The Energy Sector in Québec
Context, Issues and Questions

Québec

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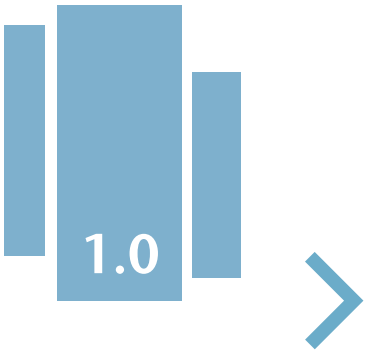
1. In this document, because of rounding, totals may not correspond exactly to the sum of the constituent parts. Unless otherwise indicated, the reference year for all the data is 2002.

INTRODUCTION



Introduction

The objective of this document is to support an open debate by presenting the main facts about Québec's energy sector, defining key issues and raising various questions. Some of the questions have also been submitted to experts, who have been asked to add extra information on specific topics. For the purposes of this document, the facts and issues have been set in their historical context and grouped under three main themes:

- Energy security
- Economic and regional development
- Sustainable development

With regard to energy security, the current debate is affected by the slower pace of development of new hydroelectric projects, coupled with higher than forecast demand for energy. This situation requires an examination of the security of Québec's energy supply and the balance between electricity supply and demand.

In its report advising the government concerning the security of Québec's energy supply and the contribution of the Suroît project, the Régie de l'énergie noted the precariousness of the current supply situation and the degree to which Québec relies on imported power. The security of the electricity supply depends, in particular, on ensuring diversity in the sources of supply, an element of key importance in ensuring reliability.

Regarding economic and regional development, there are strategic elements of which Québec must take full advantage: its hydroelectricity and the expertise built up around it. The same holds true for other energy sources, and especially wind energy which has considerable potential for generating economic benefits. In addition, if the presence of exploitable reserves of fossil fuels is confirmed, an outstanding opportunity for development would be created, especially in the resource regions in eastern Québec. Steps have already been taken to ensure that the specific environmental characteristics of the Gulf of St. Lawrence are taken into account when exploration work is carried out.

In addition to the benefits generated directly by investments in energy production, transportation and distribution, the availability of a range of reliable forms of energy throughout Québec is an important factor in economic development, since it attracts businesses that can take advantage of alternate sources of energy and the healthy competition between the various forms of energy. In some cases, energy diversity is a factor in increased industrialization, since it multiplies the number of different industries able to locate in a given region.

Québec has based a large part of its economic and industrial growth on the development and exploitation of its natural resources. In the energy sector, the main focus has been on the development of water power. A high level of industrial activity has been made possible by the availability of large quantities of hydroelectricity generated at costs among the lowest in North America.

Low electricity rates have led to a type of industrial development based, in particular, on industries that consume large amounts of power. Two sectors account for over 70% of total industrial consumption: metal smelting and refining, and pulp and paper. The chemical and petrochemical industry is also a major power consumer.

Lastly, environment quality and sustainable development are at the heart of public concerns in Québec, and constitute a key issue. Environmental requirements have become a part of our daily lives, affecting our individual and collective choices and raising numerous questions.

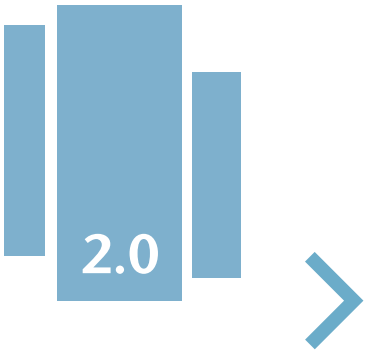
The government will deal in an open way with the ideas presented and proposals made during the consultation process, in particular during the parliamentary committee hearings that will be held next winter. Interested groups are urged to take part in the consultation process.

Already, thanks to the debates that have taken place in recent months and years, a number of fundamental values and principles are widely shared and will be taken into consideration during the deliberations of the Québec government. Priority will be given to:

- ensuring the availability, quality and continuity of energy supplies;
- developing energy resources, including hydroelectric resources, in a way that takes into account the environment, the local communities concerned and the principles of sustainable development;
- promoting energy efficiency and the development of other renewable sources of energy at the lowest possible cost;
- ensuring that consumers have access to as wide a range as possible of competitively-priced forms of energy;
- making Québec's energy sector a factor in the collective enrichment and prosperity of all regions.

