# 2008 Long Term Acquisition Plan

BC hydro

# APPENDIX F10

## Calculation of Capacity Planning Reserves

## (Extract from Alcan Inc. 2007 Electricity Purchase Agreement Proceeding)

[Revision 1 – July 4, 2008]

# Calculation of Capacity Planning Reserves

## 1. Loss Of Load Expectation and Loss of Load Probability

BC Hydro determines how much peak load can be served from its system based on a Loss Of Load Probability (LOLP) methodology. This methodology assesses the probability that specified peak loads can be served from the dependable capacity[1] that the system generation resources provide. When the probability of meeting the peak loads on particular days is summed over the year, it results in a Loss Of Load Expectation (LOLE). BC Hydro plans its system to meet the annual LOLE criterion of no more than 1 day in ten years (or 0.1 days per year).

The annual maximum peak hourly load that can be reliably served (i.e. meeting the LOLE criterion of 1 day in ten years) by a particular portfolio of generation resources is called the Effective Load Carrying Capability (ELCC). The ELCC must equal or exceed the forecast peak load in every year to achieve the reliability criterion.

The ELCC is generally a function of:

- the size of the generating units;
- the reliability of the generating units (in terms of Forced Outage Rates); and
- the intra-year shape of the daily peak loads (generally speaking, the intra-year shape of the daily peak load is not expected to change significantly over the 20 year planning horizon).

Hence, the ELCC (i.e. load) that a particular system can supply varies with the capacity characteristics of the resource type added to the system.

Generation resources that supply dependable capacity include those owned by BC Hydro, IPP supply under contract to BC Hydro and dependable capacity available from external markets.

## 2. BC Hydro's Capacity Planning Reserve Requirement[2]

In order to simplify the process of analyzing multiple portfolios and required generation additions, BC Hydro uses an average reserve level, measured in per cent, that has been determined by the LOLE and ELCC calculations.

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[1] See Appendix A for the definition of dependable capacity.

[2] From page 60 of the IEP/LTAP Decision: "Although BC Hydro states that the criterion requires the installed capacity to exceed peak load by a probabilistic factor it calculates to be 14 percent, the planning reserve margin appears to be calculated based on installed capacity and as a result remains essentially constant as peak demand increases, or in fact decreases when Burrard is eliminated. The Commission Panel finds this characterization of reserves confusing and expects that reserves should be more directly relate to peak demand for the purposes of presenting BC Hydro's load/resource balance."

BC Hydro last calculated its planning reserve margin in December 2006. The table below presents the results of this calculation.

| | | |
|---|---|---|
| Dependable Capacity | 11,567 MW | (a) |
| ELCC (as determined by LOLE) | 9,930 MW | (b) |
| Planning Reserves | 1,637 MW | (c) = a – b |
| | | |
| Percent reserve margin<br>(Dependable Capacity – ELCC) / Dependable Capacity | 14.2% | $\frac{(a - b)}{a}$ |

The average reserve level for BC Hydro that results from the above calculation is currently 14 per cent.

It should be noted that when changes are made to the system (e.g. capacity additions or retirements) the incremental reserve requirements for the system may be more or less than the 14 per cent average for the total system.

In the case of the 2007 EPA, LOLE studies indicate that the incremental planning reserve requirements are negligible. Therefore the 2007 EPA capacity is shown as not requiring reserves in the Appendix F Tables.

## 3. Load/Resource Gap Calculation

3.1 Calculation in ELCC

BC Hydro calculates the Load/Resource Gap in terms of ELCC. This means that for every one MW shortfall, BC Hydro would have to acquire dependable capacity sufficient to meet that one MW of ELCC shortfall plus any associated reserves. All capacity reliability calculations in Chapter 5 have been prepared on this basis and all presentations of the “gap” are in ELCC. The Tables presented in Appendix F, related to capacity reliability, are all based on this calculation method. They have been re-formatted for this report; however the calculations are consistent with the 2006 IEP/LTAP.

In this formulation based on calculation of the “gap” in ELCC, the reserves will not (and should not) grow with load growth. The example below calculates the “gap” in ELCC using F2013 for illustrative purposes.

| **This example uses F2013 to illustrate an ELCC calculation**<br>***(assuming Alcan 2007 EPA and EE 3,4,5 implemented)*** | | |
|---|---|---|
| | **MW** | **Formula** |
| **Supply Available** | | |
| Determine Supply Requiring Reserves | 12,343 | (a) |
| | | |
| **Planning Reserve Requirement** | | |
| Calculate Net Reserves<br>*(14% * total supply requiring reserves)* | 1,728 | (b) = 14%*a |
| Minus 400 MW market reliance | -400 | (c) |
| Net Reserves | 1,328 | (d) = b + c |
| | | |
| Determine Supply NOT Requiring Reserves<br>*(includes both existing Alcan contract and the 2007 Alcan EPA)* | 198 | (e) |
| | | |
| Calculate **ELCC**<br>*(Supply Requiring Reserves – Net Reserves + Supply Not Requiring Reserves)* | 11,213 | (f) = a - d + e |
| | | |
| Determine the **Mid Load forecast** after DSM | 11,176 | (g) |
| | | |
| **Calculate the Load/Resource Gap ELCC**<br>***(ELCC – Load after DSM)*** | **37** | **(h) = f - g** |

## 4. The ELCC Method is the Appropriate Method

The ELCC method utilized by BC Hydro is appropriate for the following reasons:

- Reserve requirements are more a function of the supply resources than they are of system peak load (see section 2, above); and
- As indicated in the 2006 IEP/LTAP, BC Hydro is acquiring new resources such as wind generation and other intermittent generation that may require different levels of reserve (measured in percentage terms).

BC Hydro will be examining incremental reserve requirements for new resources in more detail for the 2008 LTAP.