Hydro-Québec Distribution

Supply Plan
Demande R-3550-2004

Before the
Régie de l'énergie du Québec

Evidence of Ron Mikkelsen
Expert witness in energy markets

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On behalf of the
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Section I- Introduction

Evaluation of the First Plan and the Impact of Different Demand Scenarios

In the first supply plan, HQD said it would rely, for 2002-2005, almost exclusively on Patrimonial energy. Under the medium planning scenario, total energy needs would exceed that available from the patrimonial contracts in the years 2006-2007. The need was exacerbated with the signing of Alouette, adding to the need for energy beginning in 2006 in the amount of 500 MW and 4.25 TWh per year.[1] Within the plan, HQD forecast 0.4 TWh of demand reduction due to new energy efficiency programs.

Therefore, for the period 2002-2011, the need in excess of patrimonial energy was forecast as shown in table 1. This projection was based on the medium forecast scenario. The HQD strategy proposed to meet that demand by the following options:[2]

Table 1
Energy and power need for 2002-2011

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Energy (TWh)				0.5	2.4	4.1	6.4	7.5	9.2	10.8
Power (MW)				210	420	600	800	1030	1260	1480

Source : D-2002-169, page 30

- Short-term bids for 2005, as there was not enough time to initiate long-term contracts before 2006;
- Long-term firm and cyclable contracts for 2006 and 2007 for 600 MW;
- In the fall of 2002, commitment to 250 MW of long-term firm, and 50 MW of modulable service for 2008;
- In 2003, commitment to 150 MW of long-term firm for 2009; and
- For Alouette, 500 MW of long-term firm and 100 MW of cyclable

HQD also proposed a strategy to acquire sufficient energy in the case of a strong demand scenario. It proposed:[3]

- 5 TWh from the short-term market;

[1] D-2002-169, Page 11.

[2] D-2002-169, Page 31-32.

[3] D-2002-169, Page 32.

- 3 TWh (400 MW) from modulable services; and
- Accelerate output from some contracted facilities.

This plan was approved by the Régie de l'énergie in Decision D-2002-169.

We can now analyze the results of the first supply plan. First, the demand is stronger than estimated under the medium scenario and HQD needs to turn to the strong demand strategy. Second, HQD launched its first long-term bids and some contracts are now signed, but energy and power delivery will not take place before 2006. Third, HQD signed their first short-term energy contracts. Finally, political influence was very important in the selection of the kind of electricity production. Only the first call for tender was open to all forms of electricity production; all the others were open to only one kind of production, such as wind, biomass or cogeneration.

What is the present situation? During the last 3 years, HQD signed (or is in the process of signing) many long-term contracts for different forms of electricity production such as:

- Large Hydro plant (existing facilities);
- Cogeneration with natural gas, low and high degree of steam utilisation;
- Wind energy farm; and
- Biomass plant.

HQD signed, or is supposed to sign shortly, a load balancing service related to energy produced from the first wind farm call for tenders. This service could include some elements of a cyclable service. This would surely be provided from a large hydro facility with reservoir storage, and therefore it would likely be an agreement between HQP and HQD and not an open call for tender.

Finally, HQD has already signed two short-term contracts for the year 2005 and HQD plans to use more short-term contracts for 2005 and 2006 with lesser reliance on such contracts in 2007 and after.

Future needs, as identified in the current (second) supply plan are summarized in Table 2:

Table 2
Under HQD's medium scenario (TWh)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Need vised by the plan	182,2	186,3	188,5	191,1	192,3	193,7	194,7	196,6	197,3	198,6
Patrimonial energy including lost (-)	178,9	178,9	178,9	178,9	178,9	178,9	178,9	178,9	178,9	178,9
Reel time supply admistration (+)	0,5	0,5	0,5	0,5	0,3	0,3	0,3	0,3	0,3	0,3
Additionnal supply on top of patrimonial energy	**3,8**	**7,9**	**10,1**	**12,7**	**13,7**	**15,1**	**16,1**	**18**	**18,7**	**20**
TransCanada Energy (-)		1,4	4,1	4,1	4,1	4,1	4,1	4,1	4,1	4,1
HQP-Base (-)			2,6	3,1	3,1	3,1	3,1	3,1	3,1	3,1
HQP-Cyclable (-)			0,9	1,1	1,1	1,1	1,1	1,1	1,1	1,1
Short term contract already signed (-)	3									
Biomasse (-)		0,1	0,3	0,3	0,3	0,3	0,3	0,3	0,3	0,3
Wind farm (-)		0,1	0,7	1,2	1,5	1,9	2,3	2,8	3,2	3,2
Cogen on call for tenders (-)				0,1	1,7	2,8	2,8	2,8	2,8	2,8
Additionnal supply required	**0,8**	**6,4**	**1,6**	**2,9**	**2**	**1,9**	**2,7**	**4,3**	**4,3**	**5,6**
Short term contract	*0,8*	*6,4*	*1,6*	*2,9*	*0,3*	*0,3*	*0,3*	*0,3*	*0,3*	*0,3*
Long term contract					1,7	1,6	2,4	4	4	5,3

Note 1 : Cyclable with 50 % of utilisation factor.
Note 2 : Wind farm with uniforme balancing services.

This table shows that HQD will need to place significant reliance on the short-term energy market for the next few years. For 2006, the need will exceed 5 TWh, which was supposed to be the maximum reasonable exposure to the short-term market. Why is HQD exceeding its recommended exposure to short-term markets?

Mainly, there are two reasons. HQD is facing a higher level of demand, roughly equivalent to a mid-high level scenario. This higher demand can be seen in Table 2B.

Table 2b
Forecast of regular sales in Québec at medium scenario (TWh)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
2001 forecast	154,6	156,7	160,2	163,8	165,5	167,2	168,8	170,8	171,7	173,2	174,6			
2004 forecast				164	169,3	173,1	175,3	177,7	178,8	180,1	181,2	182,9	183,6	184,8

Source : R-3470-2001, HQD-2, document 1, page 11 de 28; R-3550-2004, HQD-2, document 1, page 18 de 55.

This would not be a problem if HQD had all the tools that were approved in the first supply plan. In fact, two of them are not available. The fact that modulable service is not already available, as approved, constitutes one reason for heavier reliance on the short-term market. One other tool that may have been available to HQD is accelerating delivery from long-term contracts. This does not seem to be possible for now nor is it planned.

Table 3, below, demonstrates the supply demand balance if the modulable service had been available to offset short-term market purchases.

Table 3
Under HQD's medium scenario with modulable service (TWh)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Need vised by the plan	182,2	186,3	188,5	191,1	192,3	193,7	194,7	196,6	197,3	198,6
Patrimonial energy including lost (-)	178,9	178,9	178,9	178,9	178,9	178,9	178,9	178,9	178,9	178,9
Reel time supply admistration (+)	0,5	0,5	0,5	0,5	0,3	0,3	0,3	0,3	0,3	0,3
Additionnal supply on top of patrimonial energy	**3,8**	**7,9**	**10,1**	**12,7**	**13,7**	**15,1**	**16,1**	**18**	**18,7**	**20**
TransCanada Energy (-)		1,4	4,1	4,1	4,1	4,1	4,1	4,1	4,1	4,1
HQP-Base (-)			2,6	3,1	3,1	3,1	3,1	3,1	3,1	3,1
HQP-Cyclable (-)			0,9	1,1	1,1	1,1	1,1	1,1	1,1	1,1
Modulable services	3	3	1,6	2,9	0,3	0,3	0,3	0,3	0,3	0,3
Biomasse (-)		0,1	0,3	0,3	0,3	0,3	0,3	0,3	0,3	0,3
Wind farm (-)		0,1	0,7	1,2	1,5	1,9	2,3	2,8	3,2	3,2
Cogen on call for tenders (-)				0,1	1,7	2,8	2,8	2,8	2,8	2,8
Additionnal supply required	**0,8**	**3,4**	**0**	**0**	**2**	**1,9**	**2,7**	**4,3**	**4,3**	**5,6**
Short term contract	*0,8*	*3,4*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Long term contract					1,7	1,6	2,4	4	4	5,3

Note 1 : Cyclable with 50 % of utilisation factor.
Note 2 : Wind farm with uniforme balancing services.
Note 3 : Modulable services offer a maximum possibility of 3 TWh

From Table 3, we can see that if the modulable service had been available as planned it would be enough to assure that HQD short-term market exposure was less than 5 TWh.

