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**CHALLENGES FOR EFFECTIVE COMPETITION IN LARGE-HYDRO  
DOMINATED MARKETS: THE CASE OF QUÉBEC**

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## ABSTRACT

The creation of effective competition in Québec's electricity market is seriously hampered by a number of factors, including Hydro-Québec's vertical integration, its near-total domination of the electricity market in Quebec, its control over natural gas distribution in Québec, its limited interconnection capacity with neighbouring grids, its multi-annual reservoirs, the size of many of its generation facilities and more.

Each of these obstacles would have to be overcome in order for true competition to exist in Quebec's electricity markets, yet solutions might require unprecedented transformations in the ownership and control of Hydro-Québec's assets. Both vertical and horizontal separation of Hydro-Québec's assets would be essential, possibly through divestiture to the private sector. Furthermore, due to the particular characteristics of Hydro-Québec's generation mix, additional measures would also be required. One such measure would involve guaranteeing to Québec's distributors the entire output of Hydro-Québec's three largest hydro complexes, under a long-term contract based on actual costs. Such a mechanism would permit the establishment of a true competitive electricity marketplace in Québec, while at the same time protecting consumers from the price increases that could otherwise accompany such a change.

However, in assigning most of the low-cost power in Québec to domestic consumers, the mechanism we describe would also reduce the (apparent) cost-effectiveness of Hydro-Québec's exports. Given that the drive toward competitive energy markets in Québec is geared more toward satisfying American reciprocity requirements than it is to alleviating the burden of non-existent stranded costs, *it is unclear that such transformations would be welcome or appropriate in Québec.*

Finally, in addition to overcoming obstacles to competition, any market restructuring must take into account issues of greater public interest, such as environmental and natural resource protection, R&D funding, promoting new renewable generating technologies, achieving cost-effective energy efficiency potentials, and protecting residential (and in particular low-income) consumers.

Each of these issues, while not specifically addressed in this text, must be taken into consideration prior to making the difficult choices that lie ahead.

## 1. INTRODUCTION

In the United States, where inter-regional rate differences can top 300%<sup>3</sup> and embedded costs are often higher than the total costs of new supply, electricity market restructuring has achieved support as a means of reducing prices and leveling the playing field between states. In Québec, however, with low-cost hydropower, rising marginal costs and province-wide rate equalization,<sup>4</sup> the impetus behind restructuring is very different. Indeed, the drive to restructure the electricity industry in Québec is based almost exclusively on Hydro-Québec's desire to meet American reciprocity requirements in order to sell power freely into U.S. deregulated markets, rather than on reducing electricity costs and prices within the province.

For this reason, among others,<sup>5</sup> it is far from certain that Québec will embrace the idea of competitive electricity markets. Were it to do so, however, the implementation of such changes would pose difficult problems. If electricity prices are to be deregulated<sup>6</sup> and thus constrained only by competitive forces of the marketplace, it is essential that a true competitive market exist, where no player has market power allowing it to raise prices to non-competitive levels. Hydro-Québec's continued control of over 90% of the installed capacity in

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<sup>3</sup> For example, in 1995, average industrial rates in Rhode Island were 8.9¢(US)/kWh, compared to 2.9¢ in Kentucky. In California, average industrial rates were 7.4¢/kWh, compared to 3.5¢ in neighbouring Oregon, and 2.8¢ in nearby Idaho. Rhode Island and California were the first two American states to legislate retail access to competition in electricity markets. (See EIA 1996, 35-37).

<sup>4</sup> Coupled with the full nationalization of Hydro-Québec in 1963 came legislation to ensure that all customers within a customer class pay equal rates throughout Québec. While some exceptions currently exist (Québec counts 9 municipal and one private distribution company, whose rates are allowed to be lower than Hydro-Québec's, and rate policies for the Îles-de-la-Madeleine and northern Québec allow for higher rates coupled with incentives for fuel-switching), rate equalization still covers some 97% of demand in Québec.

<sup>5</sup> For historical reasons related to the 1963 nationalization, any discussion of the restructuring of this industry in Québec raises deep passions.

<sup>6</sup> Until recently, Hydro-Québec's electricity prices were fixed by the government. They are now subject to regulation by the *Régie de l'énergie* (Québec Energy Board).

Québec would thus be extremely problematic.<sup>7</sup> Furthermore, its continued ownership of the vast majority of all transmission and distribution facilities in the province, including control over natural gas distribution, would permit a variety of discriminatory practices. If Québec is to open its electricity markets to competitive forces, these issues, among others, will have to be addressed carefully in order to ensure that the interests of Québec ratepayers are protected.

## 2. OBSTACLES TO COMPETITION

There are two main obstacles to the creation of a truly competitive electricity market in Québec. These are Hydro-Québec's ability a) to discriminate in favour of its own generation (due to its vertical integration) and b) to exercise market power (due to its overwhelming dominance of generation resources in Québec).

