



National Energy Board

Reasons for Decision

Hydro-Québec

EH-3-87

February 1988

**For Exports to the New England
Utilities**

National Energy Board

Reasons for Decision

In the Matter of

**An Application Under The National
Energy Board Act to Hydro-Québec
For Export To The New England
Utilities**

EH-3-87

February 1988

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Table of Contents

Abbreviations	(iv)
Recital and Appearances	(v)
Executive Summary	(vii)
1. Background	1
2. The Applicant	2
3. The Application	3
4. The Contract	5
4.1 Quantity	5
4.2 Price	5
4.3 Delivery Schedule	6
4.4 Deficiencies	6
4.5 Phase II Facilities	6
5. The Applicant's Evidence	7
5.1 Quebec Loads	7
5.2 Generating and Transmitting Facilities	7
5.3 Load, Supply and Excess Energy	8
5.4 Export Market	9
5.5 Offers to Canadian Utilities	9
5.6 Price	10
5.6.1 Export Price and Revenue	10
5.6.2 Canadian Costs	11
5.6.2.1 Cost-Recovery Analysis	11
5.6.2.2 Social Cost-Benefit Analysis	12
5.6.3 Cost for Equivalent service to Canadians	14
5.6.4 Alternative Costs in the United States Market Area	14
5.7 System Reliability	15
5.8 Environmental Effects	17
6. Interventions	18
6.1 Churchill Falls (Labrador) Corporation Limited	18
6.2 Manitoba Hydro	18
6.3 Maritime Electric Company, Limited	18
6.4 Newfoundland and Labrador Hydro	18
6.5 Nova Scotia Power Corporation	19
6.6 Ontario Hydro	19
6.7 Attorney General of Newfoundland	19
6.8 Minister of Energy for Ontario	19
6.9 Attorney General of Québec	19
6.10 Grand Council of the Crees (of Quebec) and the Chisasibi,	

	Eastmain, Great Whale River, Mistassini, Nemaska, Waskaganish, Waswanipi and Wemindji Bands	20
6.11	New England Power Pool	20
7.	Disposition	21
	Application for Export (Part (a) of the application)	
7.1	Surplus	21
	7.1.1 Offers to Canadian Utilities	21
	7.1.2 Available Excess Energy	22
	7.1.3 Exports Under the Firm Energy Contract	22
7.2	Export Price	23
	7.2.1 Applicable Costs in Canada	23
	7.2.2 Price for Equivalent Service to Canadians	24
	7.2.3 Purchaser's Least Cost Alternative	25
7.3	System Reliability and Licensing Conditions	26
7.4	Environmental Impact	27
	Application for Licence Amendment and Approval of Changes to international Power Line (Parts (b) and (c) of the application)	
7.5	The Board's Findings	27

Tables

5-1	Generating and Transmitting Facilities - Construction Schedule (1990-2004)	8
5-2	Energy Contract with the New England Utilities - Price and Revenue Forecast	10
5-3	Export to the New England Utilities - Cost-Recovery Analysis	12
5-4	Export to the New England Utilities - Cost-Benefit Analysis	13

List of Appendices

I	Map - System's Main Features in 1986	29
II	Licences Held by Hydro-Québec	30
III	Generating Stations in Service as of 31 December 1986	31
IV	Capability, Load and Excess of Energy (1990 - 2004)	
V	Cost-Recovery Analysis - Assumptions	3
VI	Licence EL-176	34
VII	Order AO-2-EL-167	38

Abbreviations

Units of measurement

kV	kilovolt	(1 000 volts)
kW.h	kilowatt hour	(1 000 watt hours)
MW	megawatt	(1 000 kilowatts)
GW.h	gigawatt hour	(1 000 000 kW.h)
TW.h	terawatt hour	(1 000 GW.h)
\$	Canadian current dollar (unless otherwise specified)	

Names

Act	<i>National Energy Board Act</i>
Applicant	Hydro-Québec
Board	National Energy Board
CFLCo	Churchill Falls (Labrador) Corporation Limited
DRI	Data Resources Inc.
Island	Island of Newfoundland
NB Power	New Brunswick Power
NEPOOL	New England Power Pool
NERC	North American Electric Reliability Council
NEU	New England Utilities
NLH	Newfoundland and Labrador Hydro
NPCC	Northeast Power Coordinating Council
Regulations	National Energy Board Part VI Regulations
US	United States

Recital and Appearances

EH-3-87

IN THE MATTER OF the *National Energy Board Act* and the Regulations made thereunder; and

IN THE MATTER OF an application by Hydro-Québec for a licence to export electricity to the New England Utilities, pursuant to Part VI of the *National Energy Board Act*. Filed with the Board under File No. 1923-Q1-15.

HEARD at Montreal, Quebec on 1, 2, 3 and 4 December 1987.

BEFORE:

J. Farmer	Presiding Member
A.B. Gilmour	Member
C. Senneville	Member

APPEARANCES:

Y. Fortier, c.r. J. Bertrand	Hydro-Québec
M.P. Greene W. Chamberlain	Churchills Falls (Labrador) Corporation Limited
B. Janssens P. Awashish	Grand Council of the Crees (of Québec) and the Chisasibi, Eastmain, Great Whale River, Mistassini, Nemaska, Waskaganish, Waswanipi and Wemindji Bands.
W. Lea, Q.C.	Maritime Electric Company, Limited
W. Burnett	Manitoba Hydro
N. Jiwan	Minister of Energy for Ontario
M.P. Greene W. Chamberlain	Newfoundland & Labrador Hydro
L.E. Smith D. Blinn K. Ramsauer J. Lowe	New England Power Pool
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National Energy Board

Executive Summary

Note:

This summary is provided solely for the convenience of the reader and does not constitute part of this Decision or the Reasons for Decision.

The Application of December 1985

In December 1985 Hydro-Québec applied for a licence to export 70 terawatt hours of firm energy to a group of New England utilities for a period of 10 to 14 years beginning in 1990.

The National Energy Board (the Board) held a public hearing on this application in March 1987.

In Reasons for Decision dated May 1987 the Board denied the application because Hydro-Québec had not provided sufficient evidence to demonstrate that the electricity it proposed to export was surplus to reasonably foreseeable Canadian requirements, and that the export price was not less than the price to Canadians for equivalent service.

A utility requesting an export licence is required, under the *National Energy Board Act* and Regulations, to furnish this information.

In complying with this requirement, it has been normal practice for utilities proposing to export electricity to first offer this electricity to neighbouring utilities at a price that is no higher than the export price for comparable service. Refusals of such offers have been taken by the Board as an indication that Canadian utilities do not require the electricity proposed to be exported.

Hydro-Québec failed to make such offers to its neighbouring utilities in Ontario, New Brunswick and Newfoundland, and did not provide any other evidence sufficient to satisfy the Board that the energy proposed to be exported was surplus to Canadian needs and that the price was just and reasonable in relation to the public interest.

The Application of August 1987

In August 1987 Hydro-Québec again applied to the Board for a licence. The Board held a public hearing on this application in December 1987.

At the December 1987 hearing, Hydro-Québec filed additional information in the form of letters offering neighbouring Canadian utilities the electricity proposed for export.

Only Churchill Falls (Labrador) Corporation (CFLCo), on behalf of Newfoundland and Labrador Hydro (NLH), and New Brunswick Power (NB Power) expressed an interest in Hydro-Québec's offer of the proposed export.

Subsequently, NB Power and Hydro-Québec agreed to enter into a firm energy contract and NB Power declined the offer and supported Hydro-Québec's application. Only CFLCo, on behalf of NLH, objected to the proposed export contending that it was not surplus to Canadian requirements because the Island of Newfoundland (the Island) did have unsatisfied needs during the period of the proposed

export and in any event some of the exports could be used to displace thermal generation on the Island.

CFLCo, on behalf of NLH, stated that it did not wish to purchase the energy on the terms and conditions in the offer and tendered evidence which showed that its requirements involved, inter alia, a delivery schedule, annual quantities and energy prices which differed significantly from those provided for in the export contract.

There was evidence at the hearing that an interconnection between Labrador and the Island would cost some \$1.7 billion (1991 dollars). Such an interconnection had not been committed to be constructed, nor were the conditions outlined which were needed to make it economically feasible.

The Board's Decision of January 1988

The Board announced its Decision on 26 January 1988, with reasons to follow, approving Hydro-Québec's application. The licence is subject to approval by the Governor in Council.

The Board found that the energy proposed to be exported was surplus to reasonably foreseeable Canadian requirements and the price to be charged satisfied the price tests applied by the Board.

The Board stated that it was not persuaded that Newfoundland's need for energy was one that Hydro-Québec should be required to supply before being allowed to export.

The Board also found that the energy proposed to be exported had been offered to neighbouring Canadian utilities on the same terms and conditions, including price, as those in the export arrangement. No Canadian utility had availed itself of this offer and the Board determined that the export would not take place at a price lower than that available to Canadians for a comparable service.

Chapter 1

Background

In December 1985 Hydro-Québec (the Applicant) applied to the National Energy Board (the Board) for a licence to authorize the export of 70 TW.h of firm energy to the New England Utilities (NEU) over a period of up to 14 years beginning in 1990. Because of Hydro-Québec's position that the requirements of interconnected Canadian utilities should not be considered in the context of paragraph 83(a) of the *National Energy Board Act* (the Act), it did not make the customary offers of the proposed export to interconnected Canadian utilities. A public hearing on Hydro-Québec's December 1985 application took place in Montreal and Ottawa in March and April 1987. In its Reasons for Decision dated May 1987 the Board denied this application because Hydro-Québec did not provide sufficient evidence to demonstrate:

- that the electricity it proposed to export was surplus to reasonably foreseeable Canadian requirements for use in Canada; and
- that the export price was not less than the price to Canadians for equivalent service in related areas.

A utility requesting an export licence is required, under the Act and Part VI Regulations (the Regulations), to furnish this evidence.

