Hydro Québec

Le 16 mars 2009

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Par courriel et poste

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OBJET : Dépôt – Suivi administratif des critères de fiabilité selon la décision D-2008-133
Plan d'approvisionnement 2008-2017 du Distributeur
Notre dossier : R000299 YF

Chère consœur,

La présente donne suite à la nôtre du 16 décembre 2008 dans le dossier décrit en rubrique.

Nous désirons vous informer que la Revue Triennale 2008 du Québec (Annexe H) a été approuvée le 11 mars 2009. Ce document est accessible par le biais du lien suivant, sous la rubrique « Quebec Comprehensive 2008 » :

http://www.npcc.org/documents/reviews/Resource.aspx

De là, le traitement confidentiel de ce document n'est plus requis.

Nous vous prions d'agréer, chère consoeur, l'expression de nos meilleurs sentiments.

Yves Fréchette

/nm

ANNEXE C

RESPECT DU CRITÈRE DE FIABILITÉ EN PUISSANCE
BILAN D'HYDRO-QUÉBEC PRODUCTION
POUR L'ANNÉE 2008-2009
EN MW

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ANNEXE C
Respect du critère de fiabilité en puissance
Bilan d'Hydro-Québec Production pour l'année 2008-2009
en MW

Démonstration de la fiabilité en puissance de HQP

Demande	
Demande patrimoniale	34 342
Consommation des centrales	104
Autres engagements	1 771
Engagement total[1]	**36 217**
Offre	
Offre disponible à la pointe	39 755
Puissance interruptible	515
Offre total[2]	**40 270**
Réserve disponible	4 053
Réserve requise pour respecter un critère de 0,1 jour/an	3 200

[1] : Les données reflètent les engagements d'Hydro-Québec Production (électricité patrimoniale, livraisons selon entente, exportations de long terme et ses engagements post-patrimoniaux envers le Distributeur).

[2] : Les données reflètent les informations disponibles au 24 octobre 2008.

ANNEXE E

CONCILIATION DES DONNÉES EN MW POUR LA POINTE 2008-2009

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ANNEXE E

Conciliation des données en MW pour la pointe 2008-2009

OFFRE	(1) HQD	(2) NERC	(3) NPCC	(4) HQP
Ressources d'HQP				
- Ressources disponibles existantes - HQP		39 679	39 956	39 756
- Puissance Interruptible - HQP		(a)	515	515
- Ressources planifiées - HQP		82		
Ressources d'HQD				
- Électricité patrimoniale	37 442			
- Contrats de LT avec HQP	712			
- Contrats de LT avec des tiers	44	44	44	
- Abaissement de tension - HQD	250	(a)	250	
- Électricité Interruptible - HQD	735	(a)	722	
- Achats de court terme - HQD	340		340	
- Puissance installée - Réseaux autonomes		73		
- Engagements nets d'HQP - Hors Québec		-455		
A) TOTAL OFFRE (excluant les ressources planifiées)		**39 341**		
A) TOTAL OFFRE (Ressources existantes et planifiées)	**39 523**	**39 423**	**41 827**	**40 271**

Demande	(1) HQD	(2) NERC	(3) NPCC	(4) HQP
- Besoins réguliers du Distributeur	36 040	35 887	36 040	
- Réseaux autonomes		73		
- Engagements d'HQP - Électricité patrimoniale				34 342
- Engagements d'HQP - Envers HQD				712
- Engagements d'HQP - Envers des tiers		419	1 059	1 059
- Consommation des centrales				104
- Puissance Interruptible - HQP		-500		
- Électricité Interruptible - HQD		-800		
- Abaissement de tension - HQD		-250		
B) TOTAL DEMANDE	**36 040**	**34 829**	**37 099**	**36 217**

C) Réserve disponible (A-B)	**3 483**	**4 594**	**4 728**	**4 054**

(a) : ressources considérées en déduction de la demande.

Sources :
(1) : État d'avancement du Plan d'approvisionnement 2008-2017, Novembre 2008;
(2) : Winter Assessment 2008-2009, NERC, soumis en septembre 2008 et publié en novembre 2008;
(3) : 2008 Québec Area Comprehensive Review of Resources Adequacy - NPCC, soumis en décembre 2008 et approbation attendue en mars 2009;
(4) : Annexe C, Respect du critère de fiabilité en puissance, Bilan d'HQP pour l'année 2008-2009, Novembre 2008.

ANNEXE H

REVUE TRIENNALE 2008 DU QUÉBEC
(VERSION PRÉLIMINAIRE)
SOUMISE AU NPCC

CONFIDENTIEL

December 5th, 2008

2008 QUÉBEC AREA

COMPREHENSIVE REVIEW

OF RESOURCE ADEQUACY

PRÉLIMINAIRE

Prepared by

Planning and Reliability

Direction Electricity Supply

Hydro-Québec Distribution

December 2008

1. EXECUTIVE SUMMARY

1.1. Major Findings

This 2008 Québec Comprehensive Review of Resource Adequacy is submitted to the Northeast Power Coordinating Council (NPCC) and prepared in accordance with "Guidelines for Area Review of Resource Adequacy", document B-8 revised November 29th, 2005. As in the previous review, this review shows that the Québec Area has the ability to meet the NPCC reliability criterion for the next five planning years (November 2008 through October 2013). Each planning year, corresponding to a full hydraulic cycle, begins November 1st and ends October 31st of the following calendar year.

The information presented covers November 2008 to October 2013 and is based on the Hydro-Québec 2008 load forecast according to the 2008-2017 Procurement plan progress report filed with the Québec Energy Board on October 31st, 2008. Related documents can be found at the following internet address:

http://www.regie-energie.qc.ca/audiences/EtatApproHQD/Etat-avancement_2008_31oct08.pdf

The peak load forecast for 2008-2009 is set at 37,099 MW, about 355 MW lower than forecasted in the 2005 Québec Comprehensive Review. The winter peak load is forecasted to grow at an annual average rate of 1,50% to reach 39,375 MW in 2012-2013. The planned resources are forecasted to grow a bit slower than the load over this period (annual average growth rate of 1.41 %). For the 2008-2009 winter peak, the planned resources are 41,827 MW. This is 1,000 MW less than the previous Comprehensive Review. In 2012-2013, the planned resources are estimated to be 44,238 MW, an anticipated increase of 2,500 MW over the period under review, including the return in service of the TransCanada Energy's natural gas unit in Bécancour (547 MW) and the short term purchases of Hydro-Québec Distribution.

