

Inside Québec Energy Efficiency Initiatives

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ABSTRACT

The socioeconomic climate of the province coupled with its energy profile form a unique landscape for energy efficiency. Drawing from the best practices in the United States and the Government of Canada, Québec has formed an energy policy increasingly reliant on energy efficiency. New technologies, funding mechanisms, and public-private partnerships are supported by the three pillars of Québec energy policy; namely, energy security, economic/regional development, and sustainable development.

Industry participants from the United States and the rest of Canada can benefit from the lessons learned and practices adopted inside Québec's energy efficiency initiatives. This paper explores the Québec energy market, highlights provincial energy policy, and outlines the emergent trends in energy efficiency.

Conference organizers and industry analysts should look closely at Québec initiatives. Regional events hosted within the Province of Québec featuring a French language track would facilitate an important transfer of knowledge between Québec and other territories across North America.

Transitions within the Québec Energy Market

Like much of North America in the early 1960's, Québec was dependent on international markets to meet its demand for fossil fuels. In 1962, over eighty percent of Québec's energy demand was met by fossil fuels; oil (67%), coal (11%), and natural gas (4%).

With an emergent trend towards sovereignty, Québec began its transition towards a self-sufficient energy policy. Stimulated by the energy crisis of the 1970's, Québec emphasized the development of internal energy reserves. Subsequently, government initiatives began to favor hydroelectricity; thereby shifting Québec's energy profile. By 1982, energy consumption by fuel source was 53% fuel oil, 30% electricity, 9% natural gas, and 8% other.

With three large hydroelectric plants coming online, Québec entered an era of electric supply surplus and low electricity rates. Despite the Northern climate of Québec, electricity was implemented for residential heating. In 2002, electricity accounted for 69% of the home energy market. Furthermore, energy-intensive industries were attracted to Québec.

The introduction of industry throughout the province quickly raised energy demand. By 2002, Québec's energy demand had doubled since the early 1960's and concern over domestic energy independence returned. Québec's energy consumption was met by fuel oil (38%), electricity (38%), natural gas (13%), and other sources (11%). Notable trends in Québec's energy transition included the following:

- Coal effectively disappeared from Québec's energy profile,
- Electricity gained significant market share; especially in the residential sector,
- Overall energy demand rose significantly, and
- Québec returned as a net importer of energy.

International Factors Influence Québec's Energy Markets

Deregulation of the natural gas markets in both the United States (1978) and Canada (1985) were reinforced by The Free Trade Agreement (1988) and NAFTA (1993). Pressures towards deregulation also emerged within the North American electricity market (1966). Bill 116 which passed in the year 2000 differentiated electricity production from its distribution. Hydro-Québec was now free to explore business opportunities throughout the US Northeast.

Environmental issues and pressures for sustainable energy also emerged as an important factor within the province. The Rio Summit (1992), the Kyoto conference (1997), and the sustainable development meeting in Johannesburg (2002) fueled public interest in Québec's energy policy. The subsequent ratification of the Kyoto Accord (2002) and increasing demand for renewable energy supplies has framed energy policy.

Québec Energy Policy Highlights

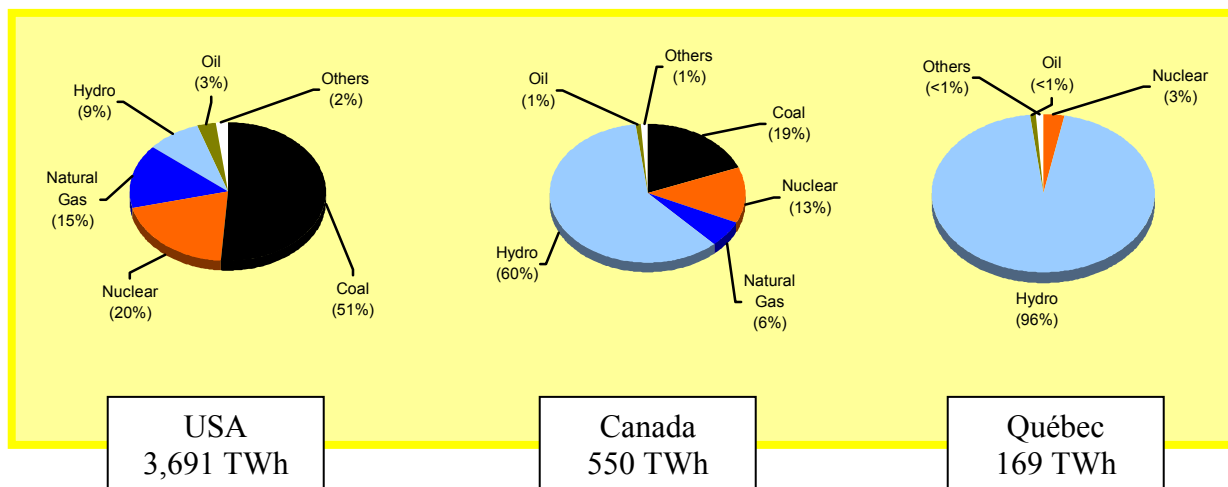
The three major themes emerging with regard to Québec's energy policy are 1) energy security, 2) economic and regional development, and 3) sustainable development. To better understand their importance, we need to explore the context in which these issues arose.