In support of its new application dated 7 August 1987, Hydro-Québec provided additional information, including copies of offers of the proposed export to directly interconnected Canadian utilities, intended to comply with the above requirement.

Chapter 2

The Applicant

The Applicant, Hydro-Québec, is a public utility producing and distributing electricity throughout Quebec. It was established in 1944 by an act of the legislature of the Province of Quebec and currently operates under the authority of the Hydro-Québec Act (R.S.Q. c. H-5).

Hydro-Québec owns and operates an electric power system which covers nearly all regions of Quebec. Appendix I contains a map of the system's main features in 1986. The map also indicates interconnections with systems outside the Province. At the end of 1986, the Applicant had generating stations with a capacity of 24 475 MW and a total supply capacity of 29 699 MW, including purchases of firm power.

Interconnections between the Hydro-Québec system and neighbouring Canadian electric systems include, among others, the 735 kV transmission lines linking it to the Churchill Falls generating station in Labrador. There are some 13 lines between Ontario and Quebec with a total transfer capacity of 1500 MW. These lines link electrically isolated regions or generating stations to either the Ontario or Quebec system. There are two direct current ties between Quebec and New Brunswick, each of which has a nominal capacity of 350 MW. There are also some alternating current lines able to supply 300 MW of the New Brunswick load through radial operation. The power transfer capacity between the two provinces is therefore approximately 1000 MW.

Hydro-Québec's main interconnections with neighbouring American states are as follows:

- State of New York: a 120 kV double-circuit line with a transfer capacity of 186 MW, owned by the Cedars Rapids Transmission Company Limited (a subsidiary of Hydro-Québec) and a 765 kV line with a transfer capacity of approximately 2500 MW;
- State of Vermont: two 120 kV lines, one between the Stanstead, Quebec and Border, Vermont substations with a transfer capacity of 100 MW and one between the Bedford, Quebec and Highgate, Vermont substations with a transfer capacity of 200 MW;
- New England States: a \pm 450 kV direct current line with an initial usable capacity of 690 MW which, according to the 1987-1989 Hydro-Québec Development Plan, would be upgraded to 2000 MW in 1990.

There are also some other international power lines fed by the Hydro-Québec system, but these are primarily low-voltage distribution circuits which supply small loads as a border service.

Hydro-Québec has been issued fourteen licences authorizing exports to the New England and New York markets (see Appendix II).

Chapter 3

The Application

By a three-part application dated 7 August 1987 Hydro-Québec applied for:

- a) a licence for a period of ten years (with the possibility of a four-year extension), beginning 1 September 1990 and ending 31 August 2000 (or 31 August 2004), to export firm energy to the New England Utilities (NEU) in accordance with the terms of the firm energy contract between Hydro-Québec and the NEU, executed on 14 October 1985. The maximum quantities that would be delivered are 9 TW.h annually and a total of 70 TW.h over the entire period covered by the licence.
- b) an amendment to Conditions 4 and 5 of Licence EL-167, to increase:
 - the maximum quantity of power which may be exported from 790 MW to 2000 MW and
 - the maximum quantity of energy which may be exported from 6920 GW.h to 15 920 GW.h.
- c) prior approval as set out in Condition 10 of Certificate of Public Convenience and Necessity No. EC-III-21 for the addition of switching equipment and relocation of the take-off point of the international power line described in the above certificate.

Board's explanatory note

Parts b) and c) of the application are dependent on Part a) for the following reasons:

Part b)

Licence EL-167 already authorizes the export of quantities of interruptible power and energy corresponding to the maximum transfer capacity of the two international power lines used to supply power and energy to New England. The maximum transfer capacity of the ± 450 kV line would be upgraded to 2000 MW to permit the additional export of 7 TW.h annually to the NEU; however, the application did not include any other supportive information related to the increase in the maximum quantities of power and energy authorized under Licence EL-167.

Part c)

NEPOOL - Phase II Facilities

Hydro-Québec was issued Certificate No. EC-III-21 authorizing construction of the Phase I facilities of the interconnection with the New England Power Pool (NEPOOL) which has been in service since 1986. Phase I includes the ± 450 kV international direct current power line and the terminal facilities at the Des Cantons substation. This line has a physical transfer capacity of 2000 MW but its nominal transfer capacity is presently limited to 690 MW by the terminal facilities.

The firm energy contract stipulates that Hydro-Québec and the NEU shall construct the Phase II facilities required to upgrade the nominal transfer capacity of the interconnection linking their respective systems to 2000 MW. Hydro-Québec is required, therefore, to add certain equipment to the Des Cantons substation. This includes protection, control and metering equipment.

Chapter 4

The Contract

The firm energy contract between Hydro-Québec and the NEU was signed on 14 October 1985. This contract sets out, among other things, the terms and conditions governing delivery schedules, calculation of the firm energy price and a mechanism for readjusting quantities and energy price in the event of deficiencies in deliveries.

The contract will come into effect no sooner than 1 September 1990 and will end no later than 31 August 2004.

4.1 Quantity

The total quantity of energy to be exported under the firm energy contract would be 70 TW.h, that is, 7 TW.h annually for a period of ten years beginning 1 September 1990 and ending 31 August 2000. If, on 31 August 2000, Hydro-Québec has not delivered the total quantity of energy, the contract period may be extended to 31 August 2004.

4.2 Price

The energy price (section 6.1 of the contract) would be calculated according to the following formula:

$$\text{Price } \$ \text{ US/MW.h} = A \times \frac{B}{40.33}$$

where

A = a reference price determined as follows:

	Period	\$ US/MW.h
from	1 Sept. 1990 to 31 Aug. 1995*	32.25
from	1 Sept. 1995 to 31 Aug. 2000	38.25
from	1 Sept. 2000 to 31 Aug. 2004	39.00

* In the event of a delay in the coming into effect of the contract, this period could be extended to 31 August 1996.

B = the annual weighted NEPOOL fossil energy cost for the twelve-month period preceding the current contract year.

Note:

40.33 (\$ US/MW.h) represents the annual weighted NEPOOL fossil energy cost for 1983.

4.3 Delivery Schedule

The contract sets out the minimum and maximum monthly quantities of energy to be scheduled for the contract year (section 3.1).

No later than 1 August of each year, Hydro-Québec and the NEU should jointly establish the monthly delivery schedule for the contract year starting 1 September of the same year, respecting the minimum and maximum limits set out in section 3.1.

4.4 Deficiencies

Article V of the firm energy contract provides a mechanism for readjustment of the price and delivery schedules in the event of deficiencies due to interruptions or reductions in the scheduled hourly deliveries, except in cases where interruptions or reductions are effected pursuant to a decision by the Operating Committee. Use of this mechanism could increase the annual quantity of energy scheduled to 9 TW.h.

4.5 Phase II Facilities

Hydro-Québec and the NEU are committed to installing and testing all facilities required for execution of the contract by 1 September 1993. If the facilities are not ready on that date, either party may terminate the contract upon two months' written notice.

Chapter 5

The Applicant's Evidence

5.1 Quebec Loads

At the end of 1986, Hydro-Québec was supplying 2 599 403 customers in the domestic and agricultural sectors and 13 045 customers in the industrial sector, out of a total of 2 862 422 customers. The industrial sector includes primary industries such as mining and pulp and paper, as well as a large number of secondary industries belonging to the manufacturing sector.

Hydro-Québec's peak domestic load during the winter of 1986-87, recorded on 26 January 1987, was 23 219 MW compared to a peak of 22 895 MW the year before. This is an increase of 1 percent. Total electricity sales, including sales outside the province, were 144.1 TW.h in 1986, a rise of 8 percent over the previous year.

5.2 Generating and Transmitting Facilities

In 1986, Hydro-Québec's total generating capacity was 24 475 MW. This figure consists of some 22 726 MW of hydraulic capacity, 1064 MW of thermal capacity and 685 MW of nuclear capacity (see Appendix III). The Applicant also uses most of the power generated by the Churchill Falls generating station, which has a nominal capacity of 5225 MW.

By 1990, when the 70 TW.h firm energy contract with the NEU would come into effect, Hydro-Québec expects to have a gross generating capacity in the order of 25 600 MW. For the period 1990 to 2004, Hydro-Québec will utilize new generating and transmitting facilities to meet the increase in regular requirements for power and energy as well as export commitments, including the 70 TW.h contract. To this end, Hydro-Québec plans to advance the construction of some facilities and has consequently modified its project installation schedule, as indicated in Table 5.1.

Table 5-1

**Generating and Transmitting Facilities
Installation Schedule (1990-2004)**

Project	Capacity MW	In-Service Date	
		Without energy contract	With energy contract
LG 2A	1900	1992-1993	*
Other Peaking Capacity Projects	1300	1997-2000	1997-2005
LG 1	1296	2001-2002	1999-2000
Brisay	385	2002	2001
LA 1	783	2002	*
Ste-Marguerite	822	2004	*
James Bay 6th Line	2000	1992	1990
James Bay 7th Line	-	2001	1999

* The in-service date is not affected by the energy contract.

During the same period, the Applicant also intends to install approximately 2000 MW of gas-turbine capacity in order to meet peak demand.

5.3 Load, Supply and Excess Energy

Hydro-Québec submitted estimates of the system's monthly power requirements and generating capacity for the period to be covered by the licence. The electricity demand estimates conform to the 1987-1989 Hydro-Québec Development Plan, which was filed as an exhibit at the hearing. According to this document, in the average demand reference case, Hydro-Québec forecasts an average load growth rate of 2.7 percent for the period 1986-2006.

A witness for Hydro-Québec explained that the estimates took into consideration Hydro-Québec's own customers' requirements, water availability, additional generating equipment and possible sales to directly interconnected neighbouring systems under the terms and conditions of Hydro-Québec's interconnection agreements. Hydro-Québec based these figures on average streamflow conditions, normal operating conditions and interseasonal and multi-year regulation of reservoirs. The Applicant

also took into account thermal and nuclear power available to the system; however, the same witness stated that thermal stations would not normally be used to generate energy.

