

QUÉBEC CONTROL AREA  
2004 INTERIM REVIEW  
OF  
RESOURCE ADEQUACY

Approved by the RCC on March 9, 2005

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**December 2004**

## **Executive summary**

This Québec Control Area's 2004 Annual Interim Assessment ("*2004 Interim Review*") of its 2002 Triennial Review of Resource Adequacy covers the period between November 2004 and October 2007. This *2004 Interim Review* is conducted to comply with the Reliability Assessment Program established by the Northeast Power Coordinating Council (NPCC). This assessment follows the resource adequacy review guidelines as outlined in the NPCC B-8 Document "Guidelines for Area Review of Resource Adequacy".

This *2004 Interim Review* underlines the changes in assumptions that had to be made since the submission of the 2002 Triennial Review and assesses the impact of these changes on the reliability of the Québec Control Area.

Results of this *2004 Interim Review* show that the Québec Control Area will comply with the NPCC resource adequacy reliability criterion under both the Base and the High Load Forecast Scenarios. In the High Load Forecast Scenario, about 300 MW of additional resources are required for the 2005/2006 peak month.

## **Introduction**

This *2004 Interim Review* is the second update of the 2002 Triennial Review of Resource Adequacy approved in November 2002. The major assumptions of this *2004 Interim Review* are consistent with Hydro-Québec's Strategic Plan 2004-2008 published in December 2003 and the "Demande d'approbation du Plan d'approvisionnement 2005-2014" of Hydro-Québec Distribution filed before the Québec Energy Board (Régie de l'énergie du Québec) in November 2004.

## **Assumptions Changes**

### **Load**

#### Base Load Forecast Scenario

The internal load forecast for the Québec Control Area covering the 2004 through 2007 period published in fall 2004 has increased as compared to the forecast used in the 2002 Triennial Review. The annual growth rate for the base load forecast for the period 2004/2005 to 2006/2007 is now 2,1 % compared to 1 % for the same period in the 2002 Triennial Review. The increase is due to a higher growth rate in both the residential and large industrial customers demand. For the 2004/2005 winter peak period, the internal peak load forecast is 34 669 MW and the firm sales outside the Québec Control Area are 482 MW. This results in a total peak load forecast of 35 151 MW which is 564 MW higher than the forecast in the 2002 Triennial Review. For the following years of the assessment period, the two winter peak load forecasts are revised upward by 1 400 MW

as shown in Table 1 and Figure 1. The increase in the firm sales outside the Québec Control Area comes from a new contract with Cornwall Electric.

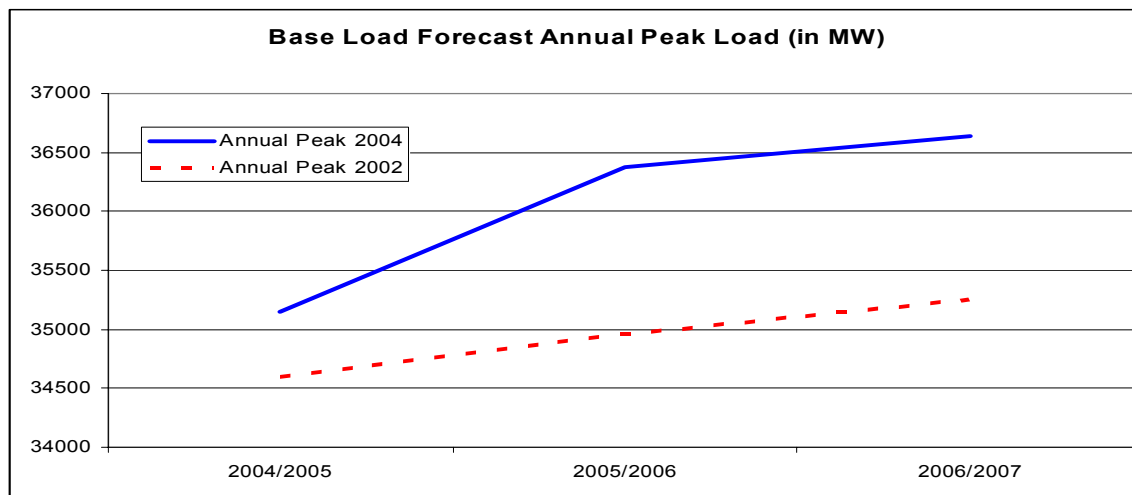
**Table 1**

**Base Load Forecast Annual Peak Load (in MW)**

Peak Year	Interim Review 2004	Triennial Review 2002	Difference
2004/2005	35151	34587	564
2005/2006	36379	34956	1423
2006/2007	36641	35244	1397

The planning year corresponds to an hydraulic cycle beginning in November and ending in October of the following year.