### **a. Discriminatory Practices**

Currently, Hydro-Québec owns and operates the vast majority of all generation, transmission, distribution and metering/billing operations in Québec.<sup>8</sup> Other than its transmission grid, which was functionally unbundled on May 1, 1997, Hydro-Québec remains a vertically-integrated utility. This vertical integration, if taken in conjunction with deregulated generation, would allow for significant abuse and discriminatory practices, notably through sharing of information, discriminatory purchasing and unfair cost-shifting.

**Sharing of information.** In the current context, Hydro-Québec has a number of opportunities for sharing information in such a way that would favour its own generation over competitors. For example, if retail competition were allowed in

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<sup>7</sup> This figure includes almost 5000 MW from the Churchill Falls project, located just outside of Québec in Labrador. This project is owned and operated by the Churchill Falls (Labrador) Corporation, in which Hydro-Québec has a 33% share. However, of the facility's 5234 MW installed capacity, 4934 MW are guaranteed to Hydro-Québec through a binding, long-term contract set to expire in 2041 (of the remaining 300 MW, the province of Newfoundland/Labrador can only use about 170 MW, with the remainder also going, for the time being, to Hydro-Québec). For these reasons, the nearly 5000 MW guaranteed to Hydro-Québec over the coming 45 years is treated in this paper as a Hydro-Québec installation, not as an import.

<sup>8</sup> For reasons of simplicity, in this paper we will include metering and billing as part of the distribution function.

the current context, HQ-Distribution<sup>9</sup> could provide critical customer information, obtained through its metering and billing services, to HQ-Generation, thus giving it an important competitive advantage. Under either wholesale or retail competition, HQ-Transmission (recently functionally unbundled and renamed “TransÉnergie”) could provide HQ-Generation with detailed information concerning foreseeable bottlenecks and other transmission constraints, allowing it to purchase transmission rights in such a way as to block access by other sellers.<sup>10</sup> Even if access to the competitive market were to be limited to wholesale customers (distributors and other resellers), HQ-Distribution could still provide HQ-Generation with information regarding bids from competitors, allowing itself to bid strategically to retain customers. Each of these possibilities would provide Hydro-Québec with unfair advantages over its competitors, and could well result in increased costs for end users.

**Purchasing.** Were generation to be deregulated in Québec, without other structural changes, HQ-Distribution would retain a strong incentive to purchase from HQ-Generation, even if lower-prices are available from other generators.<sup>11</sup> As is the case with cost-shifting, effective enforcement of a non-discriminatory purchasing policy would require extremely detailed regulatory oversight.

**Cost-shifting.** To date, Hydro-Québec's cost allocations have never been subject to independent technical review.<sup>12</sup> Cost allocation is a complex procedure which, even under the strictest and most experienced of regulatory régimes, has the

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<sup>9</sup> The terms “HQ-Distribution” and “HQ-Generation” are used in this paper to signify those functions of the utility which currently (following a recent corporate restructuring) are distinct departments within Hydro-Québec. However, since it is not yet clear to what extent there is real functional separation between these departments, these names should be regarded as fictitious. TransÉnergie, on the other hand, is a functionally distinct *division* within Hydro-Québec, with control over all the company’s transmission assets.

<sup>10</sup> Such information sharing is currently forbidden under a code of conduct adopted in response to requirements of the U.S. Federal Energy Regulatory Commission (FERC). However, enforcement of this type of code is notoriously difficult.

<sup>11</sup> There is currently no requirement that HQ-Distribution treat other generators on an equal footing with Hydro-Québec’s own generation.

potential for significant errors. If regulation of generation were to be withdrawn while Hydro-Québec remains a vertically-integrated utility, it would have an incentive to attempt to shift costs from its unregulated entities (generation) to its regulated ones (transmission and distribution), which are guaranteed a reasonable return on investment. Such cost shifting would allow Hydro-Québec to be more competitive at home and on export markets, at the expense of its competitors and of Québec consumers.

Furthermore, given the radial configuration of Québec's transmission grid, the design of transmission tariffs can in itself constitute a type of cost shifting. The transmission tariffs adopted by the Government of Québec in Bylaw 659 to the Hydro-Québec Act (Government of Québec 1997) provides for a single postage-stamp rate for the use of all transmission facilities within Québec.<sup>13</sup> Because so much of Hydro-Québec's generating capacity is located far from load centres, a significant portion of its transmission lines serve only to carry electricity to southern Québec from the large installations in the north. A postage-stamp rate in effect requires short-haul transmission customers in southern Québec to pay a share of the costs of transmitting Hydro-Québec's low-cost power, shifting costs from Hydro-Québec's generating system to the producers and users of power generated in southern Québec or imported from the United States.<sup>14,15</sup>

It is worth noting that in British Columbia, a province remarkably similar to Québec in its generation make-up (~95% hydro), grid design and industry structure, the B.C. Utilities Commission has ruled that for purposes of B.C.