The Table in Appendix IV shows annual quantities relative to generating capability, including contract purchases, regular load requirements and surplus energy for the period 1990-2004. In addition to its own customers' requirements, Hydro-Québec's regular requirements include deliveries under agreements with other Quebec systems and all firm sale contracts outside the Province of Quebec, including the quantities of energy forecast in the recent firm contract with New Brunswick Power (NB Power). This Table indicates that Hydro-Québec, after meeting its regular requirements and delivering the 70 TW.h to the NEU, would still have surplus energy during the years 1990 to 1995. According to the average growth case, 54 TW.h of the 70 TW.h delivered under the terms of the contract would be surplus energy, while the remaining 16 TW.h would be derived from the construction of generating facilities whose in-service dates had been advanced.

A witness for Hydro-Québec stated that, since 1982, the Company had changed its concept of electricity sales outside Quebec. Hydro-Québec no longer looks to external markets simply to sell off temporary or seasonal surpluses, but is trying rather to solidify a market through which it can develop Quebec's renewable resources for the benefit of Canada. Currently, most of the revenue generated by: Hydro-Québec's external sales is derived from day-to-day transactions involving economy energy or fuel replacement energy. Such types of transactions may result in significant fluctuations in revenue, as occurred with the 1986 drop in oil prices. Since 1984, Hydro-Québec has taken measures to diminish this risk by selling blocks of firm energy and this approach has resulted in the firm energy contract with the NEU. From this perspective, the contract constitutes a transition between the NEPOOL Phase I stage, in which the goal has essentially been to sell interruptible energy, and the next stage, which focusses on selling firm power and energy and thereby making the construction of new base-load generating plants in New England unnecessary.

5.4 Export Market

The client for this export project, the NEU, is a group of electrical utilities operating in one or more New England states. This group includes, directly or indirectly, almost all members of the NEPOOL consortium and provides electricity to most of the New England states. The NEPOOL system is interconnected with the NB Power and the New York Power Authority systems, as well as the Hydro-Québec system. NEPOOL expects its system's summer peak to exceed its winter peak by 1989. In 1990, the peak load in January will be 19 300 MW, while the August peak load will be 19 400 MW. For the same year, energy requirements will rise to 109.4 TW.h. The evidence indicates that, between 1990 and 2000, there will be little variation in the structure of NEPOOL's generating mix and that nearly 75 percent of NEPOOL's electricity will come from fossil or nuclear thermal sources.

The US witness noted that in its generation utilisation planning for the period covered by the firm energy contract, New England had allocated the 70 TW.h of energy from Hydro-Québec to supply its base load.

5.5 Offers to Canadian Utilities

To demonstrate that the electricity to be exported is surplus to Canadian requirements and that the price meets the second price test, Hydro-Québec, in accordance with established practice, offered the proposed export to Canadian utilities.

In a letter dated 2 July 1987 addressed to NB Power, St. Lawrence Power Company, Ontario Hydro and Churchill Falls (Labrador) Corporation Limited (CFLCo), Hydro-Québec offered these companies the electricity described in the firm energy contract with the NEU. The letters were accompanied by a copy of the contract. The offer was made under the same terms and conditions as those set out in the said contract. The Canadian utilities had already received a copy of Hydro-Québec's application pursuant to the Board's Order No. EH-1-87 issued 30 January 1987.

5.6 Price

5.6.1 Export Price and Revenue

The export price would be determined according to the provisions of section 6.1 of the contract, as explained in Chapter 4 of this report.

The prices obtained by applying the established formula correspond to 80 percent of the annual weighted NEPOOL fossil energy cost for the period 1990-95, 95 percent of the same cost for the period 1996-2000 and 97 percent for the period 2001-2004.

Hydro-Québec submitted the following estimates, based on its 1987-1989 Development Plan, showing annual revenues to be derived from the energy contract:

Table 5-2

Energy Contract with the New England Utilities Price and Revenue Forecast

Years	Quantities TW.h	Price¹ \$/MW.h	Income¹ Million \$
1990	2.3	26.8	61.7
1991	7.0	28.1	197.0
1992	7.0	29.0	203.2
1993	7.0	30.5	213.4
1994	7.0	32.0	224.3
1995	7.0	36.1	252.6
1996	7.0	43.4	304.0
1997	7.0	46.9	328.0
1998	7.0	50.1	350.4
1999	7.0	52.9	370.4
2000	4.7	56.0	263.2

1. Current Canadian dollars

5.6.2 Canadian Costs

The Applicant presented the results of a cost-recovery analysis and a social cost-benefit analysis¹ to demonstrate that the export would recover both its private costs and the social costs.

5.6.2.1 Cost-Recovery Analysis

Hydro-Québec did not provide the Board with detailed cost estimates corresponding to the advancement costs of individual facilities, preferring instead to provide annual overall advancement costs covering all the generating and transmitting facilities. Similarly, the Applicant did not provide the Board with a detailed account of the assumptions underlying its calculations of the opportunity cost².

Hydro-Québec argued that the disclosure of such information would be prejudicial to its negotiating position. However, in response to the Board's requests for additional information, the Applicant did provide some detailed cost estimates as well as the assumptions underlying the advancement costs and it explained, in a broad manner, using hypothetical figures, how the opportunity cost calculations were performed.

At the hearing, the Applicant's witnesses testified on the additional cost of an underwater crossing of the St. Lawrence River rather than the overhead crossing assumed in the cost estimates. Such an underwater crossing, estimated to cost \$120 million, is now required to be built in accordance with Decree no. 1807-87 of the Quebec government (Exhibit no. B-40). The advancement cost of \$4 million for the overhead crossing, included in the cost recovery analysis, would increase to \$13 million for such an underwater crossing. This would reduce Hydro-Québec's net benefit by \$9 million. Hydro-Québec stated that a temporary overhead crossing might be required to meet a 1990 effective date for the energy contract with the NEU. Such a crossing could also be required after 1992 as a back-up to supply Quebec requirements until the reliability of the underwater crossing was proven. In that instance, the temporary crossing would be needed for both domestic and export requirements after 1992 and only a portion of its cost would be attributable to the proposed export. The Applicant was unable to indicate when the final decision on the use of a temporary overhead crossing would be taken, since studies were still under way and the ultimate decision rested with the Quebec government. The Applicant estimated that the cost of the temporary overhead crossing for a 1990 in-service date would be \$32 million and that the dismantling cost would be \$16 million.

According to the evidence, the fuel prices assumed by Hydro-Quebec in calculating the contract revenues were generally lower than those of other public and private organizations that publish such forecasts. For this reason, as part of its sensitivity analysis, the Applicant included revenues and costs calculated from fuel price assumptions of Data Resources Inc. (DRI), a consulting firm with expertise in energy forecasting that provided forecasting services to the NEU.

¹ A social cost-benefit analysis is intended to present the benefits and costs of an export project from the perspective of the country as a whole.

² Opportunity cost, according to a definition provided by Hydro-Québec under Tab 2 of Exhibit B-4, reflects the value that Hydro-Québec estimates that it could obtain from existing markets for its surplus interruptible energy if it did not export the firm energy provided for in its contract with the NEU.

The results of Hydro-Québec's cost-recovery analysis, based on its own assumptions as well as on the fuel price assumptions of DRI, are shown in Table 5-3.

Table 5-3
Export to the New England Utilities
Cost-Recovery Analysis
(present value, millions of September 1990 \$)

	Hydro-Québec's Assumptions	DRI Fuel Price Assumptions
Gross Contract Revenues	1561	1930
Costs:		
(i) Additional Installation Cost ¹	632	632
(ii) Opportunity Cost	754	793
(iii) Crossing Adjustment ²	9	9
NET PRIVATE BENEFITS	166	496

-
1. This is the total cost of advancing the construction of the generating and transmitting facilities shown in Table 5-1.
 2. This adjustment accounts for the use of an underwater crossing of the St. Lawrence River rather than an overhead crossing.

Responding to questions at the hearing on the payback period, Hydro-Québec indicated that, overall, it expected to recover its costs toward the end of the contract period.

For a summary of the assumptions used in the cost-recovery analysis refer to Appendix V.

5.6.2.2 Social Cost-Benefit Analysis

The approach taken by the Applicant in the social cost-benefit analysis was to use the annual revenue and cost streams developed in the cost-recovery analysis described above and to apply adjustments wherever a difference between private and social costs could be identified and quantified. The results are summarized in Table 5-4. Using a social discount rate of six percent, the Applicant found that the proposed export would be expected to yield benefits to Canada in the order of \$406 million, discounted to September 1990.

As can be seen from Table 5-4, adjustments were made to account for differences between the private and social costs of labour, foreign exchange, and taxes. In addition, as discussed in the previous section, the Applicant's social cost-benefit analysis assumed an overhead crossing of the St. Lawrence River in the vicinity of Grondines. The Applicant testified that the social impact of an underwater crossing could be obtained by reducing its additional private cost of \$9 million (1990 dollars) by 20 percent.

Table 5-4

**Export to the New England Utilities
Cost-Benefit Analysis
(present value, millions of September 1990 \$)**

Social Discount Rate (Real)	6%	8%	10%
Net Private Benefits	166.0	(69.6)	(294.9)
Economic Adjustments:			
(i) Labour Externality	110.4	129.5	147.2
(ii) Social Value of foreign Exchange	75.4	68.4	62.5
(iii) Indirect Taxes	17.3	21.1	24.5
(iv) Taxes on Capital	34.9	39.3	43.3
(v) Crossing Adjustment*	2	2	2
NET SOCIAL BENEFITS TO CANADA	406.0	190.7*	(15.4)*

* The social impact of the underwater crossing of the St. Lawrence River was estimated to be equal to a benefit of 20 percent of the private cost adjustment. The Applicant provided the private adjustment at a six percent discount rate only (\$9 million). Thus the net benefits at eight percent and ten percent are slightly understated.