This analysis invites us to discuss what would be the best strategy for HQD in the future. Is it better to follow the actual strategy which is almost the same as in 2002 or could a new strategy be better?

In order to do that, we have to present the situation with the modulable service under two demand scenarios, a strong and a low.

What Did We Learn During the Suroît Case?

One significant lesson was learned in the Suroît case. It is possible to have uncertainty with the reliability of supply from some contracts, in that case, with the Patrimonial energy contract. In the months following that case, the uncertainty was resolved due to a spectacular turnaround in water storage levels. However, HQP used the interconnections to buy energy from outside Québec to assure its capability to deliver Patrimonial energy before this spectacular turnaround.

This gives us a real example that it is possible for a producer (it can be another producer that has a problem with its generating facility) to need the use of interconnections to deliver on its contracts with HQD.

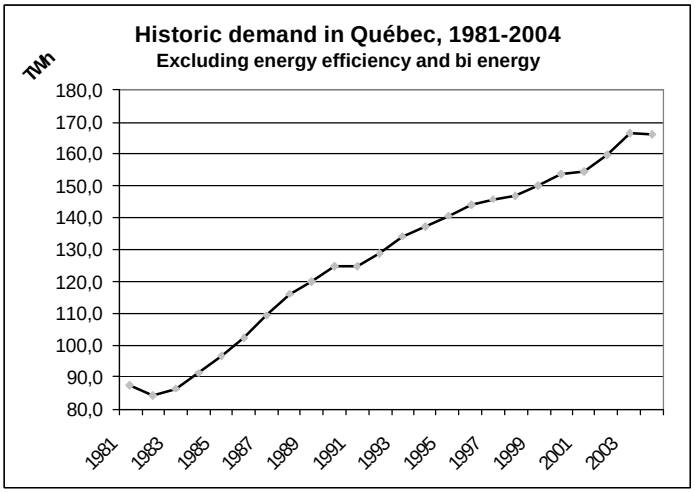
Imbalance Agreement Between HQD and HQP

HQD was supposed to sign this agreement a few years ago. HQD says, in this case, stated that it will sign this agreement very shortly. We have now learned that this agreement has been signed and review of this agreement is proposed to form a separate proceeding before the Régie de l'énergie.

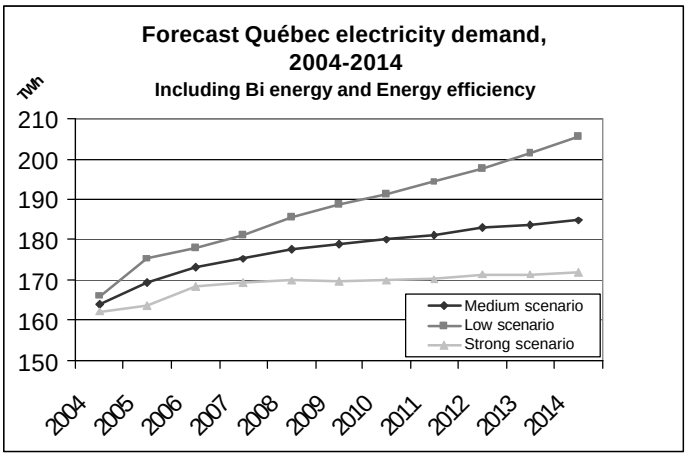
How will this agreement impact the supply strategy of HQD, particularly the short-term strategy, the optimisation of the Patrimonial energy and the need for cyclable capacity?

Do We Need More Energy?

During the last 23 years, Québec electricity demand has been constantly growing, except during two periods, 1981-1983 and 1991-1993. During these two periods, the economy was in recession.



But as we can see in the graph above, the electric demand in Québec was reduced by only a small amount during these recessions. In 1982, the demand reduction was around 3.8% and for 1991, around 0.25%.



We can also see that the growth trend was reduced in the short-term, but in the medium term, the situation was the same as if there had not been an economic recession. In fact, after one or two years, the electricity demand was higher than before the crisis. So, we can conclude that the demand for electricity would be affected by economic growth, but, except if the economic recession is very long, the impact of a reduction in demand would be short lived.

What does the future demand look like?

We can conclude, from the graph of forecast demand, that under all scenarios the growth in electricity demand in Québec will continue for almost all years. For the medium and strong scenarios, the average electricity demand in Québec will grow every year by around 2-4 TWh, or around 250-550 MW.

We can conclude that for the next 10 years, Québec will need more electricity to meet the internal demand. There are only two major elements that could greatly modify this conclusion. The first one is a significant economic depression. This situation, as we show above, creates a short-term impact in Québec electricity demand that disappears in the short-medium term (1 to 2 years). The second element that could drastically modify the demand is an important technology change, such as a commercialisation of fuel cells. But this kind of scenario would produce such a fundamental impact that all sectors would be affected. We can not prepare for this situation now.

We conclude that HQD will need on average an additional 2 TWh of electricity per year to meet increasing demand, some years double this amount, some other years nothing. HQD's supply plan has to deal with these potential situations.

Section II–Competitive Market Dynamics

Introduction

In Quebec, electricity is no longer provided within the context of a vertically integrated utility. Functional separation has split the generation assets of HQP, the transmission assets of TransÉnergie and the distribution wires of HQD.

While the Quebec industry is no longer vertically integrated, it is not an open competitive market for energy supply. Legislation requires HQD to procure new energy supplies on a competitive basis, introducing some competitive elements into energy production. For the foreseeable future, HQD will remain the dominant purchaser of energy from new suppliers. The only other customers who can actually purchase their own supply electricity are the 10 municipal and coop networks. Because the L tariff is available to them, they would have no interest to buy electricity from a party other than HQD.

The fundamental difference between a de-integrated industry and an open market structure is accountability for assuring sufficient resources to provide for future power demand. In an open market structure, no entity maintains explicit accountability for ensuring sufficient resources are available to provide capacity and energy to meet forecast needs. Alternatively, a market structure is put in place where the interaction of supply and demand provides a price signal to which both suppliers and consumers are anticipated to respond. Ultimately, the reliability provided is that which the market finds to be economically rational. Under the current structure, there is no open market in Québec and we don't expect one in the short term.

There have been separate proceedings to discuss generation resource adequacy in a provincial context, such as the Suroît case (R3526-2004) followed by the ongoing Commission parlementaire sur l'avenir énergétique du Québec. Those debates largely discuss the sufficiency of electricity supply in Québec to meet the demand.

HQD sees its role as one of assuring sufficient generation resources are available to provide capacity and energy to the load served by HQD[4]. At the same time, it is apparently satisfied that sufficient resources are available to meet demand if it relies on 6.4 TWh of purchases from interconnected regions. The question of whether to reduce reliance on short tem purchases to levels lower than 6.4 TWh would then appear to be a question of price rather than reliability of supply.

Market Structure - Physical vs. Financial

HQD has recently signed a load balancing contract with HQP related to supplying short term variances between forecast and actual load. To understand the nature of this

[4] HQD-5, document 4, page 8 de 22 : « (...) Le distributeur doit s'assurer d'équilibrer l'offre et la demande d'électricité pour chacune des heures de l'année. (...) »

agreement and alternative agreement structures that may be possible to deal with load and supply variance from scheduled or forecast values, it is useful to first describe the distinction between physical and financial transactions.