Québec's energy strategy will be developed in an open way, with the ultimate goal of meeting energy needs in Québec using the most appropriate means available.

CONTEXT AND MAJOR ENERGY ISSUES IN QUÉBEC



The important role played by energy in ensuring the well-being of the population and economic development in Québec cannot be questioned. Today, energy is considered throughout the world as an essential service that is also a basic component in social and economic development, and this is especially true in Québec, due to its cold climate and vast territory.

In recent decades, the Québec population has come to take the availability and reliability of the energy supply for granted, in particular because of the abundance of water power. The development context of the last forty years may explain this perception, but cannot guarantee that it will remain valid in the future.

2.1 Recent trends in the energy sector in Québec, and related impacts

Québec's energy sector has undergone a series of radical changes since the end of World War II. It has had a considerable impact on Québec's economic development and regions, and on the collective well-being of all Québecers.

The first reliable data on energy consumption in Québec date from the 1960s. For example, in 1962 coal represented 11% of final energy consumption, oil 67% and natural gas 4%. Together, these three forms of fossil fuel accounted for over 80% of final energy consumption, with electricity making up the difference. Yet only ten years later, coal had practically disappeared from Québec's energy profile.

In the electricity sector, Hydro-Québec was created as a government initiative, and by the end of the 1960s it was already providing power to almost all of Québec's population, except for consumers served by a small number of municipal networks and one rural cooperative. The following years saw the large-scale development of Québec's hydroelectric potential, leading to a more abundant energy supply, the development of engineering expertise, and an energy consumption profile in Québec that is much different from those of virtually all its Canadian and US neighbours. One example of the difference is the wide-scale use of electricity for domestic heating.

In the fuel oil sector, Québec was essentially dependent on international markets until 1973, when it began to receive supplies from Canadian and foreign sources following the two oil crises of 1973 and 1979. The emphasis on hydroelectric development, partly to reduce Québec's dependency on imported oil, increased.

In the natural gas sector, only Montreal and Hull were linked to the Canadian distribution network prior to the 1980s. In 1979, natural gas accounted for only 7% of Québec's energy consumption.

In 1982, energy consumption in Québec was divided as follows: fuel oil, 53%, electricity, 30%, natural gas, 9%, and biomass, 7%. A new period of change was about to begin.

Hydro-Québec continued to develop hydroelectric power. After Manic - Outardes and Churchill Falls came James Bay. Between 1976 and 1988, over 1,200,000 households switched to electric heating, and the electricity surpluses generated as the various power plants were brought into production attracted energy-intensive businesses. Electricity accounted for a substantial portion of consumption in both the industrial and residential sectors.

Natural gas became available in other areas of Québec, first in greater Québec City, and then in other regions. During this period, the industrial and commercial sectors were responsible for almost 90% of Québec's total natural gas consumption.

Fuel oil retained its monopoly in the transportation sector and a substantial part of the residential sector. After a period of about fifteen years during which supplies came from both the international market and Western Canada, Québec began to rely once again almost exclusively on the international market during the 1990s.

In 2002, electricity and fuel oil both accounted for 38% of energy consumption in Québec, with natural gas and biomass representing 13% and 10%, respectively.

Between 1962 and 2002, in other words over the space of forty years, the total demand for energy in Québec more than doubled. Over the same period, the share of electricity in total energy consumption doubled, while the share of fuel oil shrank by one-third.

A sector-by-sector examination of energy consumption shows the increasing trend of some energy sources. In 2002, electricity supplied 69% of residential energy needs, and space-heating needs are the main factor in peak electricity demands.

On the other hand, fuel oil meets practically all needs in the transportation sector, whether for road, air, sea or rail traffic.

The institutional and commercial sectors represent 34% of the natural gas and 18% of the electricity consumed in Québec. About 13% of needs in the industrial sector are met by fuel oil, a figure that is well below that for other areas in North America and many industrialized countries.