Energy Security

The Québec government solicited opinions from industry experts on the status of domestic energy production with respect to its consumption. The primary concern was to balance electricity supplies with increasing demand. The *Régie de l'énergie*, Québec's Energy Board, "noted the precariousness of the current supply situation and the degree to which Québec relies on imported power." (Resources Naturelles, Faune et Parcs Québec 2004, p. 8).

Even with additional capacity under development, Québec must consider rainfall and reservoir levels in their resource projections. Québec electricity production is tied to its hydroelectric investments. The figure below illustrates the differences between Québec's electric production and that of its North American partners (Favreau 2004).

Figure 1. Electricity Production in 2003



The conclusions submitted by the Québec Energy Board to the Ministry of Natural resources was "even if Hydro-Québec Production's uncommitted resources are taken into account, Québec still does not have sufficient flexibility and the needs of Hydro-Québec Distribution are such that imports are inevitable." (Resources Naturelles, Faune et Parcs Québec, 2004, p. 20).

With regard to fossil fuels, Québec intends to secure oil, gasoline, and natural gas at competitive prices. Since price and availability of fossil fuels are beyond the provincial jurisdiction, the Québec government must promote and defend its social and economic interests before the National Energy Board. As such, Québec remains a captive consumer for petroleum products as well as natural gas.

Renewable fuels like ethanol and biodiesel are not significant within Québec's energy profile. Still, renewable fuels are important strategically as alternatives to petroleum-based imports and greenhouse gas emitting energy consumption. For this reason, Québec has begun to integrate renewable resources such as wind generation power plants into their electric systems.

Energy expenditures accounted for 10% of *gross domestic spending* across Québec. By developing new fuel sources within Québec, the government hopes to diversify supply alternatives, leverage competitive pressures to control energy prices, and improve Québec's energy security.

Economic and Regional Development

The Province of Québec has invested heavily in its energy sector, over CAN \$2 billion annually. Of this amount, nearly 80% was invested in the electricity sector, which generates CAN\$2.8 billion in revenues annually. The energy sector as a whole provides 41,000 jobs and contributes \$8 billion in economic activity, representing nearly 4% of Québec's total economy.

The resulting industry expertise and untapped energy reserves will allow for regional development. Strong potential exist for addition hydraulic resources, wind generation, and even fossil fuel development. When coupled with dwindling oil and natural gas reserves from Western Canada, Québec's development of the oil fields in the Gulf of St. Lawrence provide an attractive option for expanded economic opportunity.

Further economic stimulus is expected from the management of supply and demand. If electricity prices are kept low, continued industrial development is assumed. Currently, metal smelting and paper industries account for 70% of industrial power consumption. The development and adoption of new technologies could greatly improve plant efficiency.

Energy efficiency investments could free energy reserves; thereby, opening export markets for electricity as well as other fuels. The exportation of electricity to the USA and other Canadian provinces remains a desirable economic outcome from widespread adoption of energy efficiency technology.

Sustainable Development

Economic and social development must be balanced with the resulting environmental impacts of a demanding energy market. Sustainable development reconciles social, environmental, and economic factors ensuring future generations are considered in the evolving energy policy of Québec.