Even if the anticipated increase in resources is lower than the anticipated load increase, the resource increase is more than sufficient to maintain the planned reserve over the required reserve by more than 1,000 MW for the next three years and around 250 MW for the last two years of the assessment period. This Comprehensive Review indicates that the required reserve margin varies in a range of 9.7 % in 2008/09 to 11.7 % in 2012/13 in order to meet the NPCC reliability criterion of a maximum 0.1 day per year of Loss of Load Expectation (LOLE). The planned reserve margin varies in a range from 12.6 % in 2008/09 to 13.7 % in 2010/11.

In the previous Québec Comprehensive Review, a tie benefits value of 500 MW was included for planning purpose. Each fall before the winter period, Hydro-Québec Distribution re-assesses the needs for short term purchases of capacity and transmission.

In this 2008 Québec Comprehensive Review, tie benefits is replaced by short term purchases and upgraded to 1,000 MW. Hydro-Québec Distribution has reserved 1,000 MW of transfer capacity over the Châteauguay-Massena interconnection (Line 7040) for a period of 5 years. Before each winter period, when needed, Hydro-Québec Distribution will contract the required capacity for the corresponding winter. For planning purposes, both Hydro-Québec Production and the New York Control Area are expected to sell the required capacity. For the 2008/2009 winter, Hydro-Québec Distribution will buy 340 MW of UCAP [(1)].

In this Review, wind power is completely derated.

The refurbishment of Gentilly-2 nuclear power plant (675 MW) will start in 2011 for a return-to-service in late 2012.

The effective contribution of the Hydro-Québec Distribution program of interruptible load has been upgraded from 70 % to 85 % of the number of MW signed under this program.

In New England, the Monroe terminal of the Phase I HVDC interconnection has been retired on March, 31st 2007. Power transmission is now possible only through the Phase II Interconnection (Nicolet to/from Sandy Pound substations). To reflect this reconfiguration, the Nicolet-Des Cantons sub area is now calls Nicolet sub area.

(1) : The latest demand forecast is lower by 400 MW, therefore no short term purchase is now required. Hydro-Québec Distribution has already bough 150 MW from New York Control Area,

1.2. Major Assumptions and Results

The following table sets major assumptions and results.

Table I Major Assumptions and Results

Assumptions	**Description**	
Study period	Winter 2008-2009 to Winter 2012-2013	
Reliability Criterion	LOLE 0,1 day/year : complying with once in 10 years NPCC criterion	
Load Model	8 760 hourly peak load with uncertainty factors	
Program	GE MARS Program	
Load Growth	2008-2009	2012-2013
- Base Case	37,099 MW	39,375 MW
- High Case	37,621 MW	41,404 MW
Required Reserve (% of Total Peak Demand)	9.7 %	11.7%
Resources Additions	2,323 MW through the study period	
Equivalent Forced Outage Rates	5 years history (2003-2007). Specific EFORd for each power station	
- Hydro	0.3 % to 1.8 %	
- Thermal, including nuclear	6.5 % to 20.5%	
Short Term Purchases	Potential of 1,000 MW (mainly from NYCA)	
Spinning Reserve	minimum amount of 250 MW	
Emergency Operating Procedures		
- Interruptible Load	1,515 MW through the study period	
- Voltage Reduction	250 MW through the study period	
Unit Dependable Maximum Net Capability	see Table A	
Maintenance Schedule	see Table A-2	
Results		
	LOLE Day/year	
	Base Case	**High Case**
2008/09	0.033	0.058
2009/10	0.038	0.080
2010/11	0.051	0.121
2011/12	0.088	0.257
2012/13	0.080	0.286

2. TABLE OF CONTENTS

3. INTRODUCTION

This resource adequacy review is conducted by Hydro-Québec and submitted to the Northeast Power Coordinating Council (NPCC) in accordance with "Guidelines for Area Review of Resource Adequacy", document B-8 revised November 29th, 2005. Hydro-Québec Distribution is the entity responsible for resource planning in Québec. Information related to Hydro-Québec Production and TransÉnergie activities was submitted to Hydro-Québec Distribution for the purpose of this Review.

Information presented in this Review covers November 2008 to October 2013 and is based on the Hydro-Québec 2008 load forecast included in the 2008-2017 Procurement plan progress report filed with the Québec Energy Board on October 31st 2008.

The Comprehensive Review demonstrates that the Québec Control Area will meet the NPCC resource adequacy criterion (i.e. the probability of disconnecting non-interruptible customers due to resource deficiencies shall be, on average, no more than once in ten years) for the period 2008 to 2013 under the base case assumptions.

This NPCC criterion stipulates that Areas shall take into account internal transmission transfer capabilities. The Québec Area is therefore divided into six sub areas (Baie James, Churchill Falls, Manicouagan, Québec Centre, Nicolet and Montréal).

The General Electric Energy "Multi-Area Reliability System" model (MARS) was used to assess the resource adequacy. (See Appendix A for technical information).

3.1 Previous Triennial Review

The last Québec Triennial Review was submitted in December 2005 and approved by NPCC's Reliability Coordinating Committee (RCC) on March 2006. Québec's resource adequacy was deemed in accordance with the NPCC criterion for resource adequacy.