International factors, as well as decisions made in Québec during the 1960s and 1970s, have had an impact on trends in Québec's energy sector. In the coming decades, other major changes could occur that will also affect the Québec population.

The deregulation of natural gas markets in North America, which began in 1978 in the United States and 1985 in Canada, had a major impact on the energy sector. The Free Trade Agreement signed by Canada and the United States in 1988, followed by NAFTA in 1993, confirmed the trend toward market deregulation.

In an effort to reduce prices in the United States, the Federal Energy Regulatory Commission (FERC) introduced a series of measures, beginning in 1996, to restructure the North American electricity market. Hydro-Québec had to separate power transmission from its other activities, and to provide open access to its transmission grid on a reciprocal basis. Bill 116, adopted in June 2000, deregulated production to increase competition in electricity supplies, and also finalized the functional separation of Hydro-Québec's activities by creating a production division and a distribution division.

By opening up its transmission grid, Hydro-Québec was able to maintain its access to the US power market and take advantage of business opportunities, especially in the US Northeast. It retained its ability to import power as needed, for example to purchase power for later resale or to raise the level of water in its reservoirs. The new context has given extra flexibility and has created opportunities on the short-term power market that did not exist previously.

The increased attention paid to environmental issues and sustainable development are also a new factor in the evolution of the energy sector in Québec.

The Rio Summit in 1992, the Kyoto conference in 1997, which led to the Kyoto Protocol, and the sustainable development meeting in Johannesburg in the fall of 2002, all changed public perceptions of the future of the energy sector. All energy development must take environmental impacts into consideration, and comply with the principles of sustainable development.

To meet these challenges and position Québec on the world energy stage, successive governments adopted energy policies in 1978, 1988 and 1996. The rapid pace of change in recent years has now made it necessary to devise a strategy, based on a new approach.

2.2 Underlying trends in the energy sector

2.2.1 Some lack of diversity

Since two components in Québec's energy profile each account for over 38% of total consumption, there is an apparent lack of diversity. However, even though electricity accounts for 38% of energy consumption in Québec, the fact that it is mainly produced within Québec makes our energy supply more secure.

This advantage, however, is tempered by three elements:

- In 2004, Québec was a net importer of electricity;
- Precipitation is a risk factor completely outside the control of Hydro-Québec; despite the abundant rainfall of 2004, its reservoirs are not "full to the brim" as sometimes stated, and water levels remain a concern due to the random nature of precipitation;
- The widespread use of electricity for residential heating creates pressure on Hydro-Québec's capacity during peak periods in winter, when an equipment unavailability would have the most critical consequences.

According to some experts, long-term forecasts for planetary oil supplies suggest that proven reserves will be able to meet needs for only the next 40 years.

Given that demand from Asian countries is expected to increase dramatically, the availability of reasonably priced fuel over the coming decades will gradually decrease. However, fuel oil will continue to be the main source of energy in the transportation sector. This suggests that the present use of oil should be re-examined, along with the possibility of gradually substituting other products for oil in other sectors.

Clearly, there is a need to increase the pace of new hydroelectric development, but the widespread reliance on electricity in the residential sector (winter peak period) and the industrial sector (energy-intensive industry) should be re-examined in the current context. This raises the question of what percentage of energy consumption in Québec should be met by electricity, especially for space heating.

Natural gas accounts for a percentage (13%) of total consumption in Québec that is far lower than elsewhere in Canada and North America, suggesting that it could be considered as an alternative to oil and electricity, especially in the residential and industrial sectors.

Natural gas is the most efficient fossil fuel for heating, and its availability is an important factor in industrialization and business location. Some experts consider that proven reserves will be able to meet demand for about 70 years, almost twice as long as oil.

Lastly, the possibility that natural gas will be found in the Gulf of St. Lawrence, even though less likely than a connection by pipeline or sea-tankers to other natural gas production sites, must be taken as seriously as these other two options, since all three could increase the security of gas supplies.

The contribution of other sources of energy (including thermal sources such as biomass and cogeneration, wind energy, biofuels, geothermal energy, solar energy, etc.) must also be examined in depth. These sources could be promoted, if they are found to be initially able to complement existing sources and, over the long term, able to make a significant contribution to energy consumption.