A simple physical or bilateral transaction would be a 100 MW load contracting with a 100 MW generator to supply energy to the load,[5] facilitated by the transmission system. The generator produces the energy, it is transported to and consumed by the load and the load pays the generator for the agreed amount of energy. In reality, neither the generation nor the load will equal exactly 100 MW in every hour, therefore arrangements have to be made by one or both of the parties, likely with third parties, to either provide energy equal to the amount the load consumes in excess of that generated or to purchase/consume the amount generated in excess of the load's consumption. In HQD's case, any generation in excess of load (if provided from the Patrimonial energy) is forfeited to HQP. Any shortfall may be purchased from HQP under the imbalance contract. Such arrangements are "physical" arrangements in that they are structured around the notion that the energy produced is physically transported to and consumed by the load.

The Alberta market structure (and other pool-based markets) are built around a different construct; a financial construct. As a default, all generators sell their energy to a "pool" and are paid the market clearing price established for every settlement period. All loads purchased from the "pool" and energy is purchased at the market clearing price. The market clearing price is established by the market operator at the intersection between supply offers and demand bids. The market clearing price can exhibit extreme volatility, therefore parties may wish to contract "around" this price. An external financial transaction between two parties substitutes a negotiated price for the volatile market clearing price although this is usually the case for only a defined quantity of energy with imbalances prices at the hourly market price. Under the financial construct, any party can make arrangements to "sell" energy to a load because "selling" energy is merely a financial transaction. For example, a financial institution can offer to sell energy (in effect guarantee the price of energy) to a load without generating the energy. The institution (absent offsetting transactions) receives a fixed price from the load and pays for the energy at the floating market price effectively transferring the price risk to the financial institution. Any differences between agreed quantities and actual production or consumption are usually settled at the market price.

Physical contracts require provision to deal with circumstances where either all generation output cannot be purchased or the contract specified quantities cannot be delivered. If excess production can be sold at a market price and shortfalls can be purchased at a market price then the physical contract looks very much like a financial contract.

It is interesting to note that, under certain circumstances, there will effectively be a financial transaction between HQP and HQD. Consider an hour when HQP schedules exports to a neighbouring jurisdiction, like NYISO. If, in the same hour, HQD is importing from NYISO, the flow on an interconnection can only take place in one direction, therefore the export and import are "netted" at the point of interconnection. If the export and import are the same quantity, no physical flow will take place, but both parties will be treated financially as if their transaction had been completed. HQP

[5] To simplify the example, it is assumed that transmission losses are provided by the transmission provider and charged through the transmission tariff.

will sell to the NYISO market at the market price and HQD will buy at the NYISO market price. Effectively, HQP has sold to HQD at the NYISO market price (and both parties would have paid for transmission to and from New York).

Under the conditions described above, the opportunity cost of both HQD and HQP is represented by the NYISO price. As long as there is transmission capacity available each party has the

The relevance of the physical vs. financial distinction to HQD lies in understanding the nature of the load balancing contract. In high demand hours the load balancing contract reflects market prices – effectively mimicking a financial contract. In lower demand hours the contract is structured as a physical contract. The reason for two separate structures is not apparent as the opportunity costs would not appear to differ between high and low demand hours.

Regardless of how many hours the contract reflects market prices, the fact that HQD has exposure to market prices suggests that HQD should have some view as to the potential risks and benefits of being exposed to market prices as either a buyer or a seller.

Price-Responsive Load

The open-market structures all maintain a real-time price of electricity. The real time price provides not only the long-term investment signal but also short-term signals that may indicate (1) inordinately high demand (perhaps due to unusual weather), (2) supply problems (perhaps due to generator outages) or (3) high prices due to supply or demand problems in adjacent markets. Regardless of the cause, high prices can signal to loads the value of power in the short-term and over time loads may alter their consumption patterns as a way of managing their cost of power. Thus, with a real time price signal, demand may become more dynamic with load decreasing in times of high prices and possibly increasing in times of low prices. We would observe this effect is self-selecting, unlike load curtailment programs that are mainly structured around curtailable load providing capacity in relatively few hours.

If HQD were to contract with HQP for short term imbalances based on market driven indices, it would be possible to develop rate structures around the indices that give price signals to customers. This would permit customers to make consumption decisions that reflected real-time economics and assist in reducing peak demand energy requirements.

Imports and Exports

Where separately coordinated markets operate adjacent to each other and interconnection capability joins the markets, there will exist opportunities to arbitrage the prices between the two markets. In Alberta, the Pool Price can be arbitraged against the open market in the US Pacific Northwest by parties purchasing transmission capability between the two markets and scheduling imports or exports between the two. Between these two open access markets, lies British Columbia. There is no open market in BC, but BC Hydro can arbitrage its own resources against both the US and Alberta markets. There is no real-time market price in BC, but BC Hydro operates as if there were, through its marketing subsidiary Powerex, which is a major importer to and exporter from Alberta. On a daily basis, Powerex exports low-

cost energy to BC at night and imports the energy back to Alberta during higher price periods.

Quebec is in a unique position as it is interconnected to numerous regions that operate in an open market structure for electric power. Using a strategy similar to that employed by BC Hydro for HQD can create the possibility to reduce the total cost of energy supply. To employ such a strategy, HQD would need to use the energy coming from sources outside of the Patrimonial energy, as the Patrimonial energy cannot be exported. However, because of the flexibility the Patrimonial contract gives to HQD (reconciling the "sticks" to various hours at the end of the year) HQD has a unique tool to arbitrage its resources against the market. To facilitate such arbitrage, HQD will need to have an active management of the electricity supply, and not a passive one. Continuing the comparison with BC Hydro, HQD would have to use a marketing subsidiary or to create that role within its own resources.

What type of arbitrage could be undertaken? The following presents one example. In the summer time on a hot day, the cost of power on the short-term market during the day is very high and HQD is obtaining its electricity from two sources: HQP for the Patrimonial energy and TCE from a long-term firm contract.

- The patrimonial energy is flexible as the 8760 different sticks are matched on the basis of net demand in an hour;
- The electricity from TCE is constant at 507 MW (4.1 TWh/8760 hours);
- The usage in the day is 22 500 MW;
- The usage in the night is 17 500 MW.

In that situation, HQD his planning to use its supplies as follows:

- Each hour of the day: TCE for 507 MW and a stick of 21 993 MW;
- Each hour of the night: TCE for 507 MW and a stick of 16 993 MW.

However, HQD can change its supply as follows:

- Each hour of the day: TCE for 407 MW, a stick of 22 193 MW and selling on the short-term market 100 MW of the TCE contract;
- Each hour of the night: TCE for 507 MW, the short-term market for 100 MW and a stick of 16 893 MW.

The example demonstrates resale options available to HQD, but it is not a panacea. It has to be used with thrift to assure that HQD retains the sticks needed to meet the demand in subsequent hours. But, this option is interesting in its potential to reduce the cost for HQD to supply energy at a certain demand level. Nevertheless, the more energy that HQD purchases in excess of the Patrimonial contract, the more opportunity HQD would have to resell into the market. It is the same with some special contracts such as the cyclable service. It is possible that in some hours of the year the short-term market would have a price higher than the 7.4 cents/kWh cost of the cyclable energy. If HQD is planning to not use part of the total capacity to meet its needs, it may be interesting to request that energy from HQP on the cyclable contract and sell it on the short-term market.

Section III– Supply Plan of HQD

Introduction

HQD presents its plan to meet the demand forecast for the next 10 years, from 2005 to 2014.

From this plan, we can deduce that HQD has three different strategies. The first strategy is that to meet the demand for the base load under the medium scenario. The second one aims to meet a higher or lower demand created by climate characteristics and the variation in economic growth. The last strategy is to optimise the use of the Patrimonial contract.

Base load

For the base load, HQD plans to first use the energy coming from the Patrimonial contract. Afterward, HQD is planning to use energy coming from long-term firm contracts, such as:

- TCE;
- HQP;
- Biomass;
- Wind farm with balancing services; and
- Actual call for tender for cogeneration (350 MW).

In the future, HQD is planning to use the balance of the cogeneration call for tender they can launch (450 MW) and wait for a new 1,000 MW call for tender related to wind power. This new one is dependent of a new decree from the Québec government obliging HQD to procure wind generation.