3.2 Comparison of Current and Previous Triennial review

The Québec Control Area is divided into six sub areas to model the major internal transfer constraints. The values provided in Figure 1 and Table 2 below represent the capabilities within the Québec system. This model does not exactly represent the actual 735 kV architecture of the system and its interfaces as defined in NPCC Transmission Reviews

Baie James sub area

This sub area is located in the northwest area of the Québec and includes 16,236 MW of generating capacity mainly from the large Baie James hydro-electric complex . The load in this region is relatively small. The peak load forecast for the 2008-2009 winter is

around 1,155 MW. The transfer capabilities from this sub area to the other sub areas are 16,050 MW.

Churchill Falls sub area

The Churchill Falls sub area, located in Labrador, represents Hydro-Québec's contractual rights on Churchill Falls hydro generation (4,930 MW during winter months).

Nicolet sub area

The Nicolet sub area has no load and is used to model the HVDC Phase 2 interconnection and its transfer capabilities within the Québec system and/or imports/exports with the New England Control Area.

Manicouagan sub area

This sub area, in the northeast, includes 8,850 MW of generating capacity and integrates the Churchill Falls (4,930 MW) generation. The Manic-Outardes generation complex (7,886 MW) is located in this sub area. The next peak load forecast for this sub area is 1,835 MW and is mainly driven by large industrial users. The transfer capability from this sub area to the Québec Centre sub area is 11,750 MW.

Québec Centre sub area

This sub area includes the Lac St-Jean, Gaspésie, Québec City and Trois-Rivières regions. The peak load is 9,160 MW and the generating capacity is 2,100 MW. This sub area can receive 14 100 MW from the Baie James sub area and 12 100 MW from the Manicouagan sub area. The transfer limit between Québec Centre and Montréal is 17,750 MW.

Montréal sub area

This sub area, in the south-western of Québec, includes the Montréal, Outaouais, and Estrie regions. The peak load is 23,891 MW, more than 66 % of the total internal load and the generating capacity is 6,213 MW.

Figure 1 Québec Internal Transmission Transfer Capabilities at 2008/2009 Peak (in MW)

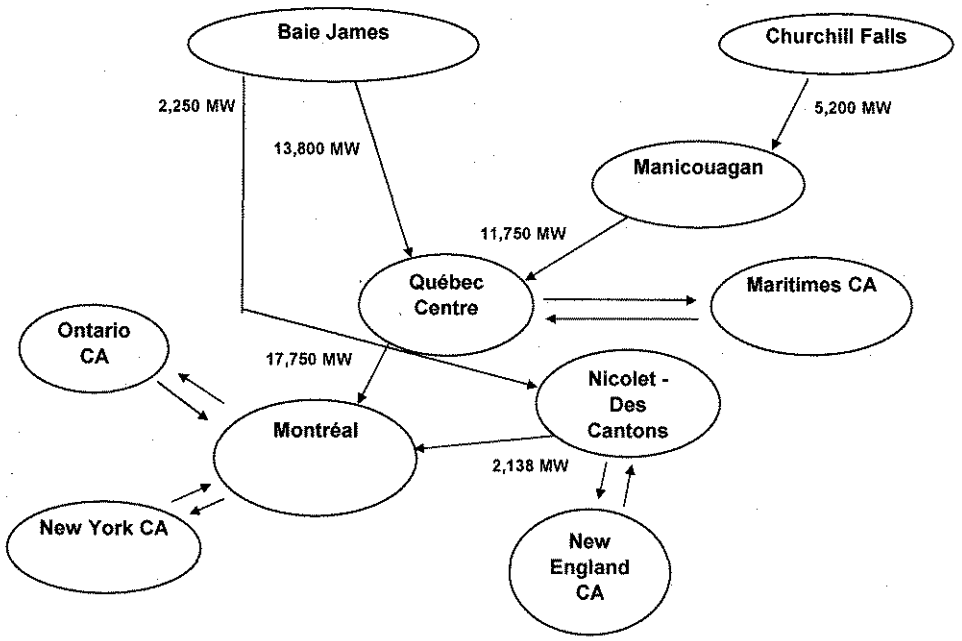


Table 2 Québec Internal Transfer Capacities

Sub area		Capacity	# of Circuits	Kv Voltage	Type of Current
Sending	Receiving	MW			
Churchill Falls	Manicouagan	5,200	3	735 kV	AC
Manicouagan	Québec Centre	11,750	5	735 kV	AC
Québec Centre	Montréal	17,750	8	736 kV	AC
Baie James	Québec Centre	13,800	6	737 kV	AC
Baie James	Nicolet	2,250	2	±450kV	DC
Nicolet	Montréal	2,138	2	±450kV	DC

3.2.1 Load

The observed peak load for the winter 2007-2008 was 37,941 MW reached on January 21st, 2008 at 8 am, including 2,589 MW of firm sales outside of Québec. This annual peak load was 903 MW higher than forecasted in the previous Québec Comprehensive Review for the same winter year. In this previous Review, capacity sales outside Québec were forecasted to be only 483 MW. Regarding the total internal load, the observed peak was 1,200 MW lower than forecasted. Last year's winter was generally milder than normal, so electric space heating demand was lower than expected.

The shutting down of certain industrials loads such as sawmills and paper mills also accounted for the reduced observed peak load.

In the 2005 Comprehensive Review, the 2008-2009 winter peak load forecast was 37,454 MW and 37,690 MW for the 2009-2010 winter peak (see Table 3 and Figure 2). In the current review, the 2008-2009 winter peak load forecast is set at 37,099 MW and grows at a annual average rate of 1,50 % to reach 39,375 MW by 2012-2013.