Energy efficiency will remain a key element in the short- and long-term planning of energy consumption in Québec. Energy efficiency helps to:

- reduce growth in energy demand;
- create a longer time-frame for diversifying and consolidating energy supplies;
- create a more competitive economy.

However, energy efficiency alone cannot compensate for increasing demand, in particular because of the cost of energy efficiency measures and the fact that energy efficiency depends to a large extent on individual consumer choices.

2.2.2 Rising prices

Decreasing fossil fuel reserves worldwide, the non-renewable nature of fossil fuels and the increase in demand will all place upward pressure on prices over the long term.

In an open market, this situation will also place upward pressure on the price of electricity in Québec. In addition, new sources of electricity supply will cost more to bring into production than those currently in operation.

If electricity supply in Québec once again exceeds demand, interesting export opportunities may open up. On the other hand, if demand exceeds supply, then power imports will be more costly.

In a context where non-renewable energy resources are declining and energy costs are rising, it is important for Québec to minimize the resulting impact on the population. This raises the question of the competitiveness of Québec's economy, and more specifically of how an energy strategy can help conserve all development possibilities for the Québec population.

2.2.3 New factors in energy development

During the 1980s and 1990s, Québec enjoyed a considerable surplus of electricity. The perception remains that Québec still has an energy surplus, which is not in fact the case.

New energy projects are now developed in a context in which their environmental impacts are better understood. This helps ensure that projects are environmentally and socially acceptable, as well as economically viable.

Thus, the concept of sustainable development, widely supported by the Québec population, requires a balance between environmental protection and sustained resource viability on the one hand, and energy security and economic growth on the other.

At the same time, it is important to remember that per-capita greenhouse gas emissions in Québec are only half those recorded in the rest of Canada, a situation that must be recognized.

2.3 Energy issues in Québec

Several energy issues must be examined, in view of their current or foreseeable impact on Québec's economic, social or environmental interests. Only by making an appropriate and suitable response to each issue will Québec be able to ensure its energy security, which will otherwise depend on decisions made elsewhere, possibly to Québec's detriment.

First issue: diversify Québec's energy sources

Diversification:

- allows demand to be met by reliance on various forms of energy;
- can give Québec a competitive advantage: it is more advantageous to invest and do business in a jurisdiction where various forms of energy are available at advantageous conditions;
- reduces the need to rely on alternative solutions imposed by circumstances;
- encourages the use of the right form of energy in the right place, improving economic performance;
- promotes competition between various forms of energy, and helps make established businesses more competitive.

To achieve and maintain an optimal level of diversification, Québec must answer the following questions:

- What forms of energy should receive priority in Québec?
- What should be the target use of each form of energy, and its percentage in total consumption?
- What price is Québec prepared to pay for each form of energy?
- How dependent does Québec want to be on imports of a given form of energy?
- What measures is Québec prepared to take to attempt to produce, within its territory, the types of energy it currently has to import?

Second issue: increase the reliability of Québec's sources of supply

Reliable sources of supply for Québec reduce the risk of:

- a breakdown in supply;
- imbalance between energy needs and the ability to meet them;
- rising energy prices;
- rate shocks.

Energy supply stability helps to:

- make Québec's economy more competitive: employers and workers all benefit from the stability of energy supplies for their businesses;
- facilitate the forecasting of supply with respect to demand;
- improve the ability to adapt to economic changes.

To consolidate its energy supplies, Québec will have to answer the following questions:

- What types of electricity generation does Québec wish to promote, in what proportion and at what cost, among the following: large hydroelectric projects, small hydroelectric power plants, wind farms, natural gas-fired or oil-fired power plants, nuclear power plants, cogeneration, biomass generation?
- What types of transportation and distribution infrastructures for natural gas (pipelines, methane terminals) and fuel oil (pipelines, ports) is Québec willing to accept to ensure stable, diversified supply?
- What approval processes does Québec intend to use to ensure that projects that require reliable sources of supply are built?
- What level of risk is Québec prepared to accept with regard to rainfall, a factor beyond its control?

Third issue: ensure at least a balance between electricity supply and demand

The balance between electricity supply and demand over the short and long term, must be studied as a priority due to the important role played by electricity in Québec's economic and energy profile.