For any additional base load or in substitution of any one of the two future calls for tender which may be launched, HQD can launch a new call for tender open to all kinds of production.

Strategy to Meet the Difference In the Base Load Under the Medium Scenario

For the next four years, HQD is forecasting to rely on the short-term market for 3.8, 6.4, 1.6 and 2.9 TWh of energy. This level of reliance on the short-term market was not planned in the medium scenario of the first supply plan, but arises from the higher demand of the last few years. In the first supply plan, reliance on the short term market was forecast only for the scenario where the demand was higher than the medium scenario. All the need from 2006 was supposed to be supported by new generation in baseload and modulable service[6].

[6] R-3570-2001, HQD-2, document 3, page 28 de 37.

Given this situation and because the modulable service is not available now, HQD is planning to rely on the short-term market to meet any difference between the medium scenario and the actual demand. If the demand is less than expected, HQD can reduce reliance on the short-term market for the years 2005 to 2008. If the demand is less than the demand under the medium scenario minus short-term energy contracts actually planned, there would be two different possibilities: reduce the use of the cyclable contract that is planned to be utilized at 50% of capacity[7] (to a maximum of 94 %) and/or postpone the delivery under other new long-term contracts (wind farm, biomass, HQP).

Faced with a higher demand, HQD would be obliged to use the short-term market at a higher level for the next 2 years, 2005 to 2006. For 2007 and 2008, it would be possible to use one or a mix of the three options available: the short-term market, higher utilization of the cyclable contracts (from the 50% planned to the 94% maximum possible utilisation, an excess of around 1 TWh) and the 40 MW available from TCE during the winter season. All other possibilities which could be used to meet the medium scenario are inaccessible because they require a lead time of 48 to 66 months. Thus, these options would be available in 2009 (to 2011) at the earliest if the call for tender is done in 2005 and one year later for any year of delay. Finally, the interruptible load service is more intended to meet higher power demand than energy so it would not contribute to meeting a stronger demand growth scenario.[8]

For the next years, HQD wants to be able to count on 400 MW of modulable service (3 TWh), but it wants to wait until the end of the Commission parlementaire sur l'énergie before it decides whether or not to launch the call for tender. The lead time for this service, assuming it would be provided by new generation facilities, is likely in excess of 48 months.

Optimisation of the Patrimonial Contract

To optimise the use of the patrimonial contract, HQD will utilise the cyclable service along with its active "sticks management" to be able to reduce the loss of Patrimonial energy for each year. For 2004-2008, HQD is projecting a loss of 0.5 TWh of Patrimonial energy. The loss is reduced to 0.3 TWh for 2009 and after.

What is the Difference Between the Situation in Québec for HQD and a Situation in an Open Market for an Electric Distributor?

In an open pool-based market, purchasers are not concerned with baseload, cyclable or modulable generating units. Buyers are concerned about market prices and, if their load is not flat, buyers are concerned about patterns in market prices. Prices are generally higher in on-peak periods than off-peak periods and this would be generally consistent with an operating scenario where higher unit cost cyclable plants are being utilized to meet peak loads. However, prices and price patterns are influenced by many factors including seasonal demand levels, generator availability and fuel prices.

[7] R-3515-2003, HQD-2, Document 1, Page 7 of 7: «Dans le cas du produit cyclable, Hydro-Québec Distribution peut à sa guise acheter ou non l'énergie associée au 250 MW de puissance contractée.»

[8] R-3550-2004, HQD-5, Document 4, Page 18 of 22.

In a pool-based market, individual buyers are concerned about price certainty rather than reliability of supply. On the physical side, the reliability of the supply is achieved through the pool by the producers. On the financial side, a buyer can protect against high prices with financial contract for any unexpected demand, perhaps through a contract that offers a price cap or a collar.

In comparison, the modulable service is like buying the right to purchase a certain amount of energy at a fixed price, similar to buying an option in the financial market. Assuming the level of short term purchases remains below a reasonable level, the choice between short term purchases and modulable service would appear to be an economic one.

Section IV–Analysis of the HQD Strategy and Presentation of Our Observations

Meeting the Demand

It is clear in the HQD supply plan that the fact that HQD has to meet a demand that is fluctuating. This demand is fluctuating in the long run, mostly due to economic activity, and in the short run mostly due to the effects related to weather.

This is demonstrated in the evidence of HQD:

- In the long run, the demand in Québec could grow between 10 to 40 TWh (representing the low and strong scenarios) in 10 years.[9] This is a difference of around 9% at term.

- In the short run, the demand can experience a reduction of up to 4.8 TWh or an increase of up to 3.8 TWh due to weather impact[10] roughly 2/3 of the time and outside this range up to 1/3 of the time.[11]

We have to recognize that there is a large difference between the short run forecast uncertainty and the long run uncertainty. In the long run, and this is true for any forecast, the further out the forecast is, the wider the gap between the low and the high scenarios. This situation can be verified in Table 5, which shows a standard deviation from 5.0 TWh to 15.3 TWh.

Table 5

Total risk on energy demand

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Standard deviation	5,0	5,3	6,4	7,8	8,9	9,9	11,2	12,4	13,8	15,3

Source : R-3550-2004, HQD-2, document 1, page 50 de 55

However, we know that HQD reviews its demand scenario every year. Every year, the review reduces the width of the standard deviation around the standard deviation of 5 TWh. So the focus is on how to get enough energy to, in the short run, accommodate a 5 TWh standard deviation with products that are quickly accessible. We also need to find a way to accommodate the potential variation in long-term demand, mainly with long-term firm contracts, which can take around five years to become accessible. Finally, is it possible to create some synergy with these objectives to reduce the price of post-Patrimonial energy, to optimise the use of Patrimonial energy and to ensure the supply of electricity for Québec customers?

Energy Efficiency

[9] R-3550-2004, HQD-2, document 1, page 55 de 55.

[10] R-3550-2004, HQD-2, document 1, page 46 de 55.

[11] Assuming the forecast demand is normally distributed a range of +/- 1 standard deviation would have a confidence interval of 67%.

Table 6

New forecast of energy efficiency coming from new PGEE

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
New PGEE	0,1	0,3	0,7	1,2	1,7	2,2	2,7	3,0	3,0	3,0	3,0

Source : R-3550-2004, HQD-2, document, page 37 de 55.

In this supply plan, HQD proposes a large increase in the PGEÉ objectives. In the first plan, HQD was expecting 0.4 TWh of energy savings from its new energy efficiency programs. Now, it is expecting 3 TWh for the 20011-2014 period. The question we have to ask is: is it possible to realize this objective and, if not, what will be the impact on the supply plan?

For the first part of the question, we have to take the position that the objective has a real possibility of being achieved. There are many reasons for this position:

- Request from the Québec Government to HQD;
- Some demands from the Régie to get more energy efficiency than in the last energy efficiency plan, particularly in the Avis sur le Suroît;[12]
- The Kyoto pact; and
- The interest of the population in environmental matters.

The new energy efficiency plan, which was treated by the Régie de l'énergie in Docket R-3552-2004, would result in more energy efficiency in Québec, but we cannot quantify exactly how much energy would be saved.

What would be the impact on supply if there is more or less energy efficiency realised by the new PGEÉ? In the short and long run, more energy efficiency would reduce the reliance on the short-term market or any short-term products such as cyclable service. In the long-term, after 2008, it would be manageable, particularly because of the yearly review of the forecast.

On the other hand, in the short-term, low results for the PGEÉ would increase the reliance on the short-term market, all else being equal. After 2008, it will depend on how HQD reacts. But, if it is the only one element that is over estimated in the HQD forecast, HQD would be able to add some energy, coming from cyclable service or the short-term market. After 2008, HQD forecasts reliance on short-term markets well under the 5 TWh limit. Also, if HQD gets some indication in 2004 and 2005 that the PGEÉ won't be able to deliver the expected results, it may have to launch a new call for tender for new long-term firm electricity contracts.