At the heart of this debate are atmospheric contaminants. Québec is tracking the emission of carbon monoxide, nitrogen dioxide, sulphur dioxide, ammonia, sulphuric acid, volatile organic compounds, and particulate matter. As a result of this tracking, the government estimates the transportation and industrial sectors produce up to 90% of principal contaminants.

Global warming tops environmental concern throughout the province. The adoption of the Kyoto Protocol calls for a 6% reduction of greenhouse gas emissions over 1990 levels between 2008 and 2012. Given the predominance of hydroelectric power in Québec and other distinctions between provincial energy profiles, the Canadian government has decided to set Kyoto targets by sector rather than by territory. Evolving decisions over the next few months will undoubtedly impact Québec energy policy; especially with regard to its energy exports and renewable energy development.

The Québec Energy Efficiency Agency

While the Québec energy market was under transition, the government established the *Bureau des économies d'énergie* (1977) to promote energy conservation through energy education and to facilitate the home insulation retrofits. These efforts were continued under the *Bureau de l'efficacité énergétique* (1988) as Québec entered an era of electricity surplus.

In 1992, Québec developed an energy policy that asked industry participants to coordinate their efforts to achieve a 15% reduction in the province's energy intensity by the year 2001. The role of the Bureau was altered as Hydro-Québec installed \$538 million in energy efficiency measures during the early 1990's. By 1994, the Bureau was transferred to Québec City as the *Direction de l'efficacité énergétique*, a government office on energy efficiency. With the transfer, the energy efficiency office divested from program implementation and began to develop energy policy.

As Québec's projected energy deficit was highlighted, a renewed focus on energy efficiency emerged. The *Agence de l'efficacité énergétique* was established in 1997 under the Québec's Minister of Natural Resources, Wildlife, and Parks. With the government's focus on energy efficiency, the Agency grew its annual budget from CAN \$5 million (1999) to CAN \$10.5 million (2004).

However, despite continued support for energy efficiency in 2005, provincial budget deficits have jeopardized funding for the Agency. Today, parliamentary commissions are evaluating the fate of the Agency; on the table are discussions to co-opt utility-funded energy efficiency initiatives.

The Energy Board

Also established in 1997 was the Québec Energy Board, the *Regie de l'énergie*. The Energy Board protects the public interest in emerging energy policy and regulates energy industry participants. In 2000, Bill 116 amended the Board's mandate and introduced a competitive element for the supply of future electricity needs. As a direct result, Hydro-Québec production, transmission, and distribution activities were segregated.

Introduced in this Bill 116 was the concept of a *heritage pool*; whereby, Hydro-Québec Production must sell 165 TWh of electricity to Hydro-Québec distribution at an average cost of \$0.00279/kWh. Worthy of note is the fact that electricity consumption across Québec now

exceeds this 'heritage pool'. As a result, incremental electricity requirements are provided at market rates.

Affecting all utilities is the requirement of distributors to file a 10-year supply plan every three years and modify the plan annually as needed. These filings outline energy efficiency initiatives sponsored by Québec's distribution companies.

Québec Energy Efficiency

As the energy surplus of the 1980s receded, the stage was set for energy efficiency. By the late 1990s, utility distribution companies had filed demand side alternatives before the Energy Board. Serving as a guidepost were the three pillars of Québec's energy policy introduced earlier; namely, energy security, economic/regional development, and sustainable development.

An Economic Rationale

Richard Aubry, general manager of energy efficiency, at Hydro-Québec explained the economic rationale behind their proposed CAN \$1 billion energy efficiency plan. The apparent cost of reducing energy demand by 3 TWh is \$0.33/kWh. However, like other supply side options, energy efficiency investments persist for the life of the installed measures. As a result, the effective per unit cost of energy efficiency is just \$0.02/kWh.

When the cost of lost revenue (\$0.06/kWh) is included, the effective price of their proposed energy is just over \$0.08/kWh. This price is directly comparable to other supply side options, estimated at \$0.08-\$0.09/kWh. In fact, this economic rationale was used to establish the desired level of energy efficiency investment by the utility. A lower investment level leaves untapped opportunity while greater investments may risk the inherent cost-effectiveness of energy efficiency.

Still, there are other factors leading to the adoption of energy efficiency. Consumers have an opportunity to express their preference between new generation sources and demand side alternatives, so some intrinsic value must exist in favor of energy efficiency.