Hydro-Québec was a net importer of electricity in 2004. If this situation continues, Québec will be subject to the random nature of the North American market, where residential consumers in Toronto and New York pay electricity rates that are respectively 1.5 and 4.5 times higher than in Québec.

Over the medium and long terms, a re-establishment of supply surpluses would allow Québec to take advantage of the growing demand for power in North America and generate benefits for the entire population by increasing Hydro-Québec's profits.

To prepare for the new context and establish a defence against possible shocks, Québec must answer the following questions:

- At what pace should Québec's electricity generation capacity be increased?
- Should steps be taken to encourage the substitution of other forms of energy for electricity? Which forms of energy should be promoted?
- What excess capacity should Québec target to protect its population from the electricity rate increases and supply problems experienced elsewhere in North America, and to have its population benefit from selling, if so decided, electricity surpluses on North American markets?

Fourth issue: fair energy prices

In contrast to oil and natural gas, which are traded at market prices, the electricity consumed in Québec is sold at preferential rates compared to the North American market in general. This has several repercussions that should be examined:

- there is a tendency to use electricity for purposes for which other forms of energy would be more efficient, such as natural gas for heating;
- low prices can encourage over-consumption of electricity;
- some energy efficiency measures can appear less attractive because of the small savings they represent;
- industry can become dependent on abnormally low electricity rates compared to the North American context, placing its profitability and the jobs it creates at risk.

To avoid maintaining an artificial situation in terms of electricity rates, which is ultimately paid for by all Québec consumers, Québec must examine several questions some of which come under the authority of the Régie de l'énergie:

- What is a fair price for Québec's electricity?
- What is the net result, for Québec society as a whole, of the current low electricity rates?
- Are the low rates beneficial or detrimental, over the long term, to a competitive economy, job creation and job retention in Québec?
- Do low rates make energy efficiency measures less attractive?

Fifth issue: reconcile reliance on energy and sustainable development

In Québec, there is an imperative need to reconcile economic development, the preservation of the environment and its resources, and respect for local communities, all of which must cohabit with energy security.

That brings forth at least the two following questions:

- What comparative advantages can Québec's ecomomy rely on in order to ensure a sustainable development while securing and diversifying its energy supplies?
- How can Québec maintain its standard of living while harmonizing economic and social development with ongoing resource viability and the preservation of the environment?

2.4 The present situation

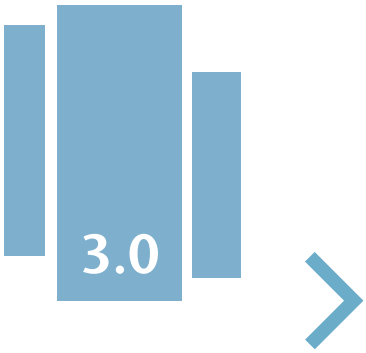
The only constant factor that emerges from this overview of the last forty years and the current and foreseeable energy situation in Québec is that change in the context and issues has been continuous, and sometimes sudden.

Over the space of 40 years, coal has practically disappeared from Québec's energy consumption profile and the share of fossil fuels has dropped from 81% to 52%, while the share of electricity has doubled from 19% to 38% and total consumption has more than doubled.

The changes forecast for the coming decades will be at least as important. It is time to build on our strengths, such as hydroelectricity, to increase the diversity and reliability of our supplies, and to prepare now for our energy future.

The following pages detail the context, issues, and problems in Québec's energy sector, to give readers an understanding of the importance of the decisions that will be made for the future and for future generations.

ENERGY SECURITY IN QUÉBEC



3.1 The issues

One of the major issues currently facing Québec is electricity supply security. The difficulties experienced in Ontario and California in recent years, in two completely different contexts, illustrate some of the possible effects of an imbalance between electricity supply and demand. The upward pressure on prices resulting from such an imbalance can create an enormous additional cost for society. The major blackout that occurred on August 14, 2003, also provides a striking example of the consequences of an insufficiency or failure of electricity supply.

Québec cannot afford to take risks that could compromise the reliability of its electricity supply. In winter peak periods, the comfort and security of the population could be seriously affected by a loss of network reliability. In addition, the development of Québec's economy could be slowed by such a loss, with repercussions on our social development.