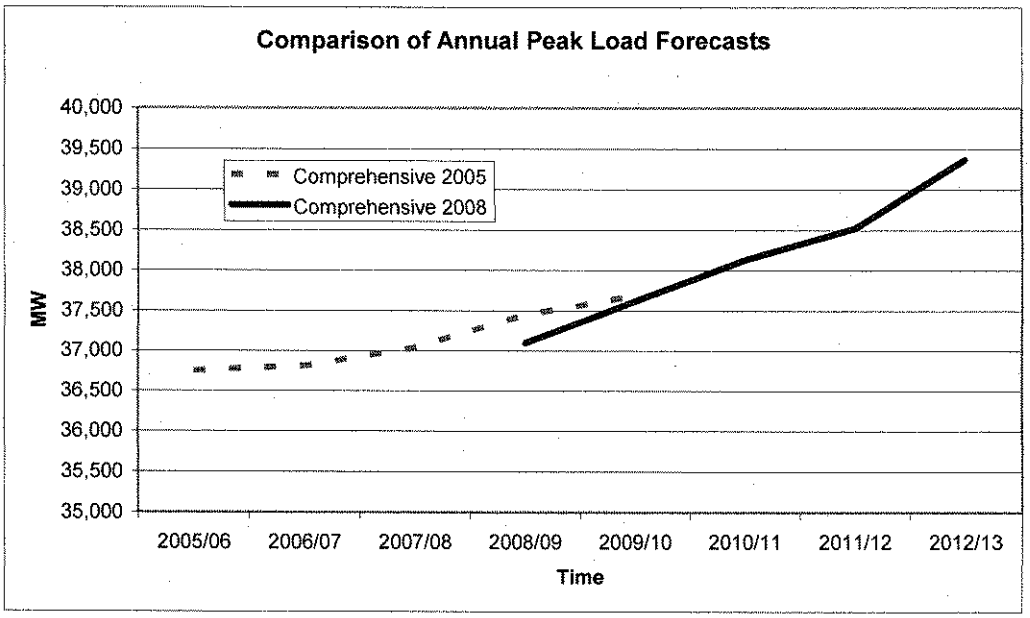
For the two common years of both reviews, the load forecast has been reviewed downward. This is mainly due to economic difficulties experienced by lumber and paper mill industries. After 2010, expected load growth is higher than forecasted in 2005. The price advantage of electricity over fossil fuels is driving upward the electricity demand for heating purposes.

Table 3 - Comparison of Annual Peak Load Forecast in MW [1]

	Comprehensive 2005	Comprehensive 2008	Difference
2005/06	36,754		
2006/07	36,813		
2007/08	37,038		
2008/09	37,454	37,099	-355
2009/10	37,690	37,620	-70
2010/11		38,130	
2011/12		38,527	
2012/13		39,375	
Average growth rate	0.63%	1.50%	

[1] : Annual peak load forecast includes firm exports but does not take into account interruptible power shaving.

Figure 2 Comparison of Annual Peak Load Forecasts in MW



3.2.2 Resources

The planned resources for the 2008-2009 winter peak are 41,827 MW. This is 1,000 MW less than the previous Québec Comprehensive Review for the same winter peak. The resources are planned to reach 44,238 MW for the 2012-2013 winter peak, representing an increase of 2,501 MW.

New resources are coming from capacity increases in hydroelectric power plants (940 MW). All government permits have been received and the construction is in progress in all of those generating stations. No construction delays are expected so there is no uncertainty related to the commissioning date.

Gentilly II nuclear plant (675 MW) will be retired during 2011-2012 winter peak for refurbishing. Independent Private Producers (HQD) increase includes the Bécancour cogeneration plant (547 MW) which is presently shut down and will be restarted on January 1st, 2010.

Table 4 Québec Estimated Total Resources in MW

Québec Area Estimated Total Resources in MW

	2008/2009	2009/2010	2010/2011	2011/2012	2012/2013	Variations over the period
Available Capacities	33,395	33,374	33,369	33,374	34,335	
Churchill Falls	4,930	4,930	4,930	4,930	4,930	
A) Available Capacities - Total	38,325	38,304	38,299	38,304	39,265	940
Independent Private Producers - HQP	1,631	1,666	1,681	1,473	1,442	
Independent Private Producers - HQD	44	591	591	616	766	
Short Term Purchases - HQD	340	400	1,000	1,000	1,000	
B) Purchases - Total	2,015	2,657	3,272	3,089	3,208	1,193
Interruptible Program - HQP	515	515	515	515	515	
Interruptible Program - HQD	722	1,000	1,000	1,000	1,000	
Voltage Reduction	250	250	250	250	250	
C) Emergency Operaring Procedures - Total	1,487	1,765	1,765	1,765	1,765	278
D) Total Resources (A+B+C)	41,827	42,726	43,336	43,158	44,238	2,411

Variations over the period for :

A) Available Capacities - Total	
- EM-1 A hydro unit	768
- La Sarcelle hydro unit	150
- Chute Allard hydro unit	31
- Rapides des Cœurs hydro unit	35
- Upgrading of Existing Capacities	-78
- Gentilly - 2	34
A) Available Capacities - Total	**940**

These figures do not include the wind power capacities. In 2009-2010, the wind power installed capacity is estimated at 1,047 MW. The forecasted wind power installed capacity is approximately 2,700 MW for 2012-2013.

Québec - Wind Generation Forecast Installed Capacity in MW

2008/2009	2009/2010	2010/2011	2011/2012	2012/2013
532	1,047	1,158	1,891	2,686

Wind power capacity credit evaluations are presently performed. Results are expected by the end of next year. More details are given in section 1.7 of appendix A. In this Review, wind power is completely derated.

Table 5 Comparison of Estimated Total Resources[3]

Year	Comprehensive 2005	Comprehensive 2008	Difference
2005/06	40,658		
2006/07	41,987		
2007/08	42,334		
2008/09	42,825	41,827	-998
2009/10	42,981	42,726	-255
2010/11		43,336	
2011/12		43,158	
2012/13		44,238	
Average annual growth rate	1.40%	1.41%	

[3]Resources include purchases and interruptible power shaving.

Mercier and Eastmain-1 hydro generating stations have been committed as forecasted in the previous review. The TransCanada Energy (Bécancour) natural gas unit has also been put in service as planned in the previous Comprehensive Review, but because of lower forecasted energy needs, this unit has been mothballed for 2008 and 2009.