In the analysis, Hydro-Québec assumed that the firm energy contract with the NEU would have no impact on the exports of other Canadian utilities to the New-England market. Those utilities did not disagree with this assumption. Based on the conclusions of studies completed to date, the Applicant also assumed that interconnected Canadian utilities would suffer no technical impact as a result of the firm energy contract.

Because of uncertainties surrounding the social cost of capital the analysis was undertaken at discount rates of six, eight and ten percent. The Applicant performed a number of other sensitivity analyses to address the uncertainty surrounding some of the other assumptions as well. Hydro-Québec determined that in the majority of cases the conclusion that the contract would yield net benefits remained unchanged. The Applicant noted, in particular, that even if no adjustment were made for the social value of foreign exchange, the export would still yield net benefits to Canada of \$129 million¹ when discounted at eight percent to September 1990.

Hydro-Québec noted that there were additional non-quantifiable benefits associated with the contract including the lasting development of a new American market. The witness representing the NEU added that, in addition to the above benefits, the interconnection would provide operational benefits

¹ This value would be about \$122 million after adjusting for an underwater crossing of the St. Lawrence River.

such as reserve sharing and the provision of mutual aid during electricity shortages to both Hydro-Québec and New England, and would increase the ability of the parties to effect transactions under their existing energy banking agreement. However, these benefits were as yet not realized and consequently the construction of the line from Comerford to Sandy Pond could only be justified on the basis that the proposed export would occur.

5.6.3 Cost for equivalent service to Canadians

To demonstrate that the export price would not be less than the price to Canadians for equivalent service in related areas, Hydro-Québec offered the electricity described in the energy contract with the NEU to all directly interconnected Canadian utilities on the same terms and conditions, subject to possible adjustment to account for any relevant technical and economic factors.

None of the interconnected Canadian electrical utilities accepted the electricity offered on 2 July 1987 on the same terms and conditions, including price, as set out in the contract with the NEU.

The evidence revealed that, further to the offer, negotiations took place between the Applicant and two of the interconnected systems: NB Power and CFLCo, which was acting on behalf of Newfoundland and Labrador Hydro (NLH).

NB Power, in a letter dated 31 July 1987, indicated an interest in purchasing 35 TW.h of the energy offered during the delivery period described in the contract with the NEU on terms and conditions the utility believed to be equivalent to those set out in the said contract. In addition to an exchange of correspondence, the parties met on several occasions and finally negotiated an agreement with a view to executing a new contract (a copy of Appendix B of this draft contract was submitted as Exhibit B-38). Finally, in a letter dated 19 November 1987, NB Power indicated to Hydro-Québec that it was no longer interested in purchasing the energy described in the export contract with the NEU.

In a letter dated 30 July 1987, CFLCo expressed an interest in purchasing power and energy from Hydro-Québec in order to assist its parent company, NLH.

Then, in a second letter to Hydro-Québec, dated 14 August 1987, NLH clearly indicated that Newfoundland's electrical power requirements differed markedly from those of the NEU. Hydro-Québec made an attempt to meet Newfoundland's "different requirements" by suggesting a meeting to discuss a suitable product; however, CFLCo answered that the purpose of any meeting would be to discuss the 2 July 1987 offer. After an exchange of correspondence, telephone conversations and a meeting between the two parties, CFLCo indicated in a letter to Hydro-Québec dated 30 October 1987 that it was not interested in purchasing the energy under the terms and conditions proposed in the 2 July 1987 offer.

5.6.4 Alternative Costs in the United States Market Area

A witness from the NEU testified that, although the energy being purchased under the firm energy contract would displace fossil fuels in New England, the long-term least-cost alternative for the NEU would most likely be the construction of new base-load generating units. Also, since there was insufficient lead time to build new coal-fired plants, even before 1995, a more flexible option would be gas-fired combined-cycle plants. These, he stated, could generate electricity at a cost well below New England's marginal production cost.

The NEU witness testified that the interconnection with Hydro-Québec, which was justified on the basis of the firm energy contract, essentially provided the equivalent of 900 MW of capacity. In the final environmental impact statement on the proposed interconnection prepared by the United States Department of Energy (Exhibit A-7), this capacity benefit was valued at \$407 million (1990 US dollars). The NEU's own analysis, included in Exhibit B-4, showed that the contract could be expected to yield overall fuel savings to New England of about 28 percent compared to the least cost alternative. This was based on the assumption that no major new base-load generating units would be added to the New England system.

5.7 System Reliability

A witness for Hydro-Québec explained that because of the nature of Hydro-Québec's system, which is characterized by large generating units located long distances from the principal load-centres, the system cannot be interconnected in synchronism with neighbouring systems. Because of this, exports to neighbouring systems are made from isolated generating units which are connected directly to the purchasing systems, or require the use of direct current asynchronous links which overcome the problems associated with synchronous interconnections. These direct current links now total 2590 MW, and with the additional capacity associated with the proposed export, this would be increased to 3900 MW. However, studies carried out by member regions of the North American Electric Reliability Council (NERC) have established a limit of 2200 MW as the maximum quantity of power that could be exported by Hydro-Québec over these links to the Northeast Power Coordinating Council (NPCC) region which could be replaced by neighbouring systems in the event of a system-wide outage of Hydro-Québec.

When the application was first placed before the Board, Hydro-Québec and NEU had agreed upon a scheme of operation of the 2000 MW direct current interconnection which would overcome the constraint of the 2200 MW limit referred to above. This scheme, called a dynamic isolation scheme, provided for the connection of 2000 MW of generating capacity at LG 2 to a bus at Radisson substation which could, if there was danger of a widespread outage of Hydro-Québec's transmission system, be isolated automatically, and during the outage would continue to supply the NEU over the direct current line without interruption.

A Hydro-Québec witness testified that this dynamic isolation scheme had now been replaced by another scheme. Under this new scheme, when the proposed export was being supplied, generators at LG 2 would be isolated from the Hydro-Québec system and would feed directly to Sandy Pond in New England¹. Because this scheme would effectively isolate 2000 MW of exports from the system, it would allow Hydro-Québec to make full use of its 3900 MW of direct current links with neighbouring systems to carry out exports.

This isolation scheme would be the normal scheme of operation when supplying the proposed export. However, after 1992, when Hydro-Québec, during its peak, would require the generating capacity at LG 2 to feed the Quebec load, the isolated generators at LG 2 would be reintegrated into the Hydro-Québec system. This reintegration operation would necessitate an interruption of deliveries to the NEU

¹ This would be required during approximately 60 percent of the time at the maximum monthly delivery rate provided for under the firm energy contract.

during some two to four hours. After this operation took place, deliveries to New England would be limited to about 690 MW, via the Des Cantons substation.

The same witness confirmed that operation under this isolation scheme will result in greater overall reliability, but with a loss in flexibility for both Hydro-Québec and the NEU. It would not, however, impair Hydro-Québec's ability to deliver all the energy provided for under the firm energy contract to the NEU.

A witness from the NEU confirmed that this operating scheme would provide for simpler and more reliable operations and hence would be more acceptable to the NPCC. The witness stated that under this scheme there would be no need to install backup equipment, costing about \$20 million, otherwise needed to protect the New England system in the event of the failure of the dynamic isolation scheme.

Both these witnesses described a program of eight major studies involving not only the Canadian and U.S. members of NPCC, but also two adjoining NERC councils, East Central Area Reliability Coordination Agreement and the Mid Atlantic Area Council. The witness from Hydro-Québec was of the view that the studies, which are scheduled for completion in early 1988, would not develop results which would require significant investments in addition to those already known. This view was supported by the witness from the NEU.

The study program to date has led to a decision by the NEU to install a static VAR compensator in the 345 kV transmission line which links NB Power with NEPOOL.

The witness from the NEU also testified that the installation of the static VAR compensator would improve the dynamic system behaviour and take care of the Eel River Runback problem and that this solution¹ had been agreed to by NB Power. This was confirmed in a letter dated 19 November 1987 from NB Power to Hydro-Québec in which NB Power indicated that it was withdrawing its intervention because its technical concerns had been satisfactorily addressed.

Hydro-Québec strongly objected to suggestions that the Board condition the export licence so that Hydro-Québec would be required to comply with the directives of the NPCC, or so that interconnected Canadian utilities that might be adversely affected by the proposed export could seek redress before the Board. According to Hydro-Québec, it was already committed to the co-operative decision-making of the NPCC, and the imposition of such a condition would disrupt the equilibrium within the NPCC and would put Hydro-Québec at a disadvantage in dealing with other members. The witness from the NEU expressed his concern that a condition could affect the ability of the NEU to obtain project financing and could put the viability of the project at risk. Finally Hydro-Québec argued that if there were any adverse impacts on interconnected utilities, they could be dealt with under section 17 of the Act which allows the Board to change, alter or vary the conditions of an export licence.

¹ The Eel River Runback is a protection system installed by NB Power to maintain its 700 MW interconnection with NEPOOL in the event of a NEPOOL system-wide disturbance (operation of this protection system results in a 200 MW reduction in transfers of energy from Hydro-Québec to NB Power). The Eel River Runback problem is the unintended operation of this protection system that could occur as the result of an outage of the 2000 MW direct current interconnection between Hydro-Québec and the NEU (such an outage would not constitute a NEPOOL system-wide disturbance). Installation of the static VAR compensator would prevent the unintended operation of the protection system.

5.8 Environmental Effects

Hydro-Québec stated that it did not foresee any environmental impacts resulting directly from the export. To effectuate the export, the Applicant proposed to advance the construction of certain generation and transmission facilities; however, the required facilities would have been built in any case for domestic use.