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<sup>12</sup> Under the new *Loi sur la Régie de l'énergie (Act concerning the Québec Energy Board)*, the Régie has full authority to set Hydro-Québec's electricity rates (including transmission rates), which until now were set by the government. However, no rate cases have yet been held. Indeed, as of October 1997, none of the substantive provisions of the Act concerning electricity, (including section 32, which foresees hearings on cost allocation methodologies) are yet in force. While Hydro-Québec indicated earlier that all provisions of the Act would be in force by September 1997 (*Hydro-Québec 1997, 10*), the government has made no commitment in this regard. It now appears that the Régie will proceed with hearings on deregulation and regulatory approaches prior to addressing these issues.

<sup>13</sup> These rates, based on a revenue requirement of \$2.26 billion (CDN), have not yet been reviewed by the Régie or any other independent tribunal.

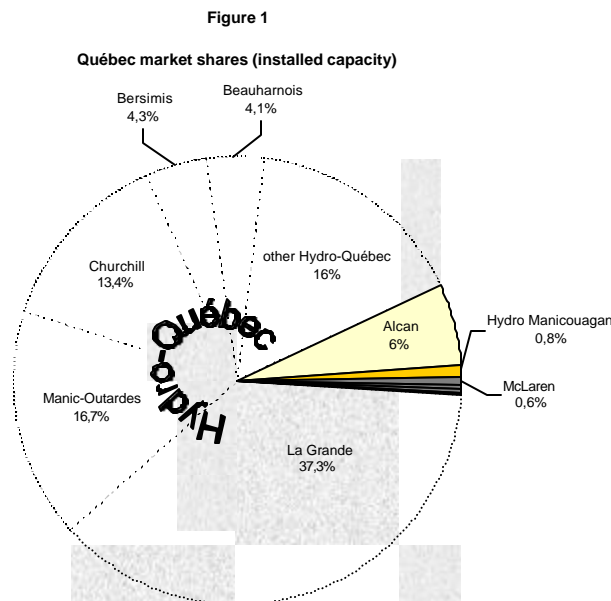
<sup>14</sup> The portion of Hydro-Québec's transmission revenue requirement that applies to these northern lines has not been made public.

<sup>15</sup> Of course, if other generators were to locate in the far north, they would also use these lines. With a postage stamp-based zonal transmission tariff, or a distance-based approach, the cost of the northern lines would be paid for by their users.

Hydro's transmission tariffs, the lines linking northern dams to the southern grid are to be treated as generation assets, thus removed from the transmission rate base (BCUC 1996).

### **b. Market Power and Abuse**

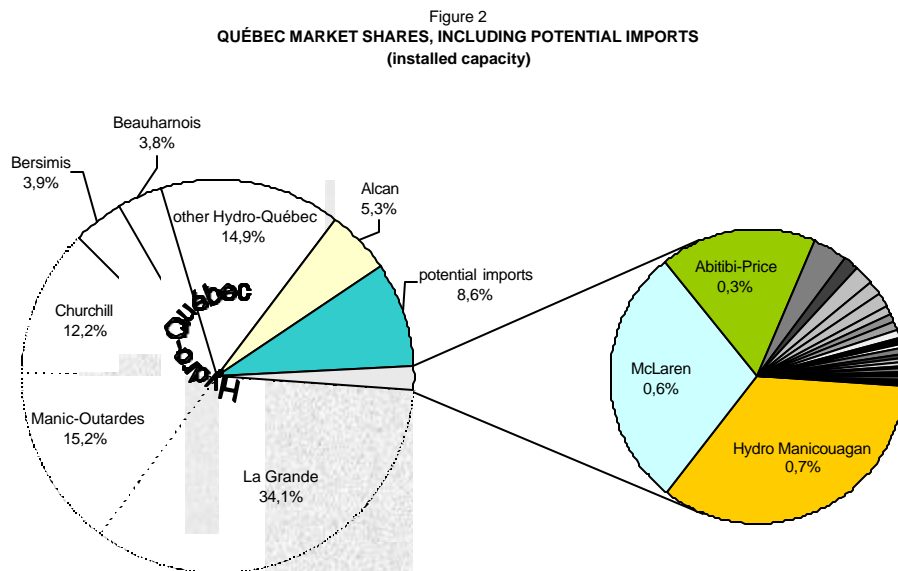
Assessing a generator's market power in a given market (geographical area defined by transmission constraints, on a seasonal basis) requires complex and detailed analysis. Still, it is widely accepted that a generator whose share in any particular market does not exceed 20% is unlikely to possess market power. Similarly, for power producers with market shares from 20% to 30%, there is a real risk of market power (Tellus 1996), and detailed analysis is generally required to assess the extent of potential abuse.<sup>16</sup> Obviously, risk increases as market share rises above 30%.



