Load Resource Balance

PURPOSE

To provide an overview of how BC Hydro forecasts the need for additional electricity resources in the Integrated Resource Plan (IRP).

OVERVIEW

What is the Load Resource Balance?

To meet BC Hydro's obligation to serve, the available supply of electricity must meet the forecast demand. The additional supply of electricity can be acquired by demand side measures (working with customers to consume electricity more efficiently) and from supply-side resources (traditional sources of electricity supply from generating plants).

BC Hydro starts with forecasts of the customers' future electricity needs. The Load Resource Balance takes this forecast of future electricity needs, reduces the needs by demand side measures to determine a net forecast demand, and compares that to the capability of BC Hydro's existing and committed sources of electricity supply. BC Hydro requires additional electricity resources to ensure reliable supply when the forecast demand exceeds the capability of available demand-side and supply-side resources.

The IRP load resource balance analysis involves assessing resource requirements from both a total system and as well as a more localized regional perspective. Local demand in regions can be met from either supply resources located there or power transmitted from other regions by the bulk transmission system. Hence, transmission transfer capabilities are also an important planning consideration when examining regional load resource balances.

Some of BC Hydro's customers live in areas too remote to be served by the integrated transmission system. Local generation serves these non-integrated communities. This document does not address the supply planning for those non-integrated areas.

When will it be used in the IRP?

The Load resource balance is assessed at the beginning of the IRP process to determine the timing and volume of energy and dependable capacity requirements over the next 20 years. The load resource balance is used throughout the IRP planning process as BC Hydro studies the benefits and costs of alternative methods to deliver the incremental supply for customers needs and ultimately to determine the timing and volume of any future acquisitions needed to supply customers' needs.

How will it be used in the IRP?

This is done with respect to two views of the system, the energy balance and the capacity balance. Energy reflects the total amount of work that is done over a period of time, typically a year, and is measured within the IRP in units of GWh/year. Capacity reflects the rate at which energy is used, typically measured as an average rate over an hour period, and is measured in the IRP in units of MW. New resources are required when the forecast load exceeds the capability of available resources for either energy or capacity requirements.

To meet B.C.'s future electricity needs, there is a need to:

- Conserve more electricity;
- Build more by reinvesting in existing assets and considering new resources, such as Site C; and
- Buy more electricity from third party renewable power projects, such as wind and run-of-river hydro.

The load resource balance determines the total amount of electricity required from these resources as a whole over the 20-year planning horizon and the IRP portfolio analysis will then study alternatives for meeting these requirements.

How is it Developed?

A 20-year load forecast for BC Hydro's integrated system is produced annually, with the most recent forecast completed in November 2010. The load forecast used in the IRP is the total gross requirements for the integrated system, which includes domestic load and firm export obligations as well as losses resulting from transporting electricity to customers over transmission and distribution lines. The load forecast provides both energy and capacity (or peak demand) requirements.

The uncertainty of the customers' load requirements must be managed in the IRP. BC Hydro prepares mid, low and high forecasts that are based on the 50 per cent, 10 per cent and 90 per cent confidence intervals. More information on the load forecast is provided in the 2010 Load Forecast material.

Supply resources include both existing and committed resources and planned resources. The distinction between committed and planned resources is that committed resources already have signed contracts with suppliers, or in the case of BC Hydro projects, already have funds committed to proceed with the project. These projects all have BC Hydro board authorization and regulatory approval (where applicable). Planned resources are defined as those projects and programs that are exempted from BCUC section 71 or CPCN review, and do not require BC Hydro to undertake an environmental assessment, but which do not yet have Board approval. An example is the Bioenergy Phase 2 call.

Resources are grouped into eight categories:

- Demand-Side Mangement (DSM);
  BC Hydro's DSM programs are designed to provide incentives for saving electricity, while developing an energy conservation and efficiency culture in B.C. Conservation efforts are focused on codes and standards, rate structures, programs and supporting initiatives that promote behavioural change, as well as energy efficiency.

- BC Hydro's Heritage Hydroelectric Resources;
  The firm energy capability of the Heritage hydroelectric facilities is 42,600 GWh/year and the dependable capacity of the Heritage Hydro resources is 9,707 MW.

- BC Hydro's Heritage Thermal Resources;
  Burrard is BC Hydro's main natural gas-fired thermal generating facility. A Clean Energy Act-related Ministerial regulation states that BC Hydro may rely on Burrard for no more than 900 MW until all of the following projects are completed and the resulting facilities are providing service:
  - Mica Units 5 and 6, a project to install two additional turbines and related works and equipment at Mica;
  - the Interior to Lower Mainland Transmission Project; and
  - the project at Meridian substation to build a third 500-230 kV transformer.