The Applicant further stated that a percentage of the capital costs of new projects is dedicated to environmental protection, that proportion being one percent for transmission lines and two percent for generation facilities. Hydro-Québec expected that the incremental environmental impacts resulting from the advancement of facilities would be negligible. For that reason, no additional environmental costs were attributed to the export.

The Applicant indicated that it would not operate its thermal stations to produce energy for the export. In addition, the Gentilly 2 nuclear station would operate essentially as a base-load unit and its operation would not be affected by the export.

The evidence was that Hydro-Québec uses a dynamic optimization program to manage its hydraulic system in order to maximize its revenues. It was intended, when making the proposed exports, to operate the system in a manner which would respect the environmental criteria used in the existing optimization program.

The Applicant also proposed to modify certain facilities at the Des Cantons substation, necessitating a relocation in the take-off point of the ± 450 kV Des Cantons - NEPOOL international power line. The Applicant stated that it would file new plans, profiles and books of reference respecting these modifications.

Chapter 6

Interventions

Eleven organizations submitted interventions regarding the application. Short summaries of each submission are given below.

6.1 Churchill Falls (Labrador) Corporation Limited

CFLCo owns and operates the Churchill Falls hydroelectric generating station which is interconnected with the Hydro-Québec system as well as the NLH system. Most of the station's energy output is sold to Hydro-Québec under a long-term contract.

In response to an offer of the proposed export by Hydro-Québec, CFLCo stated that it was not interested in the energy offered on the same terms and conditions as proposed to the NEU under the firm energy contract. CFLCo was represented at the hearing and supported the intervention of NLH.

6.2 Manitoba Hydro

Manitoba Hydro stated that the offer mechanism was an effective means of determining whether the proposed export was surplus. In its view, modification of the terms and conditions of the offer was not an issue before the Board. Manitoba Hydro also stated that the Board should not concern itself with whether meaningful discussions had taken place on the possible supply of the electricity requirements of interconnected Canadian utilities by Hydro-Québec. Finally, it was Manitoba Hydro's view that the licence condition proposed by Ontario Hydro to address system reliability concerns was unwarranted.

6.3 Maritime Electric Company, Limited

The intervention of the Maritime Electric Company, Limited was withdrawn during the hearing. Maritime Electric submitted a letter of comment expressing its support for Hydro-Québec's export application as well as its view on the principles underlying export regulation and its concern regarding constraints on interprovincial sales resulting from American reliability concerns.

6.4 Newfoundland and Labrador Hydro

In its intervention, NLH stated that the Island of Newfoundland (the Island) had essentially developed all of its indigenous energy resources and faced growing dependence on thermal generation to meet its future energy needs.

NLH sought a long-term arrangement for both the supply of electricity from Hydro-Québec to meet its own requirements and the development of the hydroelectric resources in Labrador. For this reason CFLCo, on behalf of NLH, initially indicated a serious interest in the offer by Hydro-Québec of the proposed export to the NEU. However, it was NLH's position that no meaningful negotiations had taken place because Hydro-Québec had been unwilling to be flexible in amending the terms of the offer. Hydro-Québec therefore had not demonstrated that the proposed export was surplus and, for this reason, NLH requested that the application be denied at this time.

NLH's evidence included forecasts of the loads of the Island and of Labrador and of the purchases from Hydro-Québec needed to serve these loads throughout the requested licence period.

6.5 Nova Scotia Power Corporation

In its intervention, the Nova Scotia Power Corporation reserved the right to cross-examine the Applicant and to present final argument. The Corporation was represented at the hearing but did not participate.

6.6 Ontario Hydro

Ontario Hydro supported the application, but was concerned with the possible adverse effects of the proposed export on the operations of neighbouring systems. Because evidence on system operations was incomplete, Ontario Hydro suggested that the Board should condition the licence to allow a period of time during which neighbouring utilities could consider the adverse technical and economic effects of the proposed export. Ontario Hydro acknowledged that it had no evidence that there would be adverse effects on the neighbouring utilities but it was raising this issue on principle and because the Board had already stated in its Backgrounder to the hearing that this issue would be considered.

6.7 Attorney General of Newfoundland

The Attorney General of Newfoundland was represented at the hearing and supported NLH's position and arguments.

6.8 Minister of Energy for Ontario

In his intervention, the Minister of Energy for Ontario re-affirmed his view that the Board's existing first-offer requirement was necessary to ensure the protection of Canadian interests. The Minister did not present any evidence at the hearing.

6.9 Attorney General of Quebec

In his intervention, the Attorney General stated that Quebec was in favour of electricity exports which it deemed profitable for its economy, and further, that approval of Hydro-Québec's application would be beneficial to both Quebec and Canada. He stated that Hydro-Québec had complied with Board requirements by showing that the energy to be exported was surplus to Canadian needs and that the price to be charged was just and reasonable.

It was also the Attorney General's view that the licence condition suggested by Ontario Hydro should not be imposed because such a condition was unnecessary and would have a detrimental effect on the project financing.

6.10 Grand Council of the Crees (of Quebec) and the Chisasibi, Eastmain, Great Whale River, Mistassini, Nemaska, Waskaganish, Waswanipi and Wemindji Bands

In its intervention, the Grand Council of the Crees and the other Cree Bands of Quebec reserved its right to oppose the application, in whole or in part, and further stated its intention to participate at any future hearing involving Hydro-Québec's export application.

The Grand Council outlined its concerns respecting large-scale resource development in its territory, indicating that such development could have adverse effects on the natural environment and on the Cree way of life.

In conclusion, the Council requested that the Board note its position on hydro-electric development and further, that the Board consider the question of aboriginal rights in its deliberations on any applications for hydro-electric development in Québec.

6.11 New England Power Pool

NEPOOL stated that the purpose of its intervention was to register its concern over the potential for further delays in the scheduled in-service date of the Hydro-Québec Phase II project arising from the possible imposition of licence conditions concerning system reliability. It was NEPOOL's view that such conditions were unnecessary because of the NPCC's proven ability, and the resolve of its members, to work out flexible and effective solutions to problems of mutual concern. NEPOOL added that the imposition of such conditions would almost certainly delay financing of the US portion of the interconnection and could put the viability of the project at risk.

Chapter 7

Disposition

The Board has given careful consideration to all the evidence and submissions presented and has reached the following conclusions.

Application for Export (Part (a) of the application)

Section 83 of the Act requires the Board, in examining an application for an export licence, to have regard to all considerations that appear to it to be relevant. Without limiting the generality of the foregoing, the Board is required to satisfy itself that the power to be exported is surplus to reasonably foreseeable Canadian requirements and that the price to be charged by the Applicant is just and reasonable in relation to the public interest.

7.1 Surplus

7.1.1 Offers to Canadian Utilities

In determining whether a proposed export is surplus to Canadian requirements the Board relies on the offer mechanism. Only CFLCo, on behalf of NLH, and NB Power expressed an interest in Hydro-Québec's offer of the proposed export. NB Power and Hydro-Québec agreed to enter into a firm energy contract incorporating mutually agreeable terms and conditions. As a result, NB Power declined the offer and supported Hydro-Québec's application. Only CFLCo, on behalf of NLH, objected to the proposed export contending that it was not surplus to Canadian requirements because the Island did have unsatisfied needs during the period of the proposed export and in any event some of the exports could be used to displace thermal generation on the Island.

The Board has previously used offers to adjacent utilities as a mechanism to ensure that due allowance has been made for reasonably foreseeable Canadian requirements and to give such utilities the opportunity to purchase the power and energy which would otherwise be exported. In previous cases the evidence as to surplus provided by the offer mechanism was lacking but the Board recognized that a portion of the NLH load might in time constitute a reasonably foreseeable Canadian requirement which could be supplied by Hydro-Québec regardless of the proposed export. In this case an offer of the proposed export has been made to CFLCo, and CFLCo, on behalf of NLH, has stated that it did not wish to purchase the energy offered to it on the terms and conditions provided for under the firm energy contract. NLH tendered evidence which showed that its requirements involved, inter alia, a delivery schedule, annual quantities and energy prices which differed significantly from those provided for in the export contract.

The Board notes that there is no interconnection in place between Labrador and the Island, nor is one committed to be constructed, nor have the conditions been outlined which are needed to make this interconnection economically feasible. The evidence was that the capital cost of such an interconnection would be \$1.7 billion in 1991 dollars, equivalent to about 40 mills per kW.h assuming the interconnection was carrying some 6000 GW.h annually and amortizing the cost over a period of 20 to 30 years. The evidence also indicated that such an interconnection would not be economically

feasible if Hydro-Québec energy was available to the Island only during the period of the proposed export.

For these reasons the Board is not persuaded that, in its consideration of surplus, the NLH load is one for which allowance should be made before authorizing the proposed export. In addition, the Board considers that it would be unreasonable to continue to hold up the proposed export simply to provide more time for NLH to examine how the terms and conditions of the firm energy contract might be modified to meet its requirements when it is clear that those requirements could not be met under terms and conditions comparable to those embodied in that contract. The Board, therefore, has not included the NLH load as a reasonably foreseeable requirement for use in Canada which should be met by Hydro-Québec prior to supplying of the proposed export.

In its intervention, NLH also suggested that the Board should determine that "meaningful discussions" had taken place between Hydro-Québec and those Canadian utilities identified as having foreseeable requirements for power and energy, which could be supplied by the Applicant from its surplus, before the Board approved the application.

While the Board notes that the Applicant has stated its willingness to discuss how NLH's future electricity requirements could be met by Hydro-Québec, albeit in the context of an agreement unrelated to the firm energy contract with the NEU, the Board believes that it would be impractical to attempt to discern whether meaningful discussions have taken place between a Canadian exporting utility and another interconnected Canadian utility. Intercession by the Board could compromise the negotiating positions of one or both of the parties and could put at risk an export which might be beneficial to Canada. The Board believes that its role is to ensure that all interconnected Canadian utilities which can be considered as having reasonably foreseeable requirements for the electricity proposed to be exported have been given an opportunity to purchase that electricity on terms and conditions, including price, comparable to those offered the American customer. It is the Board's view that the use of the offer mechanism continues to be an effective means for the Board to carry out this responsibility.