4. RESOURCE ADEQUACY CRITERION

4.1 Statement of Québec Resource Adequacy Criterion

Québec Area reliability criterion complies with the NPCC Resource Adequacy Criterion, which is stated as followed:

> "After due allowance for load forecast uncertainty, scheduled outages and deratings, forced outages and deratings, assistance over interconnections with neighbouring Areas and Regions, transmission transfer capabilities, and capacity and or load relief from available operating procedures, the required capacity must be sufficient so that the probability (or risk) of disconnecting any firm load due to resource deficiencies shall be, on average, no more than 0.1 day per year."

4.2 Application of Québec Resource Adequacy Criterion

To assess its resource adequacy, Québec Area uses a Loss of Load Expectation (LOLE) of 0.1 day per year. An hourly load system is represented in the simulation model.

Due to the shape of the Québec load curve, most of the expected deficiencies occur during January, where the annual peak load is expected to occur.

Emergency operating procedures are listed in Table 6 and are described below, according to their order of priority.

Interruptible load over the considered period is 1,515 MW.

The 30 minutes reserve is reduced to zero.

A voltage reduction procedure has been instated and used as an emergency operating procedure. Tests have been runned during the last two winters to confirm the potential of 250 MW in reduction capability.

The 10 minutes reserve is reduced to 250 MW, the minimum of spinning reserve required to ensure safe operation of the system. Then, load shedding will be implemented to prevent the spinning reserve from dropping below 250 MW.

Table 6 Emergency Operating Procedures

Step	Procedure	Effect	MW
1	Interruptible Load [1]	Load Relief	1,515
2	30-minute reserve to zero	Allow operating reserve to decrease	500
3	Voltage Reduction	Load Relief	250
4	10-minute reserve to zero [2]	Allow operating reserve to decrease	750

[1]: for 2008/09, 1,237 MW derated to 975 MW.
For the rest of the period, 1,515 MW derated to 1,210 MW.
[2]: the 10-minute reserve is 1,000 MW, but 250 MW of spinning reserve must be available at all time.

4.3 Statement of Required Reserve

The reliability criterion application in Québec doesn't refer to a required reserve margin. Application of resource adequacy criterion results from a complete Loss of Load Expectation (LOLE) evaluation done year by year for the power system which meets both the energy and capacity criteria. The resource capacity adequacy may vary from year to year depending on the system characteristics such as:

- Load forecast, load forecast uncertainty and the time frame;
- Type, size and commitment dates of the new resources;
- Existing and future generating unit availability (scheduled maintenance and outages rates).

As depicted in Table 7, Section 5.1, total resource requirements are expressed as a percentage of the annual peak load for the years 2008-2009 through 2012-2013, total resource requirements are expressed as a percentage of the annual peak load.

The resource requirements are 9.7 to 11.7 % higher than the annual peak load and are mostly supplied by available and committed generation and firm purchases. It shows that planned resources are more than adequate to abide by Québec Area Resource Adequacy criterion.

4.4 Comparison of Québec and NPCC Resource Adequacy Criteria

Québec Area Resource Adequacy criterion is the same as the NPCC Resource Adequacy Criterion, as stated in NPCC Document A-2 "Basic Criteria for Design and Operation of Interconnected Power Systems"..

4.5 Recent Reliability Studies

Resource requirements are evaluated each year, pertaining to the normal yearly planning process to integrate the latest information such as demand forecast, available capacity, and firm purchases and sales contracts.

Hydro-Québec Distribution has the obligation to demonstrate its resource adequacy to the Québec Energy Board in November of each year.

Québec Area fully participates in the different NPCC Working Groups that regularly conduct reliability studies in which the Québec system is modelled. These studies show that the Québec Area complies with the NPCC Resource Adequacy Criterion

5 RESOURCE ADEQUACY ASSESMENT

5.1 Planned and Required Resources for the Base Case Load Forecast

Based on the 2008 load forecast, Table 7 indicates the required reserve and the planned reserve values during the period under review, expressed as a percentage of the total annual peak demand which includes internal firm demand and firm sales to neighbouring Control Areas.

The planned resources include installed capacity, firm purchases, voltage reduction and interruptible power programs. Planned reserves are higher than required reserves throughout the reference period.

The Required Reserve margin over the annual peak load is 9.7% in 2008/09 and 11.7% for 2012/13. Required reserve margins are a bit higher than in the 2005 Québec Comprehensive Review. Internal transfer capabilities are not a constraining factor. Transmission planning is in full conformance with NPCC criteria as shown in the NPCC Comprehensive Review of the Québec Transmission System for 2012, approved by the RCC in May, 2008. The maintenance programs are adapted to various system conditions without repercussions on its reliability.

Table 7 Planned and Required Reserves (Base Case)

	Planned Resources	Annual Peak Load	Planned Reserves		LOLE	Required Reserves	
	MW	MW	MW	%	(Day/year)	MW	%
2008/2009	41,827	37,099	4,728	12.7%	0.033	3,608	9.7%
2009/2010	42,726	37,620	5,106	13.6%	0.038	3,902	10.4%
2010/2011	43,336	38,130	5,206	13.7%	0.051	4,106	10.8%
2011/2012	43,158	38,527	4,631	12.0%	0.088	4,381	11.4%
2012/2013	44,238	39,375	4,863	12.4%	0.080	4,588	11.7%

Planned and committed resources include existing hydro and thermal plants, scheduled improvements to existing capacity and also committed generating facility additions. Firm purchases include purchases from Alcan (a private electric producer in Québec), Churchill Falls Corporation Limited (CFLCo), New Brunswick Power, Québec's independent power producers and short term purchases.

The planned resources provide reliable and continuous electricity service over the currently forecasted levels of load through the end of 2013.

5.2 Planned and Required Reserves (High Load Case)

For the 2008/09 planning year, the high load scenario is 543 MW higher than the base case load forecast and the difference reaches more than 2,000 MW for the 2012/13 planning year.

For planning years 2011/2012 and 2012/2013, a significant part of the gap between both forecasts is due to large industrial projects which require special approval for normal tariff application. The rest of the difference is driven by the Québec population growth, internal consumption, general economic activity, exports and the price of fossil fuels.