**Market share.** Within Québec, Hydro-Québec controls over 90% of all electricity generation (see Figure 1). When considering all possible inputs from

neighbouring regions through existing interconnections (limited to roughly 3,000 MW), this market share remains above 85% (see Figure 2). Clearly, Hydro-Québec's market power is startlingly high. In practice, this absence of market discipline means that, were generation to be deregulated, HQ-Generation could increase its prices charged to Québec ratepayers well above its own costs. It could also adopt predatory pricing practices by selling below cost at strategic moments in order to force smaller competitors out of the market. Furthermore, in the context of a power pool, it could strategically withdraw power from the market in such a way as to require the use of very high-cost peaking facilities, raising the clearing price paid for every kilowatthour sold during those peak periods by every generator, including Hydro-Québec.<sup>17</sup>

**Size.** Hydro-Québec's particular case is further complicated by the size of several of its large generation complexes, each of which is composed of multiple generating stations on a single river system. For example, the La Grande complex,



<sup>16</sup> This set of criteria is used by the U.S. Federal Energy Regulatory Commission (FERC) as a screening step in its reviews of applications for power marketer status, which is necessary if a generator wishes to sell at market rates without seeking prior approval (based on cost-plus-reasonable-return regulation). FERC will not grant power marketer status until market power has been mitigated (see note 24, below).

which is now the largest hydroelectric complex in the world (Hydro-Québec 1996b), is composed of some eight generating stations with a combined installed capacity of more than 15,000 MW, and as such counts for more than 40% of the utility's entire generation capacity. Other “mega” dam complexes, such as Manic-Outardes and Churchill Falls, have installed capacities of about 7,000 MW and 5,000 MW, respectively.

Because the individual stations of these complexes share the same river systems, it would be very problematic for them to be owned or operated by separate entities.<sup>18</sup> But these complexes are so large that, even if they were to be divested by Hydro-Québec, each one would still control market shares so large as to be an impediment to effective competition.

**Control of natural gas industry.** Hydro-Québec's recent acquisition of a controlling interest in Noverco, the holding company of Gaz Métropolitain (as well as in IPL, the world's most important gas and petroleum pipeline company that also owns Canada's largest gas distribution utility, Consumers' Gas of Toronto), further ups the ante in terms of market power and potential for abuse. In controlling the natural gas distributor that serves nearly all of Québec, Hydro-Québec now has the ability to affect fuel prices for potential competitors (using gas turbine and cogeneration technologies).

**Market behaviour.** Finally, the hydroelectric nature of Hydro-Québec's system poses yet another substantial obstacle to real competition in Québec's electricity markets, especially in the context of a power pool (or power exchange). A pool is meant to serve as a clearinghouse through which objective market prices can be determined for electricity, based on (relatively predictable) variable costs. But in the case of a hydro-dominated market, variable costs are virtually nil, so that if generators were to follow this logic, they would end up practically giving away their power. For this reason, hydro generators would normally bid not on the basis

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<sup>17</sup> Power pools generally accept bids on the basis of a demand-based, lowest-to-highest price "merit order". Each accepted participant is then paid the price bid by the highest bid in the merit order (the market clearing price). In a thermal-dominated market, this process creates a powerful incentive for bids to reflect variable costs. The strategic withdrawal practices described here have already been observed in the British power pool (see [Wolak and Patrick 1997](#)).

<sup>18</sup> This conclusion was also reached by the MacDonald Commission in Ontario ([Advisory Committee 1996](#)).

of variable costs, but rather on the basis of perceived opportunity costs associated with the storage capacities of multi-annual reservoir systems and their estimates of future price behaviour.

As long as thermal generators dominate the pool, this makes little difference, with the hydro generators being price takers (rarely on the margin). However, since Québec's system is only 9% thermal (including all potential imports), the pool's behaviour would probably resemble more closely that of a hydro-dominated market.<sup>19</sup> Rather than predictably reflecting real variable costs, prices in a Québec Power Pool would instead rise and fall in relation to participants' views of each others' strategic behaviour, not in relation to costs. Such an outcome is probably undesirable, since increased variability and unpredictability of the price of electricity – a public good – could have serious social and economic consequences.<sup>20</sup>

### 3. STANDARD SOLUTIONS

A number of well known solutions could be applied in order to alleviate these obstacles to effective competition. This section examines how these standard solutions could be applied in Québec, and identifies their shortcomings.

#### **a. Discriminatory Practices**

As noted earlier, the current configuration of Québec's electricity marketplace allows for a significant degree of discriminatory practices by the vertically integrated utility, Hydro-Québec. The standard solution to this problem is to separate generation, transmission and distribution functions into separate entities.

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<sup>19</sup> Significantly more analysis would be needed to determine precisely what share of thermal power would be required before this dynamic would change.

<sup>20</sup> It can be argued that such variability reflects market participants' judgements about the relative value and likelihood of spills and curtailment, and thus contributes to the effectiveness of the market. However, given the enormous distance between these two extreme conditions — especially in a system with large multiannual reservoirs like Québec — and the uncertainty in the values to be attributed to them, the benefits are unlikely to outweigh the costs.