7.1.2 Available Excess Energy

The Board notes that the excess energy figures submitted by Hydro-Québec, which are shown in Appendix IV, are those levels resulting from its development plan under average hydraulic conditions, normal system operations and a 2.7 percent average annual growth rate. The Board also notes that by the mid-1990s excess energy generated by facilities installed in the past to meet the in-province load will have been depleted, and consequently, energy to meet the proposed export will be derived from generating facilities whose in-service dates will have been advanced from the dates on which they otherwise would have been required to supply future in-province load.

7.1.3 Exports Under the Firm Energy Contract

Hydro-Québec has requested a licence to export up to 70 TW.h of firm energy over a period of up to 14 years commencing in 1990 under a firm energy contract with the NEU. The maximum annual quantity of energy that could be delivered under the requested licence would be 9 TW.h. Appendix IV shows that after meeting in-province loads plus all other firm commitments including the recent commitment for the supply of energy to NB Power, Hydro-Québec has sufficient excess energy to deliver up to 9 TW.h per year during any year up to the year 1996, and up to 7 TW.h per year during

any year to the year 1999. In addition, it is apparent that Hydro-Québec could make minor adjustments to its reservoir management program to meet the scheduled deliveries between the years 1996 and 2000 which could exceed the annual targeted quantities shown in Appendix IV.

Appendix IV also shows that Hydro-Québec plans to deliver the total 70 TW.h of firm energy to the NEU by the year 2000. In the event that this does not occur, Hydro-Québec could be required to deliver any outstanding balance during the extension years of the contract, between 2000 and 2004. Since Appendix IV indicates that no excess energy is present during this period, a minor adjustment to Hydro-Québec's development plans might be needed to provide the required energy in this eventuality. Accordingly, the Board would require, as a condition of the licence issued on 22 January 1988, that Hydro-Québec be required to submit for approval, prior to 1 September 1999, its plans for fulfilling any outstanding contractual commitments during the extension period.

Considering that, in this case, offers have been made and have not been accepted, and subject to the licence condition described above, the Board is satisfied that the proposed export of firm energy to the NEU will be surplus to reasonably foreseeable Canadian requirements.

7.2 Export Price

In assessing the suitability of an export price, the Board has developed three tests: the price should recover the applicable costs incurred in Canada, the price should not be less than the price for equivalent service to Canadian customers, and the price should not be materially less than the least cost alternative in the proposed market area.

7.2.1 Applicable Costs in Canada

In its calculation of revenues, Hydro-Québec adopted assumptions for fossil fuel prices in New England which are lower than those estimated by DRI. In this regard the Board notes that the gross revenues and net private benefits based on the fuel price assumptions of DRI are significantly higher than the same results based on Hydro-Québec's assumptions. The Board recognizes the risks implicit in long-term forecasts of international energy prices but concludes that it is unlikely that revenues will be any less and more likely that revenues will be greater than those estimated by the Applicant.

The Board notes that Hydro-Québec did not supply details of individual plant construction costs as evidence, relying instead on aggregated results. While this places the Board in the position of not being able to assess in detail the Applicant's analysis, an evaluation by the Board of the evidence on the derivation of the annual advancement costs provided by the Applicant leads the Board to conclude that Hydro-Québec's advancement cost estimates are reasonable.

Similarly, the Board was unable to obtain all the detailed assumptions used by Hydro-Québec to calculate the opportunity cost. However, the Board's own examination of the opportunity cost, based on the explanation of the general assumptions provided by the Applicant and on the absence of any evidence to the contrary, leads the Board to conclude that Hydro-Québec's estimate is reasonable.

With regard to the social cost-benefit analysis the Board does not agree with the Applicant's choice of a base case social discount rate of six percent. The Board is of the View that eight percent is more appropriate for the base case social discount rate. The Board notes, however, that the net benefits to Canada were analyzed at both rates. Furthermore, the Board is not convinced that the theoretical and

empirical problems associated with the social value of foreign exchange have been resolved to the extent that adjusting foreign exchange earnings to reflect a social premium is necessarily justified.

On the subject of impacts on other Canadian utilities, the Board notes that only Ontario Hydro expressed any concerns at the hearing. In fact, NB Power, which had raised the issue during the March 1987 hearing, expressed its belief in a letter to Hydro-Québec dated 19 November 1987 that their technical concerns were satisfactorily resolved. Ontario Hydro noted that while it had no information to contradict the Applicant's statements on third party costs and while the change in the operating scheme¹ reduced the likelihood of impacts, the evidence was not complete. That utility also noted that there are studies on system reliability that have not been completed and, consequently, have not been considered by neighbouring utilities. The Board has addressed Ontario Hydro's request for licence conditions elsewhere in this report (as discussed in section 7.3) and here only notes that if adverse impacts on interconnected Canadian utilities occurred they would represent an additional social cost of the contract with the NEU. The Board believes, however, that any reduction in the net benefits due to these possible adverse impacts would be minimal.

The Board notes that the analysis of contract benefits shows net benefits of \$122 million discounted at eight percent to 1990 when the foreign exchange credit is removed. The Board also notes that under the majority of the sensitivities the net social benefits are positive and would remain so, even if the total construction and dismantling cost of a possible temporary line over the St. Lawrence River was attributable to the proposed export.

In addition to the direct benefits resulting from the proposed export revenues, Hydro-Québec alluded to benefits which would come from future transactions over the expanded interconnection. While this may be true, those benefits were not quantified by the Applicant and the Board does not believe that such intangible benefits should be given a great deal of weight in the context of this application. Nonetheless, the Board believes that those benefits, which result indirectly from the firm energy contract between Hydro-Québec and the NEU, should be acknowledged.

The Board is satisfied that the export price will recover its appropriate share of the costs incurred in Canada.

7.2.2 Price for Equivalent Service to Canadians

The evidence shows that Hydro-Québec offered the proposed firm energy export to all directly interconnected Canadian utilities, none of whom ultimately accepted the offer. However, the Board notes that the offers were made on exactly the same terms and conditions as provided for under the export contract except that the price was to be adjusted, if necessary, to reflect the cost of facilities needed to deliver the energy to the border between Quebec and the adjacent Canadian provinces.

In the May 1987 decision, the Board stated that in order for subparagraph 6(2)z(ii) of the Regulations to have any sense, equivalent service must be read not as equal or identical service but as comparable or corresponding service - that is the two services being looked at must be of a comparable or corresponding quality from a physical and a technical point of view, and there must be no significant difference in net cost to the would-be exporter taking into account differences in costs of providing the

¹ See the discussion in section 5.7.

two services. The Board continues to hold this view and continues to disagree with Hydro-Québec's position that the offer must be on exactly the same terms and conditions as provided for under the export contract.

While NLH did express an interest in pursuing discussions with Hydro-Québec on ways in which the terms of the firm energy contract could be modified to meet Newfoundland's future electricity requirements, there was no direct interest in the offer of the firm energy on similar terms and conditions as in the export contract (except for the initial interest of NB Power, which was later withdrawn).

The evidence shows that NLH's requirement was for a contract in which the terms and conditions covering, inter alia, energy prices, delivery periods, annual quantities, would be substantially different than the terms and conditions provided for under the export contract. The evidence also suggests that the price that NLH would be prepared to pay for energy purchased from Hydro-Québec would be different than the export price considering the additional cost that would have to be borne by NLH to construct an interconnection between Labrador and the Island. For these reasons, it is the Board's view that NLH's electricity requirements do not meet the equivalent service criterion described above, that is, that NLH's electricity requirements are not comparable to the proposed export service.

On the other hand, it is also the Board's view that had an interconnected Canadian utility indicated a requirement for all or part of the energy proposed to be exported, under similar or comparable, although not identical, terms and conditions as provided for under the export contract, then such a requirement would have constituted an equivalent service, and evidence would have been needed to demonstrate that that requirement had been met.

Considering that, in this case, offers were made and were not accepted, the Board is satisfied that the export price will not be less than the price for equivalent service to Canadians.

7.2.3 Purchaser's Least Cost Alternative

While the energy being purchased by the NEU is likely to be largely used to displace fossil fuels, the Board notes that as an alternative, the NEU, following accepted utility practice, would have built new facilities which would have displaced high cost fuels by lower cost energy sources.

The Board also notes that under the pricing provisions of the firm energy contract Hydro-Québec is obtaining a price based on New England's fossil fuel costs indexed so as to track changes in such costs.

The NEU is crediting the firm energy purchase with a substantial amount of capacity. On the face of it this confers a large additional benefit to the purchaser. The Board notes, however, that in committing itself to the expanded interconnection, the NEU is forfeiting the opportunity to build plants of its own, choosing instead to invest in an interconnection which could, over the long term, provide additional benefits to Hydro-Québec.

On balance, the Board is satisfied that the export price under this agreement will not be materially less than the least cost alternative in the market area.

7.3 System Reliability and Licensing Conditions

The Board notes that the choice of an isolation scheme in which generating units serving New England would normally be completely isolated from the Hydro-Québec system rather than a dynamic isolation scheme, will result in greater overall reliability, albeit with some loss in flexibility. The Board also notes that the parties have agreed upon a solution to the Eel River Runback problem, which would consist of the installation of a static VAR compensator by the NEU. The Board believes that these operational and facilities changes will contribute to the overall system reliability and help to minimize the possibility of the proposed export resulting in adverse effects on neighbouring systems.

It was Ontario Hydro's view that because not all the studies have been finalized, the Board should condition the licence to allow a period of time during which neighbouring utilities could consider the adverse technical and economic effects of the proposed export. Three to six months was suggested as an appropriate period for parties to consider these effects.