Table 8 Québec Annual Peak Load Forecasts under Base and High Scenarios[5]

Planning Year	High Load Forecast	Base Load Forecast	Difference
2008/09	37,642	37,099	543
2009/10	38,614	37,624	990
2010/11	39,562	38,134	1,428
2011/12	40,281	38,531	1,750
2012/13	41,404	39,379	2,025
Average Growth Rate	2.41%	1.50%	

[5] Annual peak load forecast includes firm exports but does not take into account interruptible load shedding.

Table 9 Planned Resources, Annual Peak Loads, Planned Reserves and LOLE (High Case)

Planning Year	Planned Resources MW	Annual Peak Load MW	Planned Reserves		Required Reserves		LOLE (Day/year)
			MW	%	MW	%	
2008/2009	41,827	37,622	4,205	11.2%	3,590	9.5%	0.058
2009/2010	42,726	38,613	4,113	10.7%	3,675	9.5%	0.080
2010/2011	43,336	39,561	3,775	9.5%	3,775	9.5%	0.121
2011/2012	43,158	40,280	2,878	7.1%	3,777	9.4%	0.257
2012/2013	44,238	41,404	2,834	6.8%	4,034	9.7%	0.286

As can be seen in Table 9, during the first two planning years, resources are sufficient to cope with a high load forecast scenario while respecting the NPCC reliability criterion.

For the year 2010-2011, an additional purchase of 700 MW in December 2010 is sufficient to cope with the reliability criterion.

For the last two planning years of this Comprehensive Review, some additional purchases (between 1,000 and 1,100 MW per month) are required for the months of December, January, February and March.

Required Additionnal Purchases for the High Load Forecast Scenario in MW

	2010-2011			2011-2012			2012-2013		
	Base Case	High Case	Difference	Base Case	High Case	Difference	Base Case	High Case	Difference
December		700	700	650	1,500	850	1,000	1,750	750
January	1,000	1,000	0	1,000	1,900	900	1,000	2,200	1,200
February	1,000	1,000	0	1,000	1,900	900	1,000	2,200	1,200
March					1,250	1,250		1,250	1,250

5.3 Contingency Plans

For the next two winter periods, the total planned resources will be sufficient to meet both base and high case load assumptions. For the other years, Québec, at the appropriate time, will purchase resources from external markets and /or will try to upgrade interruptible program.

Table 10 shows Québec's typical import capability at peak time from neighboring Areas. These numbers do not account for transmission unavailability.

Table 10
Maximum Import Capability at Peak (MW) - 2008/2009

Neighboring Area	Synchronous	HVDC	Radial	Total
CF(L)Co*	5,200			5,200
Ontario			702	702
New-Brunswick		785		785
New York**		1,100		1,100
New England		0		0
Total	**5,200**	**1,885**	**702**	**7,787**

* : CF(L)Co : Churchill Falls (Labrador Corporation Limited.
** : 100 MW through the VFT at Langlois substation.

Maximum Import Capability at Peak (MW) - 2012/2013

Neighboring Area	Synchronous	HVDC	Radial	Total
CF(L)Co*	5,200			5,200
Ontario		1,250	702	1,952
New-Brunswick		785		785
New York**		1,100		1,100
New England		0		0
Total	**5,200**	**3,135**	**702**	**9,037**

* : CF(L)Co : Churchill Falls (Labrador Corporation Limited.
** : 100 MW through the VFT at Langlois substation.

6 PROPOSED RESSOURCE CAPACITY MIX

6.1 Planned Resource Capacity Mix

Québec Area is mainly a impoundment hydroelectric generation. The breakdown by type is shown in Figure 3 for the 2009-2010 winter period. Hydropower represents 94 % and thermal generation 6 %.

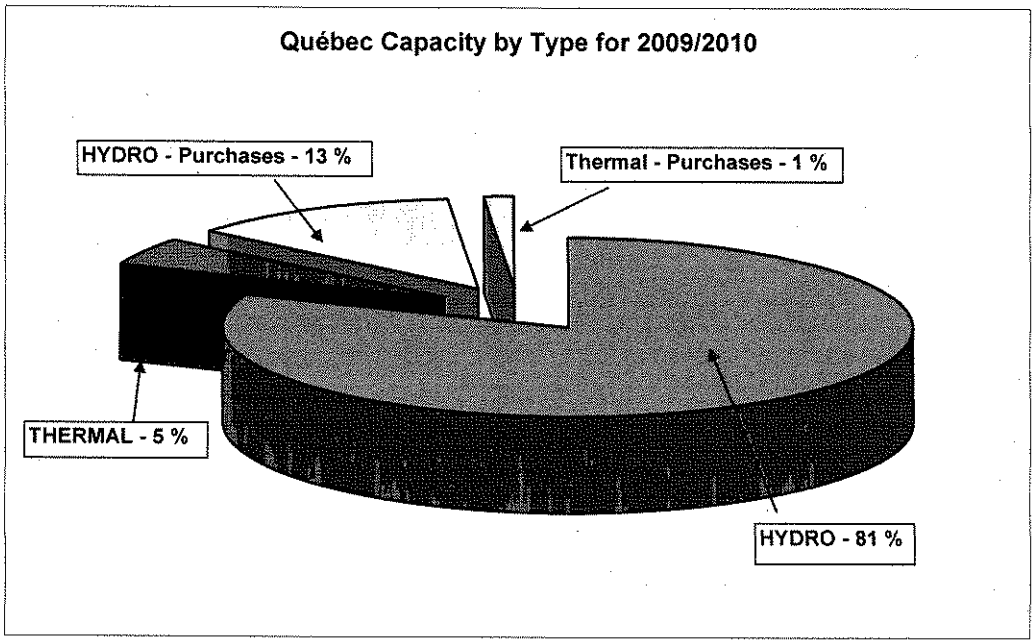
Hydropower relies on adequate water inflows to reliably meet the annual energy consumption. To assess its energy reliability, Hydro-Québec developed an energy criterion that states that sufficient resources should be available to run through sequences of 2 or 4 years of low inflows having a 2% probability of occurrence. Hydro-Québec must demonstrate three times a year to the Québec Energy Board its ability to meet this criterion.