Vertical separation of Hydro-Québec could be organized on either a functional (in-house) or corporate basis.

**Functional vertical separation.** If functionally separated, Hydro-Québec would continue to own (at least) three distinct entities, each of which would, in theory at least, be independently managed (both physically and financially). This option is not, however, free from the potential of abuse stemming from the utility's common interests. First, functionally separated “business units” could still attempt to share strategic information with each other. Second, HQ-Distribution could choose to purchase from HQ-Generation, even if its competitors’ offers are more attractive. And third, HQ-Generation could attempt to transfer costs to its regulated Transmission and Distribution “cousins”, thus entering these costs into a regulated rate base and improving HQ-Generation's competitive position. Each of these options would, in many cases, be in the corporate interest of Hydro-Québec, and could be organized in such a way as to “slip past” regulatory oversight.<sup>21</sup>

**Corporate vertical separation (divestiture).** Another option would consist of divesting each function (P/T/D) into entirely separate companies. This approach could be effective for dealing with the “common interest” problems noted above. However, if all three entities were to remain Crown Corporations (owned by the provincial government), problems would still remain, though to a lesser degree. Not only would a single entity (the provincial government) own each company, but it would also have the ability to discriminate in favour of its own companies through its powers to adopt laws, regulations and decrees, as well as to give directives to the Régie de l'énergie. For these reasons, among others, the MacDonald Commission proposed corporate divestiture of Ontario Hydro's transmission assets to a (non-generator) third party in its report *A Framework for Competition* (Advisory Committee 1996, 52-53).<sup>22</sup>

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<sup>21</sup> The most widely discussed solution — transferring control of the transmission system to an independent entity (ie. Independent System Operator, or ISO) — would alleviate only a part of the first of these problems.

<sup>22</sup> The MacDonald Commission stopped short of recommending against the new transmission owner being a Crown Corporation. However, it did propose partially or totally spinning off all of Ontario Hydro's hydroelectric and fossil fuel generation assets to the private sector, with the sole exception of its Niagara River hydro system (for fear of "considerable public opposition") (*Idem*, 65-69).

For all of these reasons, divestiture of at least two of the three units of Hydro-Québec to the private sector might become necessary to eliminate the possibility of discriminatory practices.<sup>23</sup>

### **b. Market Power**

As we have seen, Hydro-Québec's share of generation in Québec tops 90%, or 85% if import capabilities are included. These high market shares render impossible the development of effective competition under the current configuration of Québec's electricity market.<sup>24</sup>

Horizontal separation of generating units has been favoured to mitigate market power by the MacDonal Commission in Ontario as well as by regulators in California and New England. However, the size of Hydro-Québec's generating units renders horizontal separation inadequate to fully alleviate its market power.

As noted earlier, one complex (La Grande) accounts for over 40% of Hydro-Québec's generating capacity, while a second (Manic-Outardes) accounts for 18%, and a third (Churchill Falls) accounts for 15% (Hydro-Québec 1996a,b). Each of these complexes is composed of several individual stations but, because they share the same river system, it would be imprudent to break them up into separately managed facilities. As a result, even with full horizontal separation, the

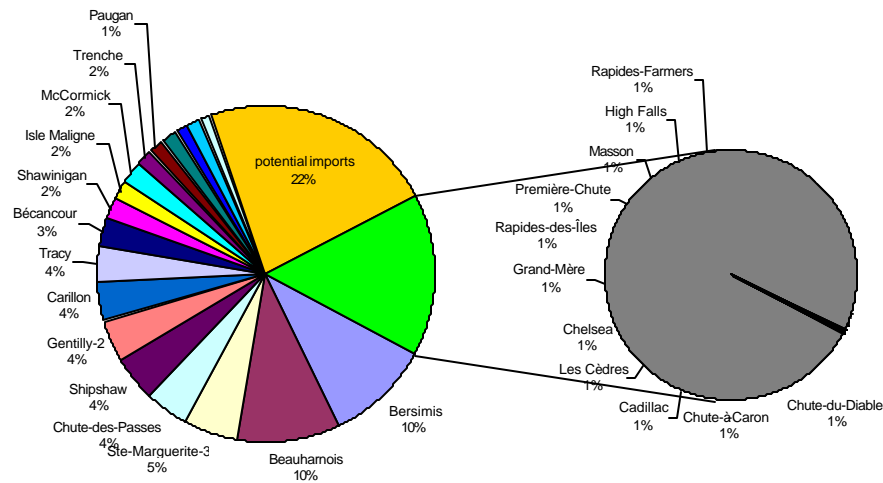
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<sup>23</sup> The potential for discrimination against natural gas-fired generators due to Hydro-Québec's effective control of Gaz Métropolitain is not addressed in this paper. It is possible, however, that specific measures would also need to be taken in this regard.