Although not all the technical studies have been completed, any concerns raised in the studies that have been finalized have been resolved and no additional evidence was put forward in this proceeding to indicate that interconnected Canadian utilities would experience adverse effects from the proposed export. The Board notes that NB Power, the only utility that put forward any evidence during the previous proceeding that it might suffer adverse technical impacts, was not present during this hearing, and had indicated in a letter to Hydro-Québec that as a result of discussions with Hydro-Québec, NB Power's technical concerns had been satisfactorily addressed. The Board also notes that witnesses representing both Hydro-Québec and the NEU were of the view that the outstanding studies would not reveal results which would require significant investments in addition to the ones already identified.

For the above-noted reasons the Board believes that the likelihood that the results of the outstanding studies will indicate any significant adverse effects on interconnected Canadian utilities is small.

Although the evidence indicates that the eight major studies identified by the Applicant should deal with all the reliability impacts of the operation of the 2000 MW direct current interconnection, the Board is aware that technical studies are being conducted on an ongoing basis and such future studies could reveal previously unforeseen effects of system operations. The Board is also aware that it must base its decisions on the evidence before it at some point in time. In this case the Board believes that it cannot delay its decision simply because not all the studies have been finalized.

On balance the Board is satisfied that both Hydro-Québec and the NEU have demonstrated a willingness to work together within the framework of the NPCC to develop an interconnection and an operating system which will satisfy the concerns of all the members of the NPCC, including all the interconnected Canadian utilities. In the unlikely event that the concerns of an interconnected Canadian utility could not be resolved within the framework of the Reliability Council, it is open to that utility to seek redress by requesting a review pursuant to section 17 of the Act. Accordingly, the Board believes it is unnecessary to condition the licence that has been issued in the manner suggested by Ontario Hydro.

The Board would, however, condition that licence to require that the outstanding studies identified by the Applicant be filed with the Board when completed. This would enable the Board to be aware of any unforeseen developments related to system reliability.

7.4 Environmental Impact

The evidence shows that the only environmental impacts would be those associated with the domestic generation and transmission facilities. Those impacts would occur with or without the export, and their costs have been included in the estimated capital cost of the facilities. No significant impact would occur as a result of advancing the construction of the facilities. The evidence further shows that the energy for export would be produced by hydraulic facilities installed or to be installed to supply the Quebec load and that the operation of the system would be consistent with established environmental criteria.

The Board, therefore, is satisfied that no material environmental impact would result from the export of energy involved in this application.

Application for Licence Amendment and Approval of Changes to International Power Line (Parts (b) and (c) of the application)

With regard to Part (b) of the application, the Board would amend the existing interruptible licence EL-167 so that the licensing of the proposed export would not affect the quantity authorized under licence EL-167. With regard to Part (c) of the application, modifications at the Des Cantons substation will necessitate the filing of new plans, profiles and books of reference, which will be reviewed at that time. Apart from the routing considerations which will be subject to that review, the Board is satisfied that no material environmental impact would result from the proposed changes to the facilities internal to the Des Cantons substation.

7.5 The Board's Findings

The Board, having satisfied itself that the energy to be exported is surplus to reasonably foreseeable Canadian requirements and that the price to be charged is just and reasonable in relation to the public interest, and having had regard to all other considerations that appear to be relevant, on 22 January 1988 has issued to Hydro-Québec, subject to Governor in Council approval,¹ a licence authorizing the export of firm energy to the NEU of up to 70 TW.h from 1 September 1990 to 31 August 2004. Applicable terms and conditions are set out in Appendix VI.

In addition to the abovementioned licence, the Board is prepared to issue an amendment to the existing interruptible licence EL-167 so that the increased level of energy exports to NEPOOL that result from the export of firm energy to the NEU will not affect the quantity authorized under EL-167. Applicable terms and conditions are set out in Appendix VII.

Finally, in accordance with condition 10 of the Certificate of Public Convenience and Necessity No. EC-III-21, the Board hereby approves the changes to the facilities at the Des Cantons substation associated with the upgrading of the capacity of the international power line from 690 to 2000 MW.

The foregoing constitutes our Reasons for Decision and Decision in the matter of the present application of Hydro-Québec pursuant to Part VI of the *National Energy Board Act*.

¹ Approved by order in Council P.C. 1955-244 dated 11 February 1988.

J. Farmer
Presiding Member

A.B. Gilmour
Member

C. Senneville
Member

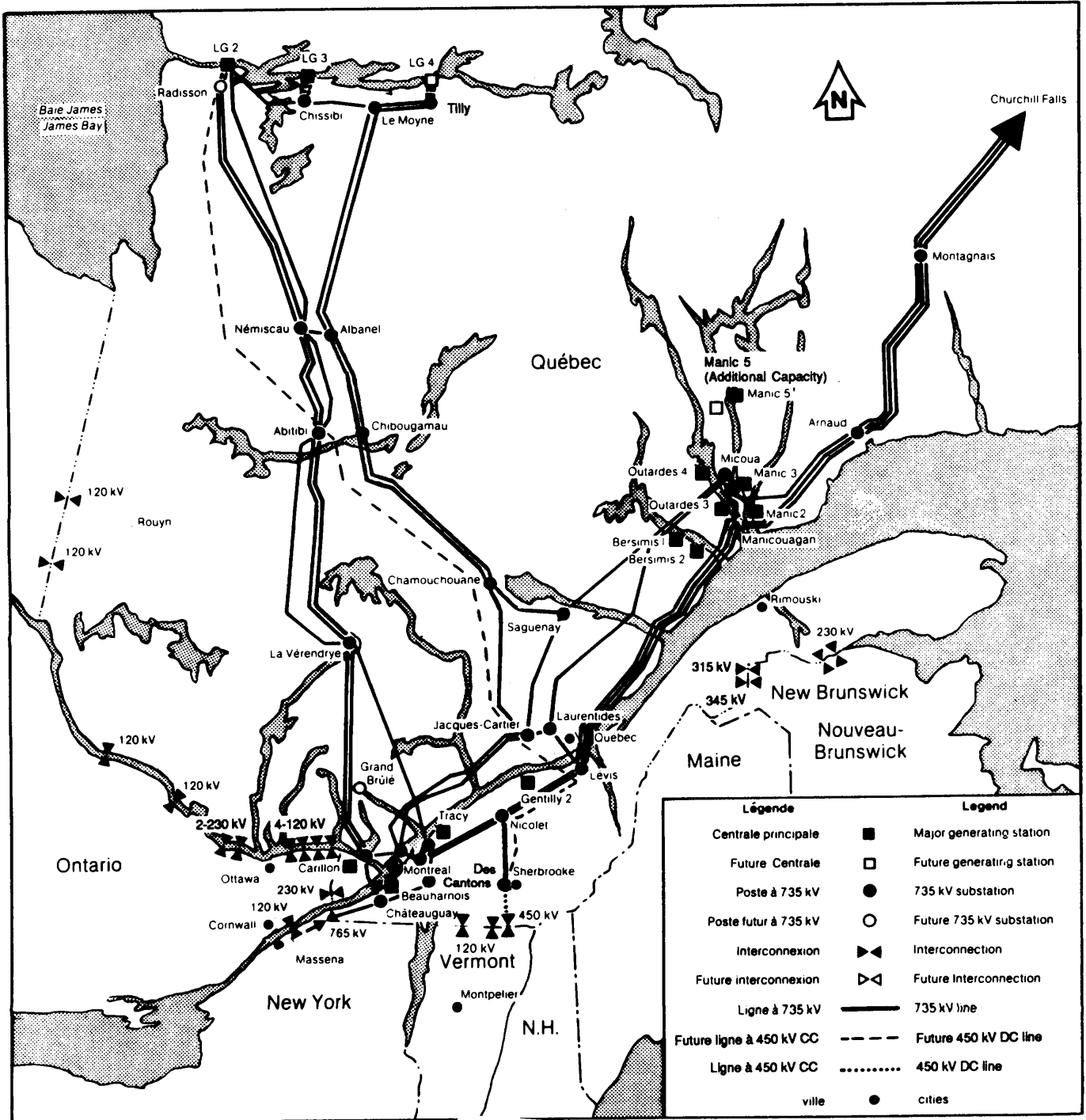
Ottawa Canada
February 1988

Appendix I

**Figure a1-1
Hydro-Québec
Systems Main Features in 1986**

Hydro-Québec
Les principales Installations en 1986

Hydro-Québec
Systems Main Features In 1986



Légende	Legend
Centrale principale	Major generating station
Future Centrale	Future generating station
Poste à 735 kV	735 kV substation
Poste futur à 735 kV	Future 735 kV substation
Interconnexion	Interconnection
Future interconnexion	Future Interconnection
Ligne à 735 kV	735 kV line
Future ligne à 450 kV CC	Future 450 kV DC line
Ligne à 450 kV CC	450 kV DC line
ville	cities

Appendix II

Licences Held by Hydro-Québec

New England States

Hydro-Québec has three licences for exports to the New England market over the ± 450 kV line with NEPOOL and over the lines to the State of Vermont. These three licences have been in force since September 1986.

Licence EL-165 authorizes the export of stored energy to NEPOOL, up to 3000 GW.h per consecutive 12-month period, from 1 September 1986 to 1 November 2004.

Licence EL-166 authorizes the export of interruptible energy according to the energy contract between Hydro-Québec and NEPOOL. This licence expires at the earlier of 31 August 2002 or the date on which the target quantity of contract energy, 33 TW.h, will have been offered and exported to, or rejected by, NEPOOL as provided by the contract.

Licence EL-167 authorizes interruptible exports to NEPOOL. The quantity of energy that may be exported during any consecutive 12-month period is 6920 GW.h, less any amounts of energy exported pursuant to any other licences authorizing exports over the international power lines linking the Hydro-Québec and NEPOOL systems. This licence expires on 31 August 1995.