Nice and Pure

Translating a phrase from Québec French, energy efficiency is 'very nice/very pure', suggesting a universal acceptance by individuals throughout the Province of Québec. By offering energy efficiency programs, utilities could access and build relationships with key accounts.

Isabelle Gendron, an Energy Efficiency Advisor with Gaz Métro, saw the adoption of energy efficiency by Gaz Métro to be a result of good corporate citizenship. Gaz Métro found energy efficiency programs provided a unique opportunity to improve customer relationships, introduce new technologies, and contribute to the protection of the environment.

Competing Priorities

Mr. Aubry expressed similar sentiments on behalf of Hydro-Québec. The introduction of electro-technologies allowed businesses to become more competitive. One common theme underlying all energy efficiency investments was the continuing need for economic incentives.

Industrial accounts prioritized the expansion of plant capacity over cost containment. As such, investment dollars are spent on equipment, property, and processes that result in greater output. While cost containment remains an important strategy for corporations, few are willing to invest dollars simply to lower operational costs.

Whether you are serving the industrial sector or the single-family home, economics drive energy efficiency says Jean-Pierre Finet, General Manager of the *Fonds en efficacité énergétique*. The role of program representatives is to demonstrate how energy efficiency impacts cash flow.

He cautions this may not be as straight-forward as it sounds. In a territory where energy prices are low when compared with neighboring states and provinces, organizations are simply not scrutinizing utility bills. For industrial accounts in Québec, capital investments often must demonstrate a one-year payback, half that of the US-clients. As such, plant engineers faced a significant barrier when attempting to gain senior management approval for energy efficiency investments.

The solution was to include comparative benefit streams. Production managers wanted to know how new technologies would increase output. To accomplish this, plant engineers worked with energy efficiency representatives to design programs that improve productivity as well as lowering operational and maintenance costs.

The homeowner had a similar concern. While the general population is concerned over their utility bills, few understand the steps that can be taken to reduce these expenditures. Even fewer individuals understand the return on energy efficiency investments. Today, few banks are willing to allow their clients to "buy-up" when considering upgrading newly constructed homes to a higher level of energy efficiency. Individuals and supporting industries largely ignore the increases in discretionary monies and the subsequent benefits the reduced expenditures can generate for a family.

Drawing from Québec Energy Efficiency Initiatives

Gazifère, Gaz Métro, and Hydro-Québec offer energy efficiency programs to all customer segments. In many cases, these programs mimic successful programs from the United States. Typical programs include appliance rebate programs, financial assistance for both new construction and energy efficiency renovation, and energy education initiatives.

A number of innovations are emerging. New technologies and funding mechanisms have been developed and introduced into the market. Also, there is talk of consolidating the provision of energy efficiency through organizations similar to that of the Vermont Energy Investment Corporation.

The following text seeks to highlight emergent trends in Québec that may be applicable within the United States and throughout the rest of Canada.

Shareholder Incentives to Fuel Energy Efficiency

Energy efficiency is funded through a split incentive. Gaz Métro shares its productivity gains between ratepayers and shareholders. Shareholders retain 50% of the gains while 50% are returned to ratepayers. Ratepayers receive 35% as a bill refund with the remaining 15% going to the *Fonds en efficacité énergétique*.

The mission of the *Fonds en efficacité énergétique* is to supplement Gaz Metro's energy efficiency plan through innovations and the development of partnerships that 'maximize the returns of energy efficiency investments across the residential, commercial, institutional, and small industrial sectors'.

Social Housing and Community Service Providers

The *Fonds en efficacité énergétique* has a mandate to serve the low-income population within Gaz Métro's service territory. Jean-Pierre Finet has taken a unique and instructive approach to address Québec's disadvantaged populations. Three of four low-income initiatives target social housing projects, defined as housing cooperatives, non-profit housing, and privately owned housing specifically designated for economically disadvantaged families. Two additional housing retrofit programs address community service providers, such as soup kitchens, homeless shelters, etc.

The philosophy is simply to help those who serve populations in need. By doing so, the *Fonds en efficacité énergétique* is able to extend the range societal benefits of energy efficiency. The impacts resulting from these efforts are currently under study. Results are due in the 2nd quarter of 2005.