**Figure 1**



The load duration curve used for the forecast of power requirement in this *2004 Interim Review* is slightly different than the one used in the 2002 Triennial Review in order to reflect customer consumption patterns. This change to the load duration curve alone increases the required reserves by more than 100 MW .

Load Forecast Uncertainty (LFU) is a measure of the possible outcome of the load given that the variables that impact the load are uncertain. It is due to load sensitivity to weather conditions and to structural uncertainty caused mainly by the evolution of economic and demographic parameters affecting the load demand in the study period. The Load Forecast Uncertainty was revised . The load sensitivity to weather conditions has been revised upward (from 3 % to 3,55 %) and the load sensitivity to structural uncertainty has been revised downward. Because the economic assumptions behind the new forecast are closer to the full potential of Québec's economy, the probability of a

higher load than forecasted is decreased, thus the load forecast uncertainty is lowered. The decrease in structural uncertainty being greater than the increase in weather uncertainty, the overall effect is a decrease of the Load Forecast Uncertainty.

**Table 2**

**Comparison of Load Forecast Uncertainty Rate (in %)**

	<b>Current year</b>	<b>+1 year</b>	<b>+2 years</b>	<b>+3 years</b>
<b>Triennial Review 2002</b>	4,80%	5,20%	5,40%	5,80%
<b>Interim Review 2004</b>	4,33%	4,62%	4,97%	5,40%

High Load Forecast Scenario

In the 2002 Triennial Review, the average annual growth rate of the peak load forecast was 2,16 % for the high load scenario over the 2004 to 2007 period. In the current review, the growth rate is revised to 2,37 % as shown in Table 3 and Figure 2 .

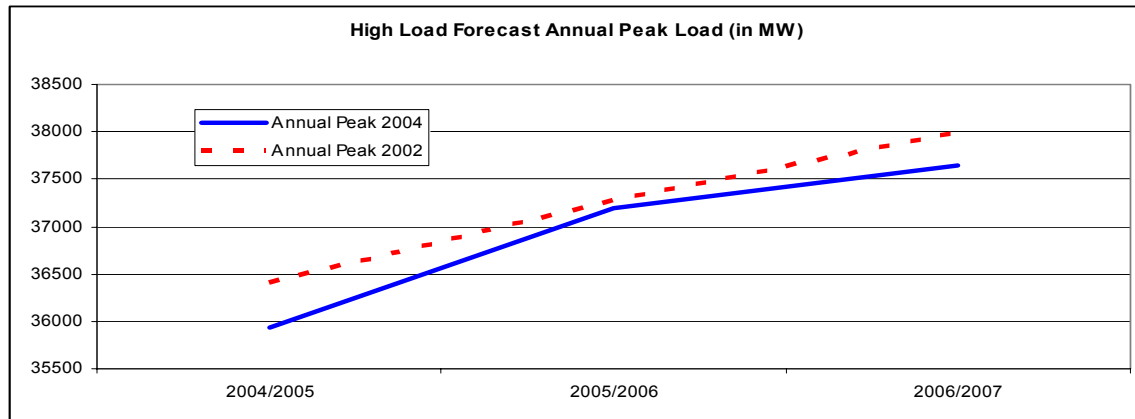
As stated earlier, the base load forecast was revised upward for the next three years. Nonetheless, the high load scenario is forecasted to be lower than anticipated in the 2002 Triennial Review. This is due to the structural uncertainty decreasing as forecasted years draw closer.

**Table 3**

**High Load Forecast Annual Peak Load (in MW)**

	<b>Annual Peak 2004</b>	<b>Annual Peak 2002</b>	<b>Difference</b>
<b>2004/2005</b>	35929	36400	-471
<b>2005/2006</b>	37200	37270	-70
<b>2006/2007</b>	37649	37990	-341

**Figure 2**



The Load Forecast Uncertainty for the High Load Forecast Scenario is only affected by the weather conditions.