<sup>24</sup> It seems clear that, were this situation to occur in the United States, the FERC would not allow a producer with similar market share to compete in deregulated markets. Indeed, earlier this year, the FERC rejected the request of New York State Electricity and Gas Company (NYSEG) for power marketer status, due to its unmitigated market power (FERC 1997). The FERC is currently reviewing a Hydro-Québec application for energy marketer status (see De Ravel d'Esclapon 1997, Lindsay 1997, and Goodman and Carlson 1997), but this review is limited to Hydro-Québec's market power in the U.S. (Northeast) market. As the FERC has no mandate to protect Québec consumers, it has no jurisdiction to address market power issues within Québec.

Figure 3

Québec market shares after divestiture (major complexes excluded)



owners of these complexes would still be able to exercise significant market power.<sup>25</sup>

If these three large complexes were to be removed from the equation, however, horizontal separation would become a realistic solution to Hydro-Québec's market power. As can be seen in Figure 3, Hydro-Québec's remaining generation assets are composed of dozens of stations, none of which at first glance seem likely to possess excessive levels of market power.<sup>26</sup>

#### 4. A MADE-IN-QUÉBEC SOLUTION : THE LGMC CONTRACT

Given the inadequacy of traditional approaches to mitigate the market power of Hydro-Québec's three large complexes, which represent some two-thirds of the

<sup>25</sup> While the Manic-Outardes and Churchill complexes each represent less than 20% of the installed capacity in Québec, they would represent 30% and 24%, respectively, of the Québec market once La Grande was excluded. Thus, all three would have to be excluded in order to create a market where no single player has an average share greater than 20%. Furthermore, the market value of these large complexes is so great that it seems extremely likely that, were they to be privatized, control of some or all of their output would pass to foreign entities. It is hard to imagine such a transfer being acceptable to Québec's body politic.

<sup>26</sup> This figure does not take into account the fact that multiple power stations on certain rivers (e.g. the Saint-Maurice) would have to remain under single ownership. Furthermore, it is likely that some level of re-mergers should be allowed insofar as they do not exceed reasonable market shares.

generating capacity in Québec and supply some 85% of current system demand,<sup>27</sup> an alternative approach must be developed to remove them from any future competitive market.<sup>28</sup> One way to do this would be to assign their entire output to the distribution companies serving Québec consumers, at a rate based on their costs plus a return on equity.

### **a. Description**

This approach would require that a long-term contract be established ensuring that the entire output of the La Grande, Manic-Outardes and Churchill complexes (LGMC) be sold to Québec's distribution utilities,<sup>29</sup> and the complexes be dispatched strictly on the basis of their needs. Without these conditions, the owners of these complexes could still move power into and out of the competitive market. As a result, their power to affect market prices would remain unmitigated.

A contract of this nature would effectively remove these complexes from the market, and thus would permit the development of a true competitive market in Québec. At the present time, such a market would include some 17,000 MW of installed capacity, taking into account existing transmission constraints for imports. If competition were limited to wholesale access, HQ-Distribution would buy in this market for its additional needs, above those met by the LGMC contract, and the market would also be open to importers and exporters. If retail access were also permitted, end users would also be able to purchase in this market, and the LGMC contract would be used to supply the distributor's standard offer. Either situation could, in theory, occur bilaterally, through a power pool or both.

### **b. Prices and Market Impacts**

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<sup>27</sup> These three complexes generate some 139 TWh a year, out of the 160 TWh required to meet Québec's needs (Hydro-Québec 1996b, 57).

<sup>28</sup> Over the very long term, as Québec load grows, the market share of these complexes will diminish. However, for La Grande's average share to fall to 20%, for example, demand would have to increase by roughly 85%, which would take roughly 60 years at an annual growth rate of 1%, or 30 years at an annual rate of 2%.

<sup>29</sup> For simplicity, we will refer hereafter to HQ-Distribution as the recipient of this power. In reality, municipal distribution utilities should also be given a share, commensurate with their share of total domestic load.

In addition to being the largest generators in the Hydro-Québec system, these three complexes also are among the lowest cost installations in Québec. No data have yet been made public concerning the actual book value of Hydro-Québec's generating stations. However, the cost of the power purchased by Hydro-Québec from CF(L)Co's Churchill Falls project, which is presumably based on the actual project costs, is now in the range of 0.5¢/kWh and will fall further over the contract's lifetime. Since the Manic-Outardes complex was built even before Churchill, its accounting costs may be even lower. Finally, the La Grande project, put on line progressively throughout the 1980s and 1990s, is likely somewhat more expensive, but still significantly cheaper than either market prices or costs of new supply.<sup>30</sup>

The long-term contract that we describe here for consideration would reflect the full costs of each complex, including remaining financing costs, if any, amortization, operations and maintenance, and a reasonable return on equity. (In the case of Churchill Falls, it would simply reflect the contract costs.) Since these costs are far below the price levels that can be expected in a competitive market, regardless of the structure adopted, such a contract would guarantee Québec consumers rates well below those of the market.