Innovative Technologies

An important role played by the *Fonds en efficacité énergétique* is the demonstration and implementation of innovative technologies. Currently, the organization has adopted the following technologies: solar walls, reflective panels, heat recovery drains, and green roofs.

Solar wall systems are typically installed on large south-facing walls. These walls typically feature an unglazed transpired solar air collector. The function of these solar wall systems is to pre-heat ventilation air. These systems often consist of dark metal absorber plates with tiny holes allowing duct fans to pull outside air into the building at near ambient temperatures. In addition to raising ventilation air temperatures, the solar wall systems can raise R-values to 50.

Reflective panels are fire resistant aluminized PVC pressed into sheets. These panels reflect 90% of the radiated heat back into the room. Furthermore, the fabricated air pockets also reduce conductive heat loss through the panels and exterior walls. The reflective panels are installed between heat radiators and the exterior walls. These low-cost retrofits can significantly improve (+10%) space-heating efficiencies.

Heat recovery drains were designed for commercial and industrial applications to pre-heat supply waters. Today, the *Fonds en efficacité énergétique* are experimenting with this technology within the residential market. This technology raises supply water temperatures increasing the effective capacity of hot water heaters. One key feature of the heat recovery drain

is its effective life. As a passive technology, the life of the measure is comparable to the life of the structure within which it is installed, often considered 30 to 50 years.

The *green roofs* initiative is not an emerging technology. Instead it is an ancient structural application that was lost with the modernization of the housing industry. The *Fonds en efficacité énergétique* is encouraging the vegetation of urban properties through financial incentives. The program requires 60% of the roof surface or building section to be covered with a minimum of 6" of soil or substrate. With this program, urban developers can meet municipal zoning requirements, the use of garden landscapes among new construction, while improving building heating/cooling efficiencies.

Public-Private Partnerships

Gazifère, Hydro-Québec, GazMétro, and the *Fonds en efficacité énergétique* have all chosen to support the provincial energy efficiency agency to help identify and serve low-income populations. Private organizations recognize the difficulty of identifying populations in need and have looked for community partnerships to assist with program outreach and service delivery.

This trend has also emerged within the United States; however, the partnerships have focused on community action agencies rather the government agencies for the delivery of program services. A close examination of the emerging public-private partnerships offers lessons to those on both sides of the border; especially at time when state and federal budget deficits threaten support for energy efficiency and conservation.

A Closer Look at Consumer Behaviors

The energy efficiency plans filed before the Energy Board rely heavily on consumer behavior to achieve the stated technical potential of chosen energy efficiency measures. Since Hydro-Québec's plan is still before the board, we will exemplify some of their proposed initiatives and the need to validate projected energy and non-energy benefits. Still, it is important to note, that many energy efficiency programs across Québec require a closer look.

Home diagnostic survey (280 GWh/\$60.7M). One million homes will receive a home energy diagnostic survey with coupons for two energy efficient light bulbs offered as an participation incentive. The surveys are to be completed and returned to the Hydro-Québec for analysis. Participating households get a report specifying energy efficient behaviors and measures that could be adopted to lower household energy burdens.

Having recently participated in this program, I can draw upon personal experiences to highlight potential inefficiencies. The survey was completed within 40 minutes and submitted via mail for analysis. A couple weeks later, we received the results suggesting the following: lower our thermostat setting to 20°C during the day and 17°C at night, maintain water heating at 60°C, take shorter showers, and disconnect unused freezers. By doing so, Hydro-Québec estimates are potential economic benefit to be \$63/year, representing 5.8% of our annual electric bill.

In this sample of one, the potential savings are far less than stated. We already keep our thermostat below the recommended set points, our water heater is already set at the recommended temperature, and we have no freezers to disconnect. Of course, we could take shorter showers, but perhaps this is compensated for by the presence of a low-flow showerhead.

As a result, we can benefit little by the recommendations. Even the complimentary light bulb coupons provided us were not redeemed; primarily due to the inconvenience of driving to the nearest Home Depot.