States of Vermont, New York and New England

Hydro-Québec holds eleven other licences authorizing exports to the Vermont, New York and New England utilities.

Three licences authorize exports of firm power and energy and one authorizes interruptible exports to Vermont.

Five licences authorize firm or interruptible exports to the Power Authority of the State of New York and to the Niagara Mohawk Power Corporation.

Two licences allow export of short-term firm power and energy to utilities located in the New York and New England areas.

Appendix III

Table a3-1
Hydro-Québec
Generating Stations in Service as of 31 December 1986
Hydro-electric Stations

	MW
1. LG 2	5 328
2. LG 3	2 304
3. LG 4	2 650
4. Beauharnois	1 639
5. Manic 5	1 292
6. Manic 3	1 183
7. Manic 2	1 015
8. Bersimis 1	912
9. Outardes 3	756
10. Bersimis 2	655
11. Carillon	654
12. Outardes 4	632
Others (less than 500 MW)	3 706
Total hydro-electric	22 726
Thermal stations	
1. Gently 2 (nuclear)	685
2. Tracy (oil)	600
3. La Citière (gas)	201
4. Cadilla (gas)	162
5. Internal Combustion	10
Total thermal	1 749
Total of Generating Stations in service as of 31 December 1986	24 475

Appendix IV

Table a4-1
HYDRO-QUÉBEC
Capability, Load and Excess of Energy
(TW.h)

	1990*	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	0 0
1. Total Capability**	59.80	174.20	173.60	175.40	175.90	173.80	178.50	176.40	180.00	183.60	184.30	182.80	185.70	189000	. 29
2. Regular Load***	49.00	146.60	152.10	155.20	158.60	161.40	165.70	169.40	173.00	176.60	179.50	182.80	185.70	189000	. 29
3. Excess (without contract)	10.80	27.60	21.50	20.20	17.30	12.40	12.80	7.00	7.00	7.00	4.80	.00	.00	0	0
4. Firm energy contract - 70 TW.h	2.20	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	4.80	.00	.00	0	0
5. Excess (with contract)	8.60	20.60	14.50	13.20	10.30	5.40	5.80	.00	.00	.00	.00	.00	.00	0	0

* The quantities indicated are for the period from September to December only.

** Total capability required to meet the regular load and to take advantage of the available export market, taking into account:

- a) average streamflow conditions and normal system operation.
- b) nuclear base load generation at 80% annual capacity factor.
- c) thermal generation for isolated area only, and
- d) advancement of facilities as required to meet the requirements of the firm contract.

*** Includes the domestic load based on a 2.7% average annual growth rate scenario plus all other firm commitments.

Appendix V

Cost-Recovery Analysis - Assumptions

Hydro-Québec's cost-recovery analysis was based on one set of assumptions for inflation, exchange rate and discount rates and on two fossil fuel price forecasts: its own and one prepared by Data Resources Inc. (DEI)

A summary of the assumptions used in the analysis is shown below.

1. Economic Assumptions:

Inflation Rate	5.2% annually
Exchange Rate	\$1.39 to 1.30 Canadian = \$1.00 US
Discount Rate	11.5% annually

2. New England Fuel Price Forecast

(current \$ US/10⁶ BTU):

	1990		2000	
	<i>Hydro-Québec</i>	<i>DRI</i>	<i>Hydro-Québec</i>	<i>DRI</i>
Coal	1.34	3.04	3.09	3.42
No. 6 Fuel Oil	2.77	1.95	5.29	9.57

Appendix VI

LICENCE NO. EL-176

IN THE MATTER of an application by Hydro-Québec (hereinafter also referred to as "the Licensee") pursuant to the provisions of the *National Energy Board Act* (hereinafter referred to as "the Act") for a licence under Part VI thereof for the exportation of electricity, filed with the National Energy Board under File No. 1923-Q1-15.

WHEREAS an application dated 7 August 1987 has been made by the Licensee to the National Energy Board (hereinafter referred to as "the Board"), under Part VI of the Act for, *inter alia*, a licence for the exportation of firm energy at points on the international boundary line between Canada and the United States of America;

AND WHEREAS a public hearing has been held commencing on 1 December 1987, at which the Licensee and all interested parties have been heard;

AND WHEREAS the Board, having taken into account all such matters as to it appear to be relevant, has satisfied itself that the firm energy to be exported does not exceed the surplus remaining after due allowance has been made for the reasonably foreseeable requirements for use in Canada and that the price to be charged by the Licensee for the firm energy to be exported by it is just and reasonable in relation to the public interest;

NOW THEREFORE, the Board, pursuant to section 82 of the Act, and subject to the conditions hereof, hereby issues this licence to Hydro-Québec for the exportation, as a sale transfer, of firm energy at points on the international boundary line between Canada and the United States of America.

THIS LICENCE is subject to the following terms and conditions:

1. The term of this licence
 - a) shall commence on the later of
 - (i) 1 September 1990, or
 - (ii) the in-service date of Phase II of the ± 450 kV direct current international power line authorized pursuant to Certificate of Public Convenience and Necessity No. EC-III-21; and
 - b) shall end on the earlier of
 - (i) 31 August 2004, or

- (ii) the termination date of the firm energy contract referred to in Condition 3 hereafter.
2. The class of inter-utility export transfer authorized hereunder is the sale transfer of firm energy.
 3. The energy to be exported shall be that described in the firm energy contract between the Licensee and the New England Utilities dated 14 October 1985, hereinafter referred to as "the firm energy contract".
 4. Any amendment or addition to, or termination or substitution of, the firm energy contract shall not be effective until approved by the Board.
 5. The energy to be exported hereunder shall be transmitted over the international power line for which the Board has issued Certificate of Public Convenience and Necessity No. EC-III-21 and over any other international power line authorized by the Board.
 6. The quantity of energy that may be exported hereunder throughout the term of the licence shall not exceed 70 TW.h subject to the provisions of the firm energy contract.
 7. The quantity of energy that may be exported hereunder in any contract year, from 1 September to 31 August, shall not exceed 9 TW.h.
 8. The price to be charged by the Licensee for exports made hereunder shall not be less than the prices defined in Section 6.1 of the firm energy contract.
 9. Prior to 1 September of each year, the Licensee shall inform the Board of the monthly delivery schedule established for the contract year commencing on the same date.
 10. By 1 September 1999 at the latest, the Licensee shall
 - a) indicate to the Board whether the duration of this licence will be extended beyond 31 August 2000; and
 - b) in the event where the term is extended beyond 31 August 2000,
 - (i) indicate to the Board the annual quantities of energy that will be delivered during the extension period,
 - (ii) submit for approval by the Board a plan to demonstrate how it will comply with the provisions of the firm energy contract during the same period, including a monthly statement of its supply, load and surplus of power and energy, and
 - (iii) indicate to the Board whether the plan referred to in sub-condition (ii) will require the advancement of new facilities and, if so, indicate the costs for advancing such facilities.
 11. The Licensee shall file with the Board a copy of the reliability studies related to the operation of the NEPOOL Phase II interconnection as listed in Appendix I of this licence, upon completion of those studies.

12. The Licensee shall, within 15 days after the end of each month during the term of this licence, file with the Board a report in such form and detail as the Board may specify, pertaining to transactions under the licence in that month.

ISSUED in the City of Ottawa, in the Province of Ontario, this 22nd day of January 1988.

National Energy Board

J.S. Klenavic
Secretary

RELIABILITY STUDIES RELATED TO THE OPERATION OF THE NEPOOL PHASE II INTERCONNECTION

Title

1. Analysis of the Interaction of Hydro-Québec HVDC Interconnections (1990 System).
2. MEN Future Study
(Part 2 only).
3. Overall Reliability Review of Final Plan.
4. NEPOOL/NBEPC Stability Study.

Source:

Hydro-Québec's written evidence filed as Exhibit B-31-C to Order EH-3-87.

Appendix VII

ORDER NO. AO-2-EL-167

IN THE MATTER OF the *National Energy Board Act* and the Regulations thereunder; and

IN THE MATTER OF an application by Hydro-Québec pursuant to the provisions of the *National Energy Board Act* for a licence under Part VI thereof for the exportation of electricity, filed with the National Energy Board under File No. 1923-Q1-15.

WHEREAS the National Energy Board has issued to Hydro-Québec, on 10 August 1984, Licence No. EL-I67 for the exportation of interruptible power and energy at points on the international boundary between Canada and the United States of America;

AND WHEREAS in its application of 7 August 1987, Hydro-Québec has requested, inter alia, an amendment to Licence No. EL-I67 in order to take into account the new export of electricity to be transmitted over the international power line authorized by Certificate of Public Convenience and Necessity No. EC-III-21;

AND WHEREAS a public hearing has been held to consider the 7 August 1987 application which hearing terminated on 4 December 1987;

AND WHEREAS the proposed amendment will not cause the total quantities of power and energy authorized for export under Licence No. EL-167 to increase;

AND WHEREAS no party at the hearing of the 7 August 1987 application objected to the amendment of Licence No. EL-167;

AND WHEREAS the National Energy Board believes it will be consistent with the public interest to grant this application;

AND WHEREAS the National Energy Board has revised Conditions 4 and 5 of Licence No. EL-167 in order to define clearly the quantities of power and energy to be exported;

IT IS ORDERED THAT Licence No. EL-167 be amended by revoking Conditions 4 and 5 and substituting therefor the following:

- “4. The quantity of power that may be exported hereunder shall not exceed 790 MW less any amount of power exported pursuant to any other licences, except for Licence No. EL-176, under which the power is transmitted over the international power lines referred to in Condition 3 hereof.
5. The quantity of energy that may be exported hereunder shall not exceed 6 920 GW.h in any consecutive 12 month period throughout the term of the licence less any amounts of energy exported pursuant to any other licences, except for Licence No. EL-I76, under which energy is transmitted over the international power lines referred to in Condition 3 hereof.”

National Energy Board

J.S. Klenavic
Secretary