of targets and compliance years; special requirements ("carve-outs") or treatment reserved for specific renewable types; resource eligibility of unbundled or tradable renewable energy certificates for compliance purposes; and the form and use of "safety valves" to address what each state deems to be unacceptable ratepayer impacts. An overview of US state RPS requirements will be provided in B&V's final report. A summary table of WECC State RPS requirements is provided in Attachment 1. In general, targets range from 15% to a high of 33% in California, with variable target dates from 2015 to 2025, with a 1% annual ramp-up requirement typical but not consistent across states. Resource eligibility also varies, whereby most states consider wind, solar and geothermal as eligible, with hydroelectricity tending to be subject to certain restrictions such as size (e.g. <10 MW in Arizona), or delivery specifications (e.g. hydro must be delivered to Washington on a real time basis and Oregon requires bundled RECs sourced from US sources and limits unbundled RECs to 20-50% of compliance, from anywhere in the WECC).

Market Scenario Approach

To achieve consistency in assumptions and comparability in assessing forecast REC prices with the price forecast of other commodities for the IRP (natural gas, GHG, electricity), BC Hydro asked B&V to use the same market scenarios in their analysis as was developed for the risk framework. These scenarios are described in more detail in the IRP Summary Briefs, *Market Scenarios for the IRP Risk Assessment* and *Greenhouse Gas Price Forecast.*

[1] Excerpt from BC Hydro Renewable Energy Portfolio Standard and REC Market Assessment (DRAFT Not Yet Dated) Black & Veatch.

Results and Discussion

The results of the REC price forecast are in the preliminary stage and subject to review. The results illustrate the sensitivity of REC prices to a number of variables, as summarized below. Detailed forecast results will be provided as the report is finalized.

- REC prices are expected to vary from state to state as the various markets respond to their specific RPS requirements and find the lowest cost solutions to meet each year's incremental RPS demand.
- REC prices are sensitive to energy prices: high energy prices lead to rapidly declining cost of solar and wind technologies, resulting in lower or no REC premium and a zero REC price case (Scenario A).
- High load growth increases the demand for renewable energy in states with RPS, lowering project costs and REC prices.
- The two scenarios that assume low economic growth and associated low levels of load growth and fuel prices result in relatively high REC prices, even with the assumption of continued PTCs, as low levels of load growth will impact the energy value of the associated energy and thus impact the premium; additionally, low levels of investment in R&D keep the costs of renewable energy projects high. In these scenarios, safety valve price limits (such as the $50 limit in California) come into effect.
- While policy is evolving around RECs and GHG compliance, currently it appears that RECs will not be able to be used for both RPS and GHG compliance. A REC will likely simply represent proof of renewable generation for RPS compliance purposes and accordingly convey GHG neutrality for GHG compliance purposes.
- REC prices tend to move in opposite direction of GHG prices. High load growth also increases GHG costs due to the relative shortage of allowances as emissions from emitting-generation sources are capped. However, when these prices are high, the extra premium required to make renewable energy cost competitive is low. Thus, GHG prices and RECs tend to vary inversely.

Next Steps

BC Hydro is in the process of reviewing and finalizing the REC price forecast, to report out at a future TAC meeting.

Attachment 1: **Note: "ACP" refers to safety valves.**

Table 5-1. WECC States RPS Summary.

State	Target and Ramp	ACP	Carve-Outs[1]
Arizona	15% by 2025; 0.5% ramp 2010-2015, 1% 2015 to 2025	None[2]	4.5% DG by 2012
California	33% by 2020; at least 1% ramp annually	$50/MWh[3]	None
Montana	15% by 2015; 1% ramp 2010-2015	$10/MWh	75 MW of "community RE projects"[5]
Nevada	25% by 2025; 3% ramp every 2 years	None	1.25% solar through 2015; 1.5% thereafter
New Mexico	20% by 2020; 1% ramp per year	None[6]	4% each wind and solar; 0.6% DG by 2020
Oregon	25% by 2025; 1% ramp per year 2015-2025	$50/MWh[7]	20 MW small solar by 2020
Utah	20% by 2025; no interim targets	None	None
Washington	15% by 2020; 6% step changes every 5 years	$50/MWh	None

Notes:

[1] In percent of total customer sales, not of the RPS requirement, unless otherwise noted

[2] Customer surcharges to comply with the RPS must be approved by the Arizona Corporation Commission; this could create a de facto future limit on price.

[3] Reflects the penalty that could be enacted for non-compliance, limited to $25MM total per utility. Total payments for renewables over market prices for power is capped per statute.

[4] Rulemaking has begun to allow tradable RECs, but is currently in the process of modification before enactment.

[5] Projects under 25 MW in size with a controlling interest from local owners.

[6] Customer rate increases are limited to 2 percent per year through 2011, rising by 0.25 percent per year through 2015.

[7] Can be adjusted every even-numbered year.