The Québec Area will have 3,216 MW of wind power installed capacity in 2012-2013 winter period. The contribution of wind power capacity is currently not included in this review. Hydro-Québec is analysing wind power contribution during peak and off peak periods and evaluating its capacity and energy contributions. Wind technology is planned to be operational over different Québec winter peak conditions that can be severe (wind, temperature and duration.

6.2 Reliability Impact of Resource Capacity Mix

Hydro-Québec's energy requirements are mostly met by hydro generating stations, which are located on different river systems scattered over a large territory. The major plants are backed by multi-year reservoirs (water reserves lasting more than one year). Québec's system can rely on those multi-year reservoirs and on some other non-hydraulic sources, including fossil generation, allowing it to cope with inflow variations.

Figure 3 Capacity Generation by Type for winter 2009/2010 in %.



Appendix A

Description of Resource Reliability Model

A. Description of Resource Reliability Model

A.1.1 Load Model

A.1.1.1 Description of Load Model

GE MARS software uses a sequential Monte Carlo simulation to compute the reliability of a system comprised of a number of interconnected sub areas containing generation and load. The MARS model simulates the year repeatedly (multiple replications) to evaluate the impacts of a wide-range of possible random combinations of generator outages and load uncertainty. MARS employs an 8,760 hour chronological zonal load model. The load model currently used is based on demographic, economic and energy conditions, which are most likely to materialise.

A 1.1.2 Load Forecast Uncertainty

Load forecast uncertainty was determined by analysing Québec's internal load over the 1971 to 2006 period.

A 1.1.3 Loads of interconnected entities within the Area

The loads and resources of interconnected entities within the Area that are not members of the Area were not considered.

A 1.1.4 Demand Side Management

There are two interruptible load programs in Québec. Each program has it own customers, large industrial customers for Hydro-Québec Production and smaller industrial customers for Hydro-Québec Distribution.

Hydro-Québec Production's program totals 791 MW most of which cannot be called twice a day and not more than 100 hours per winter period. Therefore, a derate factor is applied to model operational constraints for planning purposes.

Hydro-Québec Distribution's program totals 722 MW for winter 2008/09 and 1 000 MW for the rest of the assessment period.

A deterministic reserve of 30% is applied on program offering less flexibility. A smaller reserve ratio (15%) has been applied for more flexible interruptible loads. The 15% ratio was recently reassessed using a sequential Monte-Carlo model (FEPMC). The model allows a simulation of interruptible load dispatching according the specific program provisions. The results were presented to the CP-8 working group of the NPCC and to the Régie de l'énergie du Québec.

A 1.2 Resource Unit Representation

A 1.2.1 Unit Ratings

A 1.2.1.1 Definitions

The capacity definitions used in the reliability evaluation are as follows:

- For hydroelectric generating stations of 50 MW and above

Dependable Maximum Net Generating Capability (DMNC) is defined as the net output a unit can sustain over a specified period modified for monthly limitations and reduced by the capacity required for station service or other auxiliaries. The DMNC must be sustainable for a minimum of two consecutive hours. The proper management of the reservoirs usually makes this capacity available on a daily basis. DMNC varies monthly.

- For hydroelectric generating stations less than 50 MW

These generating stations are the run-of-river plants. DMNC is based on historical generation.

- For thermal generating stations

DMNC is defined as the net output a unit can sustain over a two consecutive hour period. DMNC varies monthly subject to ambient temperature change.

A 1.2.1.2 Procedure for Verifying Ratings

The generating station ratings are based on annual maximum net output tests conducted between November and February of the following year. The procedure is in conformance with :

- NERC Reliability Standards TOP-002-00 and VAR-001-00;
- Criterion A-13, NPCC Verification of Generator Gross and Net Real Power Capability;
- Procedure C-07, NPCC Monitoring Procedures for the Guide for Rating Generating Capability.

A 1.2.2 Unit Unavailability Factors

A 1.2.2.1 Unavailability Factors Represented

Québec represents forced outage rates, planned outages, maintenances outages, and restrictions (hydraulic, electrical and mechanical) for each resource in the Resource Adequacy Assessment. To depict the states of the generating unit, an equivalent demand

forced outage rates (EFORd) is used. With the equivalent forced outage rates State Transition Rates for each unit of the generating station are determined.

A 1.2.2.2 Source of Unavailability Factors

- Forced Outage Rates

To depict the 4 states of the generating unit, an equivalent demand forced outage rates (EFORd) is used.
For existing Capacity resource, EFORd is determining for each specific Power Plant unit from the 5 year historical performance data (2003 to 2007).
The EFORd serves as an estimate of the transition rates in the studied period.

$$\text{EFORd} = \frac{Fr.FOH + Fp.(EFOH - FOH)}{SH + Fr.FOH}.$$

Where

$$\text{Fr} = \text{Full factor} = \frac{(1/r) + (1/T)}{(1/r) + (1/T) + (1/D)}$$

$$\text{Fp} = \frac{ServiceHours}{AvailableHours}$$

r = Average forced outage duration
T = Average reserve shut-down time between periods of need
D = Average in-service time per occasion of demand
FOH = Full Forced Outage Hours
EFOH = Equivalent full Forced Outage Hours i.e the number of hours a unit was involved in an outage expressed as equivalent hours of full forced outage at its maximum net dependable capability
SH = Service Hours

- Maintenance

A daily representation of a generator's scheduled outages is modeled for each unit, based on the 2008 schedules for planned outages.

Unit outage data is based on historical data for the years 2003-2007. Hydro units not having a complete 5-year historical data were given an outage rate equal to the historical average of hydraulic units in Québec.

A 1.2.2.3 Maturity Considerations

For the newly commissioned resource, taking into account of the breaking in period, the EFORd is estimate as being 4% that is nearly twice the average of the generating system.