## Resources

For the 2004/2005 period, the net available resources are 330 MW higher than forecasted in the 2002 Triennial Review. For the 2005/2006 and 2006/2007 winter periods, the net available resources increase by 400 MW and 1204 MW respectively, as shown in Table 4 and Figure 3.

The following changes to the available resources additions and reductions were made since the publication of the 2002 Triennial Review :

- Addition of a new Combined Cycle Gas Turbine at Bécancour with generating capacity of 547 MW, owned by TransCanada Energy and in operation in October 2006;
- Addition of 550 MW of the 880 MW, originally announced in the Québec 2002 Triennial Review for the Sainte Marguerite 3, took place in 2003. In June 2005, the capacity will reach 715 MW and 860 MW in November 2006;
- Addition of a new Hydro-Québec Production hydroelectric generating station (Mercier 32 MW) in operation in October 2006;
- Addition of generating capacity at the Outardes-4 hydroelectric generating station (28 MW);
- Additional power purchases from Québec's independent power producers for a total capacity of 210 MW;
- Reduction of 100 MW of interruptible load from a large industrial customer under long term interruptible contract.

Also, Hydro-Québec Distribution has signed contracts for 800 MW of interruptible load with large sized industrial customers in Québec for the December 2004 through October 2007 period.

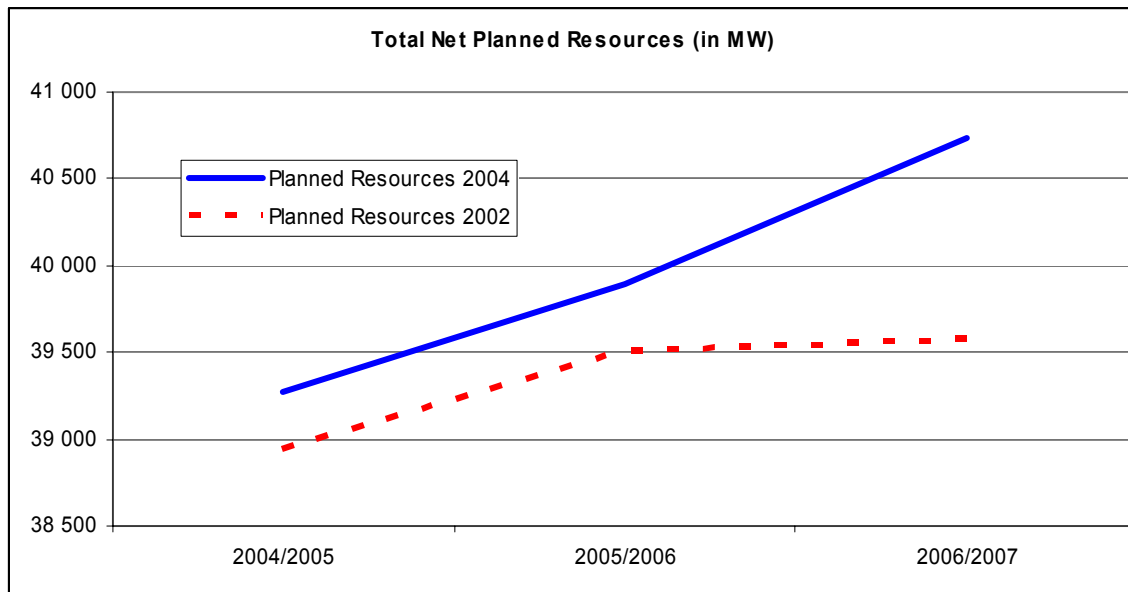
Hydro-Québec Distribution has signed a purchase agreement for 200 MW of wind power capacity to be installed in Québec for the 2006/2007 winter peak period. In this review, wind power capacity was not included. Hydro-Québec has just started evaluating the capacity value at peak load of wind power farms.