In the event that retail access were to be permitted, the long-term contract would be used by HQ-Distribution to serve its standard offer. Since the LGMC contract price would be far cheaper than either market prices or costs of new supply, most consumers would probably choose to remain with the (regulated) standard offer. However, if demand for the standard offer were to exceed supply from those long-term contracts, HQ-Distribution would have to purchase additional power from the more expensive competitive market. As a result, the gap between the standard offer and the market price would decline.

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<sup>30</sup> The second phase of the La Grande project, finished last year, was much more expensive than the first phase. We estimate the current accounting costs for the second phase (generation only) to be over 4¢/kWh (\$7.2 billion in capital costs, almost 750 million in annual financing costs, 15.8 TWh annual production) (Hydro-Québec 1996b). However, Phase II counts for only 20% of total output of the La Grande complex.

In the unlikely event that demand under the standard offer were insufficient to use the energy purchased under the LGMC contract, care would have to be taken to ensure that the surplus power does not unduly disrupt the marketplace. Requiring that these complexes be managed based on the distributor's needs would mean that, in the first place, any short-term surpluses would be stored in their large, multi-annual reservoirs, rather than sold as surplus. Should reservoir levels rise to the point where spillage becomes a real risk, the distributor would then be empowered to sell the surplus on the open market.<sup>31</sup>

### **c. Advantages and Consequences**

In addition to allowing workable competition in at least part of the overall electricity marketplace, removing the LGMC facilities from competitive markets also provides societal advantages. Because this power would be contracted with Québec distribution utilities, it would effectively guarantee to Québec consumers the right to Québec's lowest cost power. Without such a guarantee, Québec consumers could eventually face price increases, since a large proportion of the power they now consume is supplied at a cost far below market prices. Such increases would be inequitable toward Québec consumers, since they have already paid much of the financing costs of these three complexes.

Hydro-Québec's average generation cost is roughly 2.6 ¢/kWh, while the market price is expected to fall in the range of 4¢ (CDN) in the medium term (CET 1997, 3). HQ's average costs include low-cost power from the older stations (probably under 1¢/kWh), as well as much more expensive power from newer stations (probably over 4¢/kWh). If all the power in Québec were to be sold at market rates, Québécois would therefore see their average supply costs rise substantially (precisely the opposite of U.S. consumers, who would see them fall). Such an outcome would undoubtedly be seen as unjust, since the existing plants were built with public funds to serve the long-term needs of Québec's population.

Guaranteeing Québec's lowest-cost power to Québec consumers would also affect Hydro-Québec's exports. Even if average supply costs are used as the

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<sup>31</sup> To our knowledge, no significant spills have occurred on the Hydro-Québec system since the mid 1980s.

benchmark, short-term exports have not been profitable in recent years.<sup>32</sup> If Hydro-Québec's low-cost power were to be reserved for Québec consumers, and thus not available for export, the supply cost for exports would unavoidably rise, reducing their profitability even further.

## 5. OTHER OBSTACLES AND IMPERATIVES TO COMPETITION

We have described several approaches, borrowed and original, which can be used to effectively mitigate most obstacles to workable competition in Québec electricity markets. Still, other obstacles remain, particularly in the case of a hydro-dominated power pool.

### **a. Market behaviour**

As briefly discussed earlier at the end of section 2, a power pool is normally designed to ensure that bids reflect variable costs, and that prices reflect variable costs of the most expensive plants. As such, it is expected that prices would be sufficient to cover total costs (variable and capital), particularly given very high prices during occasional demand spikes. However, where variable costs are nearly zero (as in hydroelectric systems), this approach would not allow for sufficient recovery of capital costs.

Even after removing the La Grande, Manic-Outardes and Churchill complexes from the Québec electricity market, it would still be dominated by hydroelectric generators, many with substantial storage capacity.<sup>33</sup> There is thus a risk that the market behaviour would be erratic, as participants' bids would be based strategically on their estimates of future prices.

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<sup>32</sup> The average revenue from short-term exports in 1996 was just 2.67¢, which must, in addition to generation costs, offset *transmission* prices of between 0.8 and 1.67¢ according to the transmission rates established in Bylaw 659.

<sup>33</sup> If we assume that the full import capacity is filled with thermal generators (fossil and/or nuclear), in addition to the 2,100 MW of thermal power now in Québec, 83% of installed capacity in the market would still be hydraulic.

A number of innovative market mechanisms have been proposed to improve upon the generic power pool design described above. One which may potentially resolve this problem has recently been proposed by two economists with the World Bank, in reference to Brazil, which also has a large hydroelectric system (Estache and Rodriguez-Pardina 1997). In a brief article, the authors propose a dual market, where the spot market in energy is supported by a second market for “firm energy certificates” (FECs). Before a distributor can purchase energy in the spot market, he needs to obtain FECs for each TWh of energy he wishes to buy<sup>34</sup>. FECs are automatically granted to generators in proportion to their expected annual energy output. Prices in this FEC market, which exists in parallel to the spot market, will over the long term reflect the costs of new supply, and will vary based on the changing equilibrium between supply and demand.