For the time being, Québec no longer has an electricity surplus, since it already imports electricity. Although the addition of new production capacity may restore the situation in coming years, several risk factors must be taken into consideration, including rainfall, reservoir levels, growth in demand, the difficulty of predicting the dates at which various facilities currently in the planning or construction stages will come on line, and dependency on electricity. It is up to the government to make sure the Québec population is guaranteed a high level of security in terms of electricity supply in the medium and long term.

The Régie de l'énergie, in its report to the government on energy security in Québec, concludes that 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.

In the area of fossil fuels, the government's objective is to ensure a secure supply of oil, gasoline products and natural gas at competitive prices.

The price and availability of crude oil depend on the economic context and international geopolitical situation, both factors over which Québec has no influence. The main role played by the Québec government with regard to fossil fuel supplies is to promote and defend the social and economic interests of Québec at hearings of the National Energy Board (NEB), in order to influence decisions that could have impacts on fossil fuel supply security in Québec.

Petroleum products occupy a strategic position in the daily lives of Québecers, especially in the transportation field. Government monitors the petroleum product market closely in order to be aware of the realities of the marketplace.

Québec is a captive consumer of natural gas supplies from a single production source, the sedimentary basin of Western Canada mainly concentrated in Alberta. However, over the last few years and like other production areas in North America, the sedimentary basin has shown signs of depletion, despite increasing exploration in recent years. In addition, Québec receives its supplies through a single natural gas carrier from Western Canada.

Emerging renewable fuels such as ethanol and biodiesel currently contribute only modestly to Québec's energy profile. However, they offer numerous advantages, for example by reducing dependency on petroleum and imported petroleum products, generating economic benefits from raw material production and processing, and reducing net greenhouse gas emissions. Like growing numbers of European, Asian and American countries, Québec would benefit from encouraging the development of renewable energy within its territory. Some other Canadian provinces have already begun to do this.

By developing these new fuels, Québec would have access to new energy sources, allowing it gradually to diversify its supplies and increase the competition between the different forms of energy. The combined effects of diversification and competition would help ensure the reliability of supplies and ensure best possible costs.

The broad range of energy forms to which we should have access is also an important issue in supply security. Fuels such as heating oil, natural gas and propane play a complementary role, helping to reduce the demand for electricity, especially during peak periods, and thus reducing pressure on electricity production facilities. This type of flexibility is extremely valuable in a strategy aimed at securing supplies.

The government's responsibility in the area of energy security, in addition to promoting the supply and availability of energy throughout Québec, includes taking the appropriate steps to ensure that energy is managed efficiently so as to limit growth in demand.

Appropriate energy tariffs that reflect the actual value of each source, also help to regulate consumption and ensure that consumers use the best energy source for a particular application.

Energy accounts for almost 10% of gross domestic spending in Québec. Taking steps to reduce its relative weight will involve making efforts to reduce energy consumption, optimizing energy efficiency measures, and managing energy demand in a way that minimizes supply needs and the impact of energy bills on the various categories of consumers. It will also involve effectively coordinating the actions of the main players in the sector, namely the Régie de l'énergie, energy distributors, the Agence de l'efficacité énergétique, and the government departments concerned.

The effective management of Québec's energy resources will also require a re-examination of our current methods, including the role played by the private sector in energy supplies, possible changes to the current regulatory framework, the role played by technological innovation, research and development, the use of benchmarking to place Québec at the same level as the leaders in the sector, and so on.

Economic and social bases

The rules governing the energy sector are market based, although set in a regulatory framework. The supply and demand of energy respond to a series of market conditions, such as those resulting from the integration of the North American market. To move too far away from those conditions could have negative impacts on the population and the economy of Québec.

The government must ensure conditions that enable energy to be produced at the lowest possible cost to meet domestic needs.

The effective management of the energy sector has a positive effect on the government's ability to meet the social needs of the community.

3.2 Electricity

Québec has a great asset in the form of major reserves of water power, which provide a renewable source of energy with low environmental and climatic impacts compared to other conventional forms of electricity generation.