**Table 4**

**Total Net Planned Resources (in MW)**

	<b>Planned Resources 2004</b>	<b>Planned Resources 2002</b>	<b>Difference</b>
<b>2004/2005</b>	39 273	38 943	330
<b>2005/2006</b>	39 895	39 498	397
<b>2006/2007</b>	40 770	39 566	1 204

**Figure 3**



In term of fuel diversity, the addition of the TransCanada Energy's combined cycle gas turbine and the increase in private production from sources other than hydraulic will upgrade the fuel diversity in Québec.

**Table 5**

<b>Québec Interim Review 2004</b>			
<b>Planned Net Resources (in MW)</b>			
	2004/2005	2005/2006	2006/2007
Available and Committed Generation	31 227	31 902	32 763
Firm Purchases	6 731	6 678	6 692
Interruptible Load	1 315	1 315	1 315
<b>Total Planned Net Resources</b>	<b>39 273</b>	<b>39 895</b>	<b>40 770</b>
<b>Committed Generation (in MW)</b>			
	2004/2005	2005/2006	2006/2007
Refurbishing	0	49	101
Grand-Mère Station	0	0	0
Upgrading Outardes-3	0	128	190
Toulnostouc Station	0	465	465
Upgrading Outardes-4	0	14	28
Mercier Station	0	0	32
Biomasse			20
Wind Power			0
Trans-Canada Energy c.c.	0	0	547
<b>Total Generation</b>	<b>0</b>	<b>656</b>	<b>1 383</b>
<b>Firm Purchases (in MW)</b>			
	2004/2005	2005/2006	2006/2007
Churchill Falls	5 064	5 093	5 087
NB Power	200	200	200
Private Producers in Québec	1 340	1 385	1 405
New England Generators	127		
<b>Total Firm Purchases</b>	<b>6 731</b>	<b>6 678</b>	<b>6 692</b>

## RESULTS

Québec Control Area uses the Loss of Load Expectation (LOLE) approach in determining generation requirements with a criterion of 2.4 hours per year. This criterion meets the NPCC resource adequacy criterion as showed in the Québec 2002 Triennial Review. Except some minor and required model parameter updates, there is no change in the model used for this *2004 Interim Review* and the 2002 Triennial Review.

## Base Load Forecast Scenario

Table 6 summarizes the Québec Control Area system Loss of Load Expectation (LOLE) results for the Base Load Forecast Scenario and Table 7 shows the required and observed reserves for the *2004 Interim Review*. They indicate that Québec Area is in compliance for the period from 2004 through 2007 with the NPCC criterion under the Base Load Forecast Scenario.

**Table 6**

### **Base Case LOLE**

<b>Year</b>	<b>2004 Interim Review (Hours/year)</b>	<b>2002 Triennial Review (Hours/year)</b>
<b>2004/2005</b>	0,80	1,23
<b>2005/2006</b>	2,40	1,08
<b>2006/2007</b>	1,58	1,27

**Table 7**

### **Québec Control Area Reserves for the Base Case Forecast Scenario (in % of the Annual Peak Load)**

	<b>2004/2005</b>	<b>2005/2006</b>	<b>2006/2007</b>
<b>Required Reserves</b>	9,6%	9,7%	10,3%
<b>Observed Reserves</b>	11,7%	9,7%	11,4%

## High Load Forecast Scenario

Table 8 indicates that Québec Control Area is in compliance for the period from 2005 through 2007 with the NPCC criterion under the High Load Forecast Scenario except for the year 2005/2006 with a LOLE of 3,53 Hours/year. The magnitude of additional net resources necessary to bring down the LOLE to 2,40 Hours/year is about 300 MW at the peak month. If an High Load Forecast Scenario occur Hydro-Québec will manage to get enough additional resources to meet the criterion.



**Table 8**

**High Case LOLE**

<b>Year</b>	<b>2004 Interim Review (Hours/year)</b>	<b>2002 Triennial Review (Hours/year)</b>
<b>2004/2005</b>	1,41	1,68
<b>2005/2006</b>	3,53	2,98
<b>2006/2007</b>	2,07	6,26

**CONCLUSION**

The Québec Control Area meets the NPCC Resource Adequacy Criterion under the Base Load Forecast Scenario assumptions through November 2004 to October 2007 period.

For the High Load Forecast Scenario, 300 MW of net resources need to be added at the 2005/2006 peak load month only.