How to Meet the Demand

HQD is proposing a plan to meet the demand. This plan consists of using different sources of electricity, in the following order:

1. Patrimonial energy;

[12] Avis sur le Suroît: «RECOMMANDATION NO 4 :L'objectif minimal d'économie d'énergie du Distributeur doit être fixé à 2,1 TWh à l'horizon 2010.»

2. Long-term firm contracts, such as TCE, HQP 350 MW, Biomass, Wind farm, cogeneration, and other long-terms contracts if necessary.

3. Modulable service;

4. Cyclable services, such as HQP 250 MW cyclable; possibility of balancing of the wind farm;

5. Short-term market; and

6. Interruptible service.

This plan includes a global strategy based on two objectives. The first one is to obtain enough electricity to meet Québec electricity demand at the lowest cost. The second one is to optimise the Patrimonial energy contract to get the lowest total cost; this objective includes managing the short-term volatility of the demand - volatility primarily influenced by the weather.

Getting Enough Electricity

HQD can use all six of the sources if ever it needs them. But, in general, HQD will, to meet the Québec energy demand, use four of the six sources discussed before.

Those four sources are: Patrimonial contract, long-term firm energy, modulable service and the short-term market.

However, we can separate those four sources in two segments: the first one, to assure the base load (Patrimonial and long-term contracts); the second one, to make up for deficiencies of the first one, modulable service and short-term market.

Actually, HQD cannot count on the modulable service because it has not yet launched the call for tender. HQD said that it will wait until the end of the Commission parlementaire before making any decision on the modulable service. HQD explained the rationale for this choice:

> L'impact de cette décision sera de priver le Distributeur, pour l'année 2008, du service modulable qu'il avait déjà planifié.[13]

HQD said that this is not a problem in 2008, because its actual forecast, under the medium scenario, demonstrates that the Patrimonial and the long-term contracts will be enough to prevent a dependence of over 5 TWh on the short-term market.

This opinion differs from that presented in the past. In the first plan, HQD claimed it needed the modulable service to be sure not to be overly dependent on the short-term market. Because HQD doesn't yet have this modulable service, it will be dependent for more than 5 TWh for the year 2006. If the strong demand scenario occurs in the next year, this dependence would be higher and in 2008, it may be close to 8 TWh, and higher in the next years if there is no change in the actual timetable for new long-term firm contracts.

[13] R-3550-2004, HQD-3, Document 3, Page 23 of 46.

In fact, the supply limitations that would result from a strong demand growth scenario in the next two years supports HQD's assertion that it is important to get some reserve energy, in the range of 3 TWh, which HQD wants to secure from the modulable service. The question following this assertion is to ask whether modulable service is the best option that can be used by HQD and whether a dependence on the short-term market higher than 5 TWh is acceptable. If the modulable service is the best way to be assured that HQD will be able to meet Québec electricity demand, when is it the best time to launch the call for tender?

Reducing the Energy Contribution to Meet a Slower Growth in Electricity Demand

In the eventuality of slower growth in electricity demand, the actual situation would be an unexpected chance for HQD. The forecast heavy reliance on the short-term market gives HQD flexibility to reduce its short-term purchases until 2008 if a lower growth scenario evolves. However, if the medium scenario occurred between 2009 and 2014, a reduction of electricity demand in Québec would be harder to deal with. In that situation, HQD would have the following options[14]:

- Reduce purchases in the short-term market;
- Postpone the launch of a new call for tender;
- Reduce the quantity of a call for tender in progress;
- Postpone the beginning of the delivery of some long-term contracts;
- Reduce the use of flexible products such as cyclable service (in that situation, the price per kWh would be higher than 7.4 cents as HQD would reduce the capacity factor below 50%); and
- Conclude agreement with a supplier, when possible, to reduce some deliveries.

Because HQD doesn't, for now, want to sell its surplus of energy in a lower demand case, the options listed above are the only ones that can be used.

The options above are all achievable. However, we cannot understand why HQD refuses to take into account another strategy, such as the sale of its extra kWh into adjacent markets.

In conclusion, we agree with HQD to structure the long-term contracts such that it may postpone the delivery of energy, reduce the deliveries or use others means. Nevertheless, in a situation of low demand, we consider that HQD will have to consider what would be less costly, postponing contract deliveries or selling extra kWh on the market.

Optimising the Use of the Patrimonial Contract

HQD explains the characteristics of use of the Patrimonial energy and which strategy it will use to reduce the loss of that energy.

[14] R-3550-2004, HQD-3, Document 3, Page 20 of 46.

HQD will use its 8760 different sticks in combination with the long-term firm contracts and the short-term contracts and flexible (long-term and short-term) contracts to optimise the Patrimonial energy. All remaining deficiencies would be covered by the special agreement HQD recently signed with HQP. Those deficiencies are inevitable in the current HQD strategy to optimise the Patrimonial energy.

HQD will try to first use the Patrimonial energy in an attempt to fully utilize the 8760 different charges for each hour of the year. And because the exact demand from the customers is unpredictable, it is impossible for HQD to achieve a perfect match of supply and demand in each hour.

So, the actual HQD strategy will result, under the medium scenario forecast, in a loss of 0.5 TWh per year until 2008, and 0.3 TWh, from 2009.[15] On the worst case scenario, HQD would be obliged to renounce up to 4 TWh of patrimonial energy.[16]

To be able to obtain the forecasted result, HQD will actively manage the sticks during the year with the combination of the other supply tools, particularly short-term flexible ones, to try to reduce the loss of Patrimonial energy as much as possible. At the end of the year, HQD will decide the definitive place of each stick to reduce the energy it would purchase from HQP under the imbalance agreement.

In our opinion, the strategy of HQD is, in theory, a good one when we take into account the constraints faced in the Patrimonial contract. Surely, if HQD had the option to use an economic storage service of around 5 TWh, this strategy would not be the least costly. But this option is likely impossible to get from the only one which can supply this service HQP.[17] Until this type of service is available, either because HQP decides to commercialise it or because the Québec government decides to include it in a review of the Patrimonial contract, the storage strategy has to be dismissed.

Analyzing the Price of the Flexible Options in HQD's Strategy

As demonstrated by the reliance on short-term purchases in 2006 being offset by alternatives such a cyclable generation in 2007 and 2008, the cyclable facilities are a substitute for market purchases. Therefore, the cost of the flexible supply that HQD wants to acquire has to be comparable to the price of the short-term market. Is that the actual situation?

We can only make this comparison with one product: the contract signed with HQP for 250 MW of cyclable service.

In that contract, the price is set at 7.4 cents/kWh,[18] which is comparable to the average price from the short-term market contract signed by HQD of 7.5 cents/kWh.[19]

However, the price set with HQP for the cyclable service is for 20 years and is set for a minimum capacity factor of 50%. Below this capacity factor, the price per kWh for HQD

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[15] R-3550-2004, HQD-5, Document 1.1, Page 57 of 77.

[16] R-3550-2004, HQD-5, Document 7, Page 16 of 30.

[17] R-3550-2004, HQD-5, Document 1.1, Page 61 of 77.

[18] R-3515-2003, HQD-1, Document 2 et HQD-2, Document 8; D-2003-159, Page 17.

[19] R-3550-2004, HQD-5, Document 1.1, Page 63 of 77.

would be higher. As the pricing of the cyclable contract appears to include both fixed and variable components, HQD will not be making a choice between market purchases vs. the all-in cost of the cyclable contract, but rather against market purchases and the variable cost of the cyclable contract.

This being said, what price could be acceptable for the modulable service and the load balancing agreement HQD has just signed with HQP? A price for a modulable service, for the load balancing agreement and for additional cyclable capacity significantly above the price of the first call for tender (A/O 2002-01) cyclable service or the market price for the short-term contract for 2005 for HQD (around 7.4-7.5 cents/kWh) would have to be reconciled against the similarity of the products. It must be recognized that the duration of the contract can have an impact on the price. Finally, another acceptable comparison would be to compare the price of each type of service to the market price revealed by energy exchanges, such as New England ISO or the NYISO.

Other Possible Strategies?