Promotion of Energy Star appliances (369 GWh/\$75.4M). Rebates are offered to those buying Energy Star rated appliances. Currently, the focus has been placed on electronic thermostats and pool filter timers. In addition to the free rider issues facing all rebate programs, the application of thermostats and pool filter timers require in-field observations to quantify energy savings. While electronic thermostats eliminate the inherent variability of mechanical thermostats, consumer interactions with these devices are certain to play a role in achievable savings. The same must also apply to timers.

Low-income home weatherization (45 GWh/\$19.8M). Government programs sponsored by Hydro-Québec encourage the renovation of low-income single-family households. The program includes a home inspection, energy education, low-cost measures, and the free installation of electronic thermostats.

The customer is asked to pay 10% of the significant home renovations undertaken in response to EnerGuide recommendations; such as envelope treatments. While this is a generous offering, low-income tenants and homeowners rarely have the discretionary income to contribute even modest amounts to home improvement. Participation rates must therefore be closely monitored to ensure the success of this initiative. However, since the initial draft, this deficiency has been resolved through the regulatory process.

Public awareness and governmental action (200 GWh). Hydro-Québec studies and integrates new technology into their programs across all market segments. The resulting programs and practices are communicated to industry stakeholders through a variety of methods. Where appropriate, the program allocates resources to assist government in the adoption of environmentally friendly alternatives and energy efficient technologies.

The published energy efficiency guidelines, resulting consumer awareness, housing standards, and technology adaptation are the primary outputs of this effort. One must decide what contribution this effort plays in resulting regulatory activity and legislative action before quantifying the impact.

In the case of legislative action, the impacts could be grossly understated. All major utilities agree that government action could lead to significant improvements in the provincial energy profile. Raising housing standards, legislating appliance efficiencies, and funding housing retrofits would effectively eliminate the need for ratepayer-funded initiatives and spread the costs over a larger tax base. In addition, government action could significantly speed the adoption of energy efficient technology; thereby, lowering the overall cost of energy efficiency.

In Conclusion

The socioeconomic climate of the province coupled with its energy profile form a unique landscape for energy efficiency. Drawing from the best practices in the United States and the Government of Canada, Québec has formed an energy policy increasingly reliant on energy efficiency.

An economic rationale still predominates utility-sponsored energy efficiency. Despite public support for sustainable development, utilities still rely on the total resource cost test to justify the use and magnitude of energy efficiency investment. As a result, Dunsky Energy

Consulting pointed out in hearings before the Energy Board that the level of energy efficiency investment by Hydro Québec, as a percent of revenue, lags the investments made by their North American counterparts (Dunsky, Belliview, and Plunkett 2005).

Québec utilities have used energy efficiency programs to gain access and establish closer relationships with key accounts. Noting competing priorities for capital investments, industry professionals now work closely with plant engineers and property developers/owners to move energy efficiency investments beyond the realm of simple cost containment strategies. Québec has developed energy efficiency initiatives that reduce energy and maintenance costs while also raising their client's competitive position.

At this time, utility ratepayers and taxpayers fund Québec energy efficiency investments. Although energy efficiency is supported within Québec, competing social priorities may jeopardize traditional funding sources. Recent economic cycles and government budget deficits have already eroded support for the *Agence de l'efficacité énergétique*.

The Energy Board authorized a shareholder incentive to create the *Fonds en efficacité énergétique*, rewarding utility shareholders for productivity gains while fueling energy efficiency with the remaining dollars. Productivity gains often remain year-after-year, providing an interesting on-going funding source for energy efficiency.

Electric and gas utilities have also favored legislative action to adopt energy efficient technologies and raise current housing standards. By doing so, the market would be forced into action with the whole of society sharing in the costs and benefits of energy efficiency, rather than the utility ratepayer.

Energy efficiency that targets social housing projects and community service providers are featured low-income programs. This innovative approach helps to extend the range of societal benefits resulting from energy efficiency while removing many of the barriers associated with identifying and serving low-income families.

Québec initiatives use technologies that have not been widely adopted throughout North America. Reflective heat panels are just one such technology. Opening a dialog with Québec energy efficiency experts could yield strategies for future program development. Attendance and active participation in energy efficiency and housing conferences held in the United States would be instructive to Québec industry leaders.

In the opinion of this author, regional events hosted within the Province of Québec, featuring a French language track, would facilitate an important transfer of knowledge between Québec and their North American neighbors; thereby publicizing what is inside Québec energy efficiency.

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