This concept has only been briefly sketched out, and requires much more reflection. Nevertheless, it is possible that this approach, or one like it, when coupled with the mechanisms we described earlier, might enable the orderly development of a competitive hydro-dominated Québec electricity market.

## 6. OTHER CONSIDERATIONS

The issues dealt with in this paper concern the requirement that any eventual deregulation of electricity generation in Québec be coupled with effective, workable competition, but this is only one of the many issues that must be addressed in the context of electricity industry restructuring. The electricity sector is unique in that it has such a significant impact on issues and objectives of greater public interest, including access by low-income consumers to essential services, protection of the environment and natural resources, the promotion of new, renewable generation technologies like wind and solar power, the exploitation of cost-effective energy efficiency potentials, the advancement of research and development, and a host of others.

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<sup>34</sup> The article specified that FECs could be traded among “generators, distributors, *large deregulated consumers*, and brokers (*our emphasis*)”, but did not clarify how this concept could be applied in a retail access market open to small consumers as well. Specific additional mechanisms may be required to this end.

These issues should not be allowed to be marginalized in any public policy discussion of electricity industry restructuring. Competition may have adverse impacts on the cost-effectiveness of market-based energy efficiency measures (particularly for small residential or commercial end-users), on the ability of intermittent renewables to compete in power pools and on the continuation of long-term R&D investments, among many others.

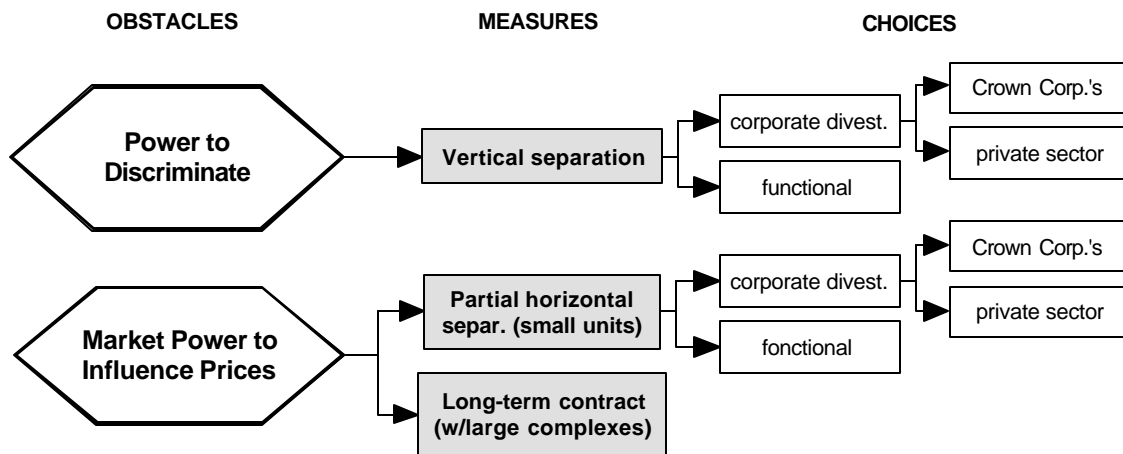
For these reasons, specific mechanisms may be required to protect and promote public interest goods in a competitive electricity marketplace. In particular, non-bypassable public goods charges to finance efficiency, new renewables, R&D and low-income consumer protection measures, tradeable credit schemes for new renewable generating technologies, levies on natural resource use, taxes, caps and/or trading schemes for pollution and/or greenhouse gas (GHG) emissions, network support pricing and scheduling practices for intermittent resources in power pools, green power labelling and certification, reverse metering and net billing, and a host of other mechanisms will require carefully study and consideration in order to ensure that, beyond ensuring competition, broader public interest objectives are equally achieved under a competitive electricity marketplace.

These issues must not be deferred until after decisions have been made on deregulating generation, but *should rather be integrated directly and explicitly into the broader discussion and debate.*

## **7. CONCLUSION**

For workable competition to be introduced into Québec's electricity marketplace, an important number of obstacles would have to be addressed (see figure 4). These would probably have to include full horizontal and vertical separation, as well as other mechanisms to exclude the largest hydroelectric complexes from the competitive market. Without such measures, consumers would not be adequately protected against abusive market practices.

Figure 4. Decision Points for Workable Competition in Large Hydro-Dominated Markets



Whether or not such changes are in the ultimate interests of Québeckers would require not only significantly more analysis of price and competition issues, but equally of broader issues of public interest, including those touching on environmental sustainability, energy efficiency and social equity. Still, it seems unlikely that such an overhaul of Québec's electricity marketplace would be deemed acceptable or even appropriate by the body politic.

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