Up to now, we have analyzed the strategy of HQD. According to HQD, this strategy is the only one that can be considered to optimize the utilisation of the energy coming from the Patrimonial contract. We beg to differ. There is another strategy. This strategy is to contract long-term firm commitments and resell the surplus on the short or medium term market. But, this analysis has not been presented by HQD, except as an argument:

> Le Distributeur doit, au moindre coût, s'assurer des approvisionnements nécessaires pour satisfaire les besoins québécois. Opter pour le service de base et la revente des surplus expose le Distributeur au risque des fluctuations du prix de l'énergie. Risque qui, le cas échéant, devrait être assumé par les consommateurs, pour la durée du contrat.[20]

We present, hereafter, our opinion on this strategy.

Is it Possible to Not Sign the Special Agreement with HQD?

The load balancing agreement that HQD has recently signed with HQP is a unique one. Which other contract between two parties in the energy sector can be seen ‘‘after the fact’’, only at the end of the year? As mentioned before, this is partly comparable to an open market where the ISO bills any energy deficiencies at the market price, but this is done at every hour of the year not at the end of the year, after HQD has decided the distribution of the Patrimonial sticks.

Due to the configuration of the Québec transportation network, any deficiencies between supplies contracted in Québec and using the transportation service of TransÉnergie would be supported by HQP. This explains why HQP is the only one in Québec that can offer this service. The option given to HQD in the Patrimonial contract to move sticks at the end of the year and, to consequently create deficiencies after the fact, is another element that explains why an imbalance agreement with HQP is necessary.

[20] R-3550-2004, HQD-5, document 4, page 19 de 22.

Another option would be to buy a larger amount of post-Patrimonial electricity to be sure to not have any deficiencies during all the hours of the year. We would presume in such a situation that any excess electricity would be relinquished. This situation could be quite onerous and would result in the HQD relinquishing significant amounts of patrimonial energy. For example, at one hour notice, the forecast of HQD can miss its target by 200 MW to 250 MW.[21] So, in this case, HQD would need to have this 250 MW in surplus for every hour of the year in case of such a variance between the forecast and the actual demand.

In conclusion, our opinion is that the imbalance agreement is a necessity, except if the price is too high, as it offsets the equivalent of around 250 MW of additional supply all year round.

Using Firm Contract with Option for Selling Surplus Compared to Flexible Products in HQD's Strategy

HQD has to secure its supply to meet the electricity need in Québec. Because its forecast cannot be precise, it has to protect itself against variances between forecast and actual demand.

HQD needs around 9 TWh of energy reserves to deal with different scenarios. This reserve counts on three main products: 5 TWh from the short-term market; 3 TWh from future modulable service; and 1 TWh from extra cyclable service plus the 40 MW extra available in winter from TCE.

This energy is available in the case of a demand higher than the forecast under a medium scenario. Alternatively, if the demand is lower than the medium scenario, HQD would use different options, depending on the situation: reducing the use of the short-term purchases, modulable service and cyclable service; delay some future contracts.

How would HQD integrate a purchase and resale strategy? According to HQD's proposed strategy, an energy reserve of around 9 TWh in excess of current firm resources is required. With a reliance of 5 TWh on the short-term market, 4 TWh remains to be provided by other means. Of that, there is 1 TWh that is accessible from the cyclable service and the 40 MW extra accessible in the winter from TCE.

This leaves the 3 TWh, which HQD wants to acquire as a modulable service. This 3 TWh could also be available via a firm service. So the discussion is limited to 3 TWh.

This strategy is based on two assumptions. First, HQD always has 3 TWh of excess capability, equivalent to the modulable service. Because this service is firm, it may be possible that the distributor would have the entire amount in surplus depending on the growth of the demand. However, it is possible to reduce this surplus by not using a short-term market contract or to replace energy coming from contracted plants that are in a refurbishing situation or deficiencies. At that time, a strategy has to be in place: to sell the surplus on the short-term market, to postpone new firm contracts, and/or to get a different imbalance agreement with HQP. Finally, in unusual circumstances it is possible that HQD may have surplus that it could not sell and this may have an impact

[21] R-3550-2004, HQD-5, document 1.1, page 65 de 77.

on the percentage utilization of the Patrimonial energy and/or the cyclable service (under 50% utilisation factor).

Could a purchase and resale strategy be less costly?

Who Bears the Risk?

As stated before, HQD expressed its opinion that the price risk associated with sales of surplus energy will be borne by the customers.

In our opinion, with any strategy, the risk will be borne by the customers. For example, if HQD needs to turn more to the short-term market for some years, as it has forecast for the year 2006, or the obligation cost for not using the 400 MW of modulable service, the cost will be projected at the beginning of the year and will be included in the rate case. So under any options, customers would bear a risk, a risk to pay more or a risk to receive less than what they paid for. But either way, the risk will be borne by the customers. So, the discussion is not about who will bear the risk but what strategy will minimize the cost and the risk.

However, there is part of the risk that could be borne differently. This would be clearer when the final decision of the Régie de l'énergie is made on who bears the risk from the spread between the forecasted sales in a rate case and the actual sales. At present, there is 1.9 TWh for which HQD bears the variance risk, more of that variance is supported by customers. But some other evidence and decisions on this issue will likely be presented in the 2006 rate case[22] or in the review application submitted by HQD (R-3567-2005).

Is HQD Able to Get the Ability to Use the Short-Term Market at any Moment for Selling and Buying Energy?

HQD doesn't want to put in place a trading room. Actually, the only option HQD is considering is to put in place a strategic office that would drive different strategies and leave the trading role to other parties.[23]

The role of that group is to make sure, on an hourly basis, that HQD's supply is reliable. To do so, the group is comprised of 13 employees: economists, engineers, mathematicians and finance specialists.[24]

In our opinion, such a group should be able to undertake the trading role. It might be necessary to add some more people, some trading room specialist maybe. But it is a good base.

Is it economic to complete this team and make them capable of trading directly in the market? Recognizing that HQD doesn't want to trade directly and wants to use counterparties to undertake that part of the job, is it possible to delegate that part of the job to an independent trading room, such as the one of HQP, at cost in a manner similar to other tasks delegated to the Centre de service partagé (CSP)?

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[22] D-2005-34, Pages 48 and 50.

[23] R-3550-2004, HQD-5, Document 4, Pages 9 and 10 of 22.

[24] R-3550-2004, HQD-5, document 4, Page 9 of 22.

We can affirm, for now, that it is possible, in our opinion, for HQD to put in place a group or to delegate the task for having access on an hourly basis to a trading room for buying or selling energy on the short-term market to minimize its supply cost.

Table 7
Comparison of the HQD's scenario vs firm service for modulable service

1.Extra energy need scenario				
HQD's scenario		TWh	Cost	Sub total
Base load			kWh	
	Patrimonial	165	0,0279	4 603 500 000 $
	TCE 507 MW	4,063	0,0600	243 780 000 $
	HQP 350 MW	2,416	0,0550	132 880 000 $
	HQD 250 MW Cyclable	1,725	0,0740	127 650 000 $
Modulable	HQP 400 MW	3	0,0750	225 000 000 $
Short term	150 MW	1,5	0,0750	112 500 000 $
Lost	Patrimonial	0,5	0,0279	13 950 000 $
Total cost				**5 431 360 000 $**
Cost per kWh	**TWh vendu**	**177,7**		**0,03056 $**
Firm service for modulable				
Base load				
	Patrimonial	165	0,0279	4 603 500 000 $
	TCE 507 MW	4,063	0,0600	243 780 000 $
	HQP 350 MW	2,416	0,0550	132 880 000 $
	HQD 250 MW Cyclable	1,725	0,0740	127 650 000 $
Firm reserve	HQP 400 MW	3	0,0610	183 000 000 $
Short term	150 MW	1,5	0,0750	112 500 000 $
Lost	Patrimonial	0,5	0,0279	13 950 000 $
Total cost	**TWh vendu**	**177,7**		**5 389 360 000 $**
Cost per kWh				**0,03033 $**

However, would this situation be economically the best one to optimise the use of the Patrimonial energy and to reduce the cost of the total HQD electricity supply?