- Resource Smart Projects;
  BC Hydro's program of improvements to existing power generation facilities to increase supply-side efficiency through physical and/or operational modifications. Since 1987, BC Hydro has been implementing an ongoing program of investment in existing facilities to improve their output, known as Resource Smart. Some of the gains are reflected in the calculation of the Heritage energy and the dependable capacity of the Heritage Assets discussed above. BC Hydro currently has 5 existing Resource Smart projects that add incremental energy and/or dependable capacity to the heritage hydroelectric capability. These projects are at GM Shrum, Cheakamus, Aberfeldie and the new 5th unit at Revelstoke. Eleven additional projects upgrade existing facilities at GM Shrum, Cheakamus and the 5th and 6th units at Mica Generating Station.

- Electricity purchase agreements with independent power producers (IPPs) and others;
  BC Hydro presently has 111 signed electricity purchase agreements signed with IPPs from the following processes:
  - Pre-F2001 EPAs
  - 2000 Expressions of Interest
  - 2001 Green Call for Tenders
  - 2002 Customer Based Generation Call for Tenders
  - 2003 Green CFT
  - 2006 Call for Tenders
  - Alcan 2007 EPA
  - Clean Power Call
  - Bioenergy Phase I
  - Standing Offer Program
  - Integrated Power Offer
  - Waneta Expansion
  - Alta Gas

- Downstream Benefits;
  The Canadian Entitlement (CE) is the Canadian portion of the additional electricity produced in the Columbia River in the western U.S. as a result of provisions of the Columbia River Treaty of 1961 and has not been included in the 2011 IRP load resource balance because it is not generated "solely from electricity facilities within the Province". The CE continues to be a contingency resource option.

- Non-Firm/Market Imports Allowance;
  The 2,500 non-firm/market allowance consists of reliance on two resources: (1) Heritage hydro non-firm energy, and (2) imported non-firm energy. The 2,500 GWh/year non-firm/market allowance is removed from the energy load resource balances after 2015.

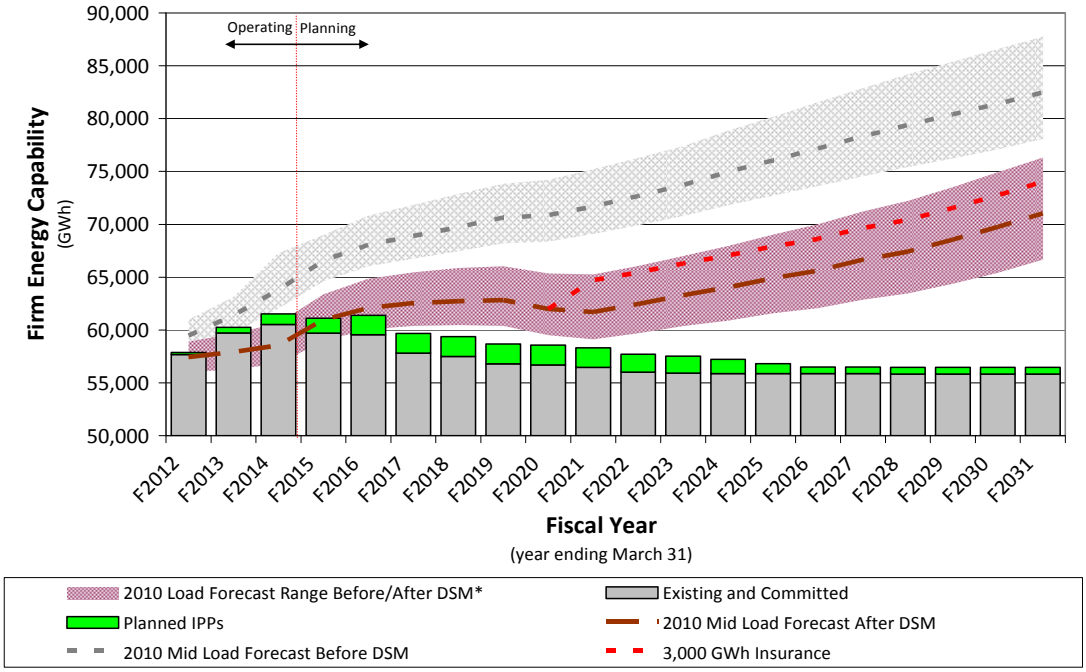
  The CEA precludes reliance on Heritage hydro non- firm energy. The CEA also provides that external markets cannot be relied upon after 2015 for purposes of meeting BC Hydro's mid-level energy and peak forecasts.

- 400 MW Market Reliance;
  Similar to the non-firm/market imports energy reliance, the CEA precludes reliance on external markets after 2015 for the purposes of meeting BC Hydro's mid-level peak forecasts so the 400 MW market reliance is removed from the capacity load resource balance after 2015.

BC Hydro determines its ability to reliably meet its customers' needs by determining the firm energy and dependable capacity capability of the electric system.

To determine the electric systems annual firm energy capability, in GWh/yr, BC Hydro uses a Firm Energy Load Carrying Capability (FELCC) criterion. Energy reliability is a significant issue in hydroelectric and clean resource systems due to the variability in annual energy inflows resulting from variable water inflows or wind flows. For BC Hydro's predominantly hydroelectric system, the FELCC is defined as the maximum amount of annual energy that a hydroelectric system can produce under critical water conditions where critical water conditions are the most adverse sequence of stream flows occurring within the historical record. BC Hydro relies on the FELCC of resources when determining its available supply and load resource balance.