A 1.2.2.4 Tabulation of Unavailability Factors

Table A-1 Equivalent Forced Outage Rates

Unit Type	2005 Triennial Review FOR	2008 Comprehensive Review EFORd
Hydro Unit	1.1% to 1.8%	0.3% to 1.8%
Thermal unit	4% to 9%	6.5% to 20.5%

Maintenance

2008 schedules for planned outages are used. The monthly volumes are comparable to historical volumes shown in the following table.

Table A.2 – Typical Maintenance for Power Station

	Maintenance	
Month	**2005 Triennial Review**	**For the year 2008-2009**
January	0.4%	0.2%
February	0.4%	0.7%
March	4.4%	0.9%
April	13.7%	7.8%
May	17.7%	16.9%
June	22.5%	21.2%
July	24.9%	18.6%
August	17.1%	19.5%
September	21.6%	15.7%
October	10.5%	10.1%
November	5.3%	5.1%
December	0.4%	0.4%

A 1.2.3 Purchase and Sale Representation

Purchases

Based on Hydro-Québec Distribution procurement policies, suppliers located outside the Québec Control Area must be treated on the same basis as local suppliers, as long as they provide an equivalent quality of service. Hydro-Québec Distribution calls for tenders are open to existing or new power units as well as to new demand response programs. All suppliers must provide a guarantee that the resources offered are not committed elsewhere.

The capacity purchases from other Control Areas and sales to other Control Areas are shown in Table A.2.

Table A.2
Firm Purchases and Firm Sales in MW

Firm Purchases	2008/2009	2009/2010	2010/2011	2011/2012	2012/2013
- New York CA	150				
- Maritimes CA	200	200	200		
Total Purchases	350	0	0	0	0

Firm Sales	2008/2009	2009/2010	2010/2011	2011/2012	2012/2013
- Maritimes CA	220				
- New England CA	329	329	329	329	268
- Ontario CA	154	154	154	154	154
- Québec CA	356	356	356	356	356
Total New Generation	1,059	839	839	839	778

Churchill Falls Corporation Limited (CFLC0)

The capacity purchases are represented according to the contracts between Hydro-Québec and CFLCo.

Québec has access to 4,930 MW during winter and from 2,900 to 4,200 MW during the rest of the year.

Alcan

Alcan has its own generating facilities in Québec. Some of its loads are connected to the TransÉnergie system and are included in the internal load forecast. Hydro-Québec Production and Alcan have contracted for 890 MW of capacity purchases from Alcan, but the capacity is reduced by 267 MW during the winter period to account for availability constraints.

Maritimes CA

Hydro-Québec Production has a purchase contract for 200 MW of peaking capacity until October 2011.

Independent Power Producers in Québec

In 2008-2009, the purchase contracts from Independent Power Producers amount to 585 MW. For the upcoming years, there will be an additional 733 MW available from these producers for a total of 1,318 MW at the 2012/2013 winter peak. This total includes the return in-service of the TransCanada Energy natural gas unit (547 MW) in January 2010.

Short term purchases

For the winter period 2008-2009, Hydro-Québec Distribution will buy 340 MW of capacity from New York Control.

Sales

Québec has three firm export contracts. One contract is with New England Control Area, 329 MW losses included). The export will be reduced to 268 MW beginning November 2012. This export contract is delivered through the Highgate interconnection (225 MW capacity), the Derby Line (50 MW capacity) and the NEPOOL Phase II. The second contract is with the Ontario Control Area (154 MW losses included). Finally, the third contract is with New Brunswick Power for the Winter 2008-2009 only and represents a capacity of 110 to 220 MW including losses.

Hydro-Québec Production has compensation agreements (356 MW) with industrial customers operating hydro generating stations in Québec.

A 1.2.4 Retirements

An agreement to temporarily suspend generation at TransCanada Energy natural gas unit in Bécancour (547 MW) is effective for the calendar years 2008 and 2009. Deliveries under the original contract with TransCanada Energy will resume on January 1st 2010.

The Cadillac gas turbine units (162 MW) were withdrawn from service in November 2008 by Hydro-Québec Production.

A 1.3 Interconnected Systems

Neighbouring systems are not modeled in this Comprehensive Review. The 1,000 MW short term purchases from 2010-11 to 2012-2013, will be procured come from New York CA, as an assumption derived from the latest NPCC Tie Benefits study (see Table 10).

A 1.4 Modeling of Limited Energy Resources

For most hydro generating stations, energy limitations are modeled by using a different monthly values of dependable maximum generating capability (DMNC). This accounts for the effect on the net head of the reservoir level variations on the net head and generatorg cooling water temperature.

Unlike hydro generating stations with reservoirs, the run-of-river Beauharnois and Les Cèdres generating stations are operated in parallel on the Saint-Lawrence River. Their capability depends on water availability and varies according to seasons. Moreover, during ice-cover formation , capacity output must be reduced. Ice-cover formation restrictions are also modeled for all generating stations where they may apply.

A 1.5 Modeling of Interruptible Resources

Québec models 1,515 MW of interruptible power contracts with industrial customers. A description of interruptible contracts and reserves applicable is given in section A 1.1.4.

A 1.6 Modeling of all Resources

No uncertainty is modeled over the commissioning date of the planned generating stations. Regarding the new units to be commissioned during the period under review, all government permits have been received and the construction is in progress at all of those generating stations. No construction delays are expected so there is no uncertainty related to the in-service date. Available capacities of each station are modeled with latest available data. Maintenance, restrictions and outages are taken into account.

A 1.7 Others Assumptions

The TransÉnergie system and its maintenance and up-grade programs, included in this Review, have been submitted and approved by the NPCC.

In this Comprehensive review for resource adequacy, Québec completely derates wind power.

The wind power generation during these events will be subject to an in depth analysis, requiring the development of a new approach. This research will be realized in partnership with Environment Canada

A 1.8 Impacts of market Rules on Reliability

The Québec capacity purchases contracted through request for proposals in other Areas are secured by procedures put in place with the neighbouring NPCC Control Areas.