Which Strategy Is Less Costly?

Table 7 presents the results if we use a long contract compared with modulable service in a situation were we use the 3 TWh; Table 8 where we use 1.5 TWh and sell the extra and Table 9, when we do not need the 3 TWh and resell it. These three scenarios are presented to demonstrate to the Régie what the impact would be in all situations. The situation in Table 7 is shown to be less costly because firm supply at 6.1 cents is less costly than modulable supply at 7.5 cents. We recognize that these two case are not totally comparable but they are presented as a base of comparison with the situations in Table 8 and 9.

For now, it is impossible to answer the question of which strategy will be the less costly because we do not have enough information from HQD. In fact, the lack of information comes from the fact that HQD doesn't want to compare the two scenarios because it already has rejected one of them in the absence of any further economic study.[25]

However, HQD often brings another element in its discussions of different scenarios. HQD suggests that price is not the only element that is taken into consideration; there is also the security of supply. This element disqualifies the strategy of relying solely on short-term purchases for any discrepancy between the forecast and actual demand due to limitations arising from the interconnections. But, this is not the case if HQD decides not to use the modulable service and transform it into a firm service with the use of a strategy to dispose of surplus electricity, such as short-term sales (reducing planned purchases, selling excess), reducing the use of cyclable service or postponing some new firm contracts.

[25] R-3550-2004, HQD-5, Document 4, Page 19 of 22.

What economic analysis can we undertake to assess these options? The one we will produce is inaccurate for many reasons, particularly because we do not have access to all information than HQD has. But we can produce a conceptual analysis, presented in Tables 7, 8 and 9. In those tables, we present different scenarios: one with extra energy need and two with excess energy acquired from firm services.

Table 8
Comparison of the HQD's scenario vs firm service for modulable service

2.Disposed extra energy scenario of 1.5 TWh

			TWh	Cost/kWh	Sub total
HQD's scenario					
Base load					
	Patrimonial		165	0,0279	4 603 500 000
	TCE 507 MW		4,063	0,0600	243 780 000
	HQP 350 MW		2,416	0,0550	132 880 000
	HQD 250 MW Cyclable		1,725	0,0740	127 650 000
Modulable	HQP 400 MW		1,5	0,0750	112 500 000
Short term	150 MW			0,0750	0
Lost	Patrimonial		0,5	0,0279	13 950 000
Total cost					**5 206 360 000**
Cost per kWh	**TWh vendu**		**174,7**		**0,02980 $**
Firm service for modulable with out selling extra energy					
Base load					
	Patrimonial		165	0,0279	4 603 500 000
	TCE 507 MW		4,063	0,0600	243 780 000
	HQP 350 MW		2,416	0,0550	132 880 000
	HQD 250 MW Cyclable		1,725	0,0740	127 650 000
Firm reserve	HQP 400 MW		3	0,0610	183 000 000
Short term	150 MW			0,0750	0
Lost	Patrimonial			0,0279	0
Not used	Patrimonial		1,5	0,0279	41 850 000
Total cost	**TWh vendu**		**174,7**		**5 248 960 000**
					0,03004 $
Firm service for modulable with selling extra energy					
Base load					
	Patrimonial		165	0,0279	4 603 500 000
	TCE 507 MW		4,063	0,0600	243 780 000
	HQP 350 MW		2,416	0,0550	132 880 000
	HQD 250 MW Cyclable		1,725	0,0740	127 650 000
Firm reserve	HQP 400 MW		3	0,0610	183 000 000
Short term	150 MW			0,0750	0
Lost	Patrimonial		0,5	0,0279	13 950 000
Sell	Short term		1,5	0,0750	112 500 000
Total cost	**TWh vendu**		**174,7**		**5 164 360 000**
Cost per kWh					**0,02956 $**

We have made a number of assumptions:

- using the prices from the calls for tender already signed (TCE, HQP, short-term contract);
- using, for the modulable service, the cost of the short-term contract;
- using for the cost of firm service of 400 MW from HQP the average cost of the first call for tender. In Tables 8 and 9 under ''Firm service for modulable without selling extra energy'', we made the assumption there would be no loss of Patrimonial energy because there is enough surplus; and
- exclude the energy from the imbalance agreement with HQP, which would have the same impact in each scenario, so it would not alter the conclusion of the analysis.

As we can see, this exercise allows us to conclude that it would be less costly to use a firm energy contract to replace the modulable service if the surplus is sold. Only one option would cost more than HQD's option, if the extra energy from the firm service which replaces the modulable service is not resold.

If we analyze further the data in table 8, we will also find that the cost of the short-term market can be as low as 4.7 cents/kWh to assure that the firm service scenario would not be less costly than the HQD's scenario. On Table 9, the cost can be as low as 6.1 cents/kWh.

The analysis comes down to recognizing that a strategy of purchasing firm and reselling is financially equivalent to purchasing the modulable service if the market price is less than the cost of the firm service by the premium paid for the modulable over the firm service (all else being equal). Perhaps as much as anything, this highlights the necessity to examine the premium required for modulable service over firm service.

Table 9

Comparison of the HQD's scenario vs firm service for modulable service

3.Disposed extra energy scenario 3 TWh				
HQD's scenario		TWh	Cost/kWh	Sub total
Base load				
	Patrimonial	165	0,0279	4 603 500 000
	TCE 507 MW	4,063	0,0600	243 780 000
	HQP 350 MW	2,416	0,0550	132 880 000
	HQD 250 MW Cyclable	1,725	0,0740	127 650 000
Modulable	HQP 400 MW	0	0,0750	0
Short term	150 MW		0,0750	0
Lost	Patrimonial	0,5	0,0279	13 950 000
Total cost				**5 093 860 000**
Cost per kWh	**TWh vendu**	**173,2**		**0,02941 $**
Firm service for modulable with out selling extra energy				
Base load				
	Patrimonial	165	0,0279	4 603 500 000
	TCE 507 MW	4,063	0,0600	243 780 000
	HQP 350 MW	2,416	0,0550	132 880 000
	HQD 250 MW Cyclable	1,725	0,0740	127 650 000
Firm reserve	HQP 400 MW	3	0,0610	183 000 000
Short term	150 MW		0,0750	0
Lost	Patrimonial		0,0279	0
Not used	Patrimonial	3	0,0279	83 700 000
Total cost	**TWh vendu**	**173,2**		**5 207 110 000**
				0,03006 $
Firm service for modulable with selling extra energy				
Base load				
	Patrimonial	165	0,0279	4 603 500 000
	TCE 507 MW	4,063	0,0600	243 780 000
	HQP 350 MW	2,416	0,0550	132 880 000
	HQD 250 MW Cyclable	1,725	0,0740	127 650 000
Firm reserve	HQP 400 MW	3	0,0610	183 000 000
Short term	150 MW		0,0750	0
Lost	Patrimonial	0,5	0,0279	13 950 000
Sell	Short term	3	0,0750	225 000 000
Total cost	**TWh vendu**	**173,2**		**5 051 860 000**
Cost per kWh				**0,02917 $**

What conclusion can we draw from this analysis of the risk? In fact, the risk size seems to be around the same, (0,115 cents/kWh), but symmetrically opposite. On HQD's scenario, the cost per kWh is higher when the demand is higher and lower when the demand is lower. On a strategy with selling the extra energy, the cost per kWh is lower with a strong demand and higher with a low demand.

So the risk we have to look at is the total risk. Is the total risk between a firm service and a modulable service the same? In our opinion, there are two different kinds of risk, the short and long run risks. The short-term risk is very similar between the two scenarios. Under HQD's scenario, the risk would be on the penalties or obligation the contract would include and the price per kWh used. Under the firm scenario, with the sale of extra energy, the risk is on the cost per kWh of the contract versus the short-term market price.