Figure 1 depicts the integrated system firm energy load resource balance. Based on the mid-load (expected) forecast after DSM the domestic requirements demand exceeds firm energy supply in F2016.

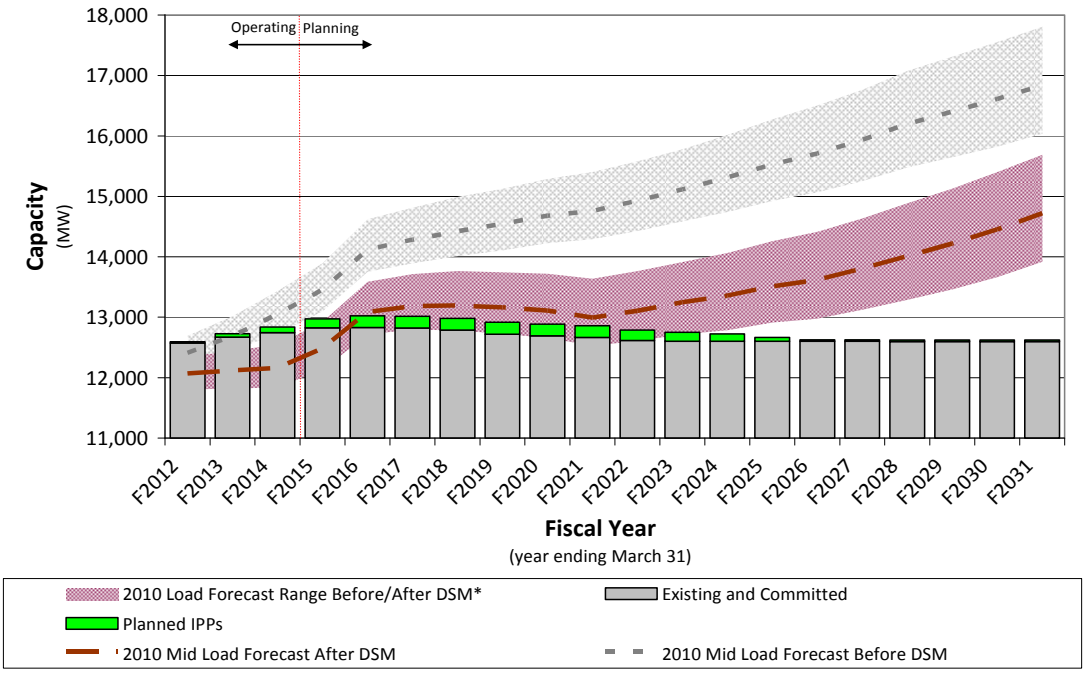


* Draft 2010 Load Forecast Range

To determine the system's hourly peak dependable capacity capability, measured in MW, BC Hydro uses an effective load carrying capability criterion. This criterion is the amount of dependable capacity that resources are capable of supplying to meet the hourly peak load for electricity with a high level of confidence.

Supply-side resources all have a probability of failure over time due to mechanical breakdown. In addition, intermittent resources that do not have ability to store energy (i.e., water in a dam) have varying output due to uncertain energy inputs (wind or hydro without storage). Thus, BC Hydro must assess the likelihood that the different sources of supply result in adequate levels of dependable capacity contribution to meet system dependable capacity requirements with a high degree of probability. BC Hydro has adopted the probabilistic Effective Load Carrying Capability (ELCC) criterion to estimate resources contribution to dependable capacity. Using the ELCC criterion results in BC Hydro building a surplus or buffer of capacity over customers needs that is call the Reserve Margin. Practically, the Reserve Margin is used to meet uncertain load requirements, provide operating flexibility and to manage uncertain output from variable output resources.

Figure 2 depicts the integrated system dependable capacity load resource balance. For ease of presentation, planning reserve margins are added to the peak demand forecast. Based on the mid-load forecast after DSM the peak demand exceeds dependable capacity supply in F2016.



* Draft 2010 Load Forecast Range

KEY PLANNING QUESTIONS

The two major uncertainties in the load resource balances beyond meeting firm energy and dependable capacity requirements are in load growth and resource delivery uncertainty. The risk of these uncertainties is both a shortfall of electricity supply that results in BC Hydro not meeting its legislated planning requirements and an oversupply of energy in non-critical water years. A shortfall of energy would require BC Hydro to secure additional resources if available in the markets or not being able to meet customers' load requirements. An oversupply of energy in non-critical water years would require BC Hydro to sell excess energy to the markets or to spill water from its reservoirs.

BC Hydro manages uncertainties in the load resource balance by analyzing the different outcomes and potential future scenarios and assessing how BC Hydro would meet these future worlds. This is reflected in contingency resource plans and acquisition actions in the IRP.