If the demand is lower than expected, under the firm scenario, it would be possible to reduce the loss if the short-term market is too low by postponing a new call for tender for firm energy. So in one to five years, the demand in Québec would reduce the surplus. On the other hand, if the demand is lower than under HQD's scenario, we would have two options: delaying new firm services to use modulable service all year long; or paying the obligations coming from the modulable contract. When we compare those two scenarios, the only way for the modulable scenario to be less risky is for the price of modulable service to be the same as the firm service. We would be very surprised if this were the case.

In conclusion on the risk discussions, the risk under the HQD strategy and the resale strategy do not appear markedly different.

This analysis indicates that a resale option may be promising. We made a number of assumptions in our analysis, but because we are not trying to beat the market, for example in selling more during the high price periods or in using very short-term market, such as DAM or HAM, to sell extra energy, the scenarios looked conservative to us and would not require extra resources for HQD. It would be possible for HQD to use their counterparties to sell the surplus energy. In our opinion, it is improbable to not be able to sell energy surplus up to a maximum of 3 TWh. The only element that would modify this opinion is a strong technological improvement in electricity and energy industries. But this would have an impact on any kind of scenarios.

Is this analysis sufficient to decide to not allow HQD to buy a modulable service? We don't think so. In fact, this gives us some guidance to determine under which characteristics a modulable service could be attractive. But in our opinion, a strong demonstration would need to be made to prove that the modulable service with a price of long-term firm service or higher is less costly than the firm service scenario with resale of excess energy.

The Role of Short-Term Contract Energy

The strategy of HQD to not depend on short-term contracts for more than 5 TWh seems reasonable for assuring the security of supply. As per HQD's answer to FCEI's questions, this is a long run strategy.[26] So it is possible, for a short period, to need more than 5 TWh of energy, as forecast for 2006. If the modulable service (or firm service with resale scenario) was available, HQD would not be over the 5 TWh in 2006.

In conclusion, HQD's plan of using the short-term market appears appropriate. But the modulable service or its equivalent needs to be accessible as soon as possible to reduce the future dependence on the short-term market. Without this option, HQD faces potential dependence on the short-term market in excess of the even the 6.4 TWh forecast for 2006.

What Could Be Included in the Imbalance Agreement: Is There an Impact on the Sticks Administration?

HQD wants to take on an imbalance agreement with HQP (which has now been signed and will be reviewed by the Régie de l'énergie in the case R-3568-2005). This agreement is intended to protect HQD for any over consumption during the year in excess of the tools already used and permit after the fact of optimisation of the Patrimonial sticks. Elements of this agreement compare with the open market – those hours with pricing tied to the market price and others resemble a cyclable contract at a fixed price.

In fact, it is necessary for HQD to have such an agreement or to over contract for around 250 MW all year round, as discuss previously, to manage the very short-term forecast error. We can already conclude that this special agreement would help HQD in its management of the Patrimonial sticks, and to deal with the very short-term volatility of the demand.

[26] R-3550-2004, HQD-5, Document 4, Page 12 of 22.

However, this special agreement can affect HQD's decision on the use of the other supply tools. In fact, the utility of the imbalance agreement will depend on two elements: quantity and price.

If the special agreement is at the short-term market price, such as HAM or DAM (as it appears to be for the top 300 hours, unless the floor price of 30 cents/kWh is triggered), for any quantity, there is no reason for HQD to go to these markets. It would use the imbalance agreement for any deficiencies between the forecast and the actual demand. In the same line, if the special agreement is at the cyclable price (as it is appears to be for the remainder of the hours), there is no more incentive to buy that kind of product.

However, if the price is two times the HAM market, HQD would have to minimise the use of this agreement by an active management of its supply tools, particularly in the optimisation of the Patrimonial sticks and the use of flexible supply tools.

In our opinion, the price of this service should represent the cost of the short-term market such as, for example, the HAM price in the New England ISO or NYISO. Because HQP would want to minimize and forecast the use of the service by HQD, it would likely be necessarily to add some constraint on the quantity.

So, we think the special agreement should represent the short-term market price with a maximum quantity for each year. This situation would assure the necessity for HQD to get and utilize flexible tools to minimize the cost of its electricity supply needs.

Is the Balancing Tool for the Wind Farm Supply Necessary?

In HQD's plan, following the first call for tender for wind farm production of 1,000 MW, HQD would add another service coming from HQP,[27] such as a balancing service. This service can transform the wind energy to the equivalent of a flat supply source or it is possible that HQD could transform this balancing service into a cyclable service. Those discussions or the call for tender would be launched in 2005.[28]

We have analysed the impact of the wind farm supply to understand if it is necessary for HQD to get a new service from HQP to balance this energy. The question comes by the fact that wind farm is not a firm service that can be precisely forecast.

As we said previously, the variation between demand forecast one hour before the fact and the actual demand in an hour can vary by 250 MW in winter and 200 MW in summer. If the variation in wind generation from hour to hour is a significant fraction of their output, then the potential imbalance in each hour would increase further.

This is a problematic situation that HQD has to deal with. The imbalance in hourly demand and supply can be dealt with under a special agreement or under a balancing service. The best option would depend what kind of constraint the special agreement would contain and the price for that energy compared with the balancing service.

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[27] As explained by HQD, the service would come from a hydroelectric power plant. In Québec, it is almost certain that the company who can provide such a product is HQP, with its hydro reservoirs.

[28] R-3550-2004, HQD-5, Document 1.1, Page 59 of 77.

Actually, because we don't have information for both services, it is impossible to compare adequately and draw conclusions.

However, is it possible to just use the flexibility offered by the Patrimonial sticks to follow the energy and the power from the wind farm? This is hard to conclude. In fact, it would depend when the wind generation was not available. If it is unavailable during the peak time, HQD is obliged to find a way to protect its energy supply. If it is sure that the wind farm would be out during other times of the year, HQD can move its sticks to reduce the deficiencies at the end of the year.

In our opinion, HQD has to protect its supply during the peak time. For that, there are a number of options that can be used, such as special agreement, flat balancing service, cyclable balancing service and peak time balancing service. HQD will have to demonstrate the economics of the various options.

Section V–Conclusion and Recommendations

In conclusion, the global strategy presented by HQD can respond to the Québec electricity demand for the next few years. It appears that if HQD had implemented the first plan, as approved, it would not have to depend on the short-term market for more than 5 TWh in 2006.

We did not undertake an analysis of the accuracy of HQD's demand forecast, but it is clear now that the demand can be different than the medium scenario, and by a significant margin. HQD has to protect itself against these possible differences. For the duration of this supply plan, any lower demand would result in a lower use of short-term energy purchases. However, a stronger demand would require even higher reliance on short-term energy and, starting in 2007, higher than forecast utilization of the cyclable service.

Before 2008, HQD is largely dependant on the short-term market because it did not get sufficient energy under long-term contracts. This situation will change in 2008 and after, if the medium scenario is realised. But if the demand is higher, HQD would not be able to use its modulable service and it would depend even more heavily on the short-term market.

The modulable service may not be the best option in regards to the cost, unless the price is equal or very near of the long-term contract. At the time that a call for tender for modulable service is contemplated, we would encourage HQD to evaluate this alternative alongside firm purchases with resale of excess energy.

In addition, the decision of HQD to significantly reduce reliance on the market after 2006 could result in higher cost of supply in the future. We have not seen, in this case, evidence of the economics of short-term market purchases versus long-term contracting.

HQD cannot at the same time reject reliance on the short-term market due to potential higher cost than contracting (implying a forecast of high market prices) and also reject a strategy utilizing contracting with resale due to insufficient revenue from short-term sales (implying a forecast of low market prices).

Unless HQD purchases a significant level of dispatchable capacity, it will inevitably rely on short-term markets either for purchases or sales. While we cannot conclude whether it would be better for HQD to be a buyer or a seller in the short-term market, we would like to understand the relative costs and risks related to reliance on the short-term markets.

Finally, we cannot explain the exact use of the short-term market and the balancing service for the wind farm energy until we know the price and the restriction on power and energy the special agreement and the balancing service contains. But from what we know, the balancing service for the wind farm energy, as a cyclable or stable one, would be necessary.