Since the nationalization of electricity, the development of hydroelectric potential has taken on symbolic importance for the Québec population as a whole. Currently, the total capacity available to Québec is around 43,000 MW, of which 40,250 MW is generated by water power.

TABLE 1

TOTAL AVAILABLE POWER GENERATING CAPACITY IN QUÉBEC (AS OF DECEMBER 31, 2003)

	MW
Waterpower	35,126
Churchill Falls	5,128
Wind power	104
Thermal power	2,592
Total	**42,950**

Québec still has major undeveloped hydroelectric capacity, estimated at 45,000 MW, of which almost 20,000 MW has economic potential in the current context.

Megawatts (MW) and terawatt-hours (TWh)

It is important to distinguish between two concepts used in the electricity sector - the amount of available power, and the amount of energy produced or consumed in a given period of time. In the first case, the megawatt or MW (1 million watts) is the unit used to state the amount of power that a facility or network can supply at any given time. In the second case, the terawatt-hour or TWh (1 million million watthours) is the unit used to measure the amount of energy supplied or consumed over a given period of time.

The number of TWh that a hydroelectric facility can supply depends mainly on the amount of water available to power its turbines, and the capacity of the turbines in MW.

For example, in Québec, the amount of energy needed to meet the highest peak demand during the winter of 2004 was over 36,000 MW, and the quantity of energy sold by HQD during 2003 was 167.1 TWh.

For comparison purposes, 1,000 MW is equivalent to the peak winter demand of around 50,000 houses, and 1 TWh is the amount of electricity consumed in a year by 37,700 houses that have a ground area of around 10 metres by 15 metres and use electricity to meet all their energy needs.

3.2.1 Hydroelectric projects

Five hydroelectric projects, with a total capacity of over 1,500 MW (8.1 TWh annual production), are currently under construction and are scheduled to come on line between 2005 and 2008.

TABLE 2

HYDROELECTRIC POWER PLANTS UNDER CONSTRUCTION

Projects	Installed capacity (MW)	Average annual production (TWh)	Total Cost of project including transmission ($ million)
Grand-Mère (addition)	81	0.2	506
Toulnustouc	526	2.7	1,080
Mercier	51	0.3	145
Eastmain-1	480	2.7	2,300
Péribonka	385	2.2	1,351
Total	**1,523**	**8.1**	**5,382**

In each case, the project has proved to be economically viable, and will be implemented in accordance with environmental protection regulations and with due respect for the local and Aboriginal communities affected.

Even with the addition of these projects and other projects on which bidding has started, Québec could face a critical imbalance between electricity supply and demand over the short term.

The Régie de l'énergie, in its report to the government on energy security in Québec, observed that, with average rainfall and reservoir levels, Hydro-Québec Production will be unable to respond to Hydro-Québec Distribution's additional demands in 2005-2008, and will need to work to capacity to do so in 2009-2011. If rainfall is low, the situation is even worse, and Hydro-Québec Production simply does not have the flexibility to respond to Hydro-Québec Distribution's additional demands. In such a case, Hydro-Québec Production and Hydro-Québec Distribution would be forced to import as much electricity as their network connections would allow.

Even the better conditions recorded in 2004 have not radically changed the Régie's conclusions, given the basic uncertainty concerning fluctuations in rainfall. The energy security of the Québec population should not be dependent on climate variations.

Three other hydroelectric projects, two of which are large-scale, are currently being examined by Hydro-Québec. They have a total capacity of about 2,400 MW and would produce 16.1 TWh annually, coming on line between 2008 and 2015.

TABLE 3

HYDROELECTRIC PROJECTS UNDER EXAMINATION

Projects	Installed capacity (MW)	Average annual production (TWh)	Total Cost of project including transmission ($ million)
Eastmain-1A Rupert Diversion	770	7.7	3,000
Rapides-des-Cœurs and Chute-Allard	138	0.9	722
La Romaine	1,500	7.5	6,624
Total	**2,408**	**16.1**	**10,346**

The projects under construction or currently being considered represent a total installed capacity of roughly 3,900 MW, and a potential annual production of 24.2 TWh.

By way of comparison, in 2003, Hydro-Québec had a total capacity of around 38,500 MW and produced a total of 180.8 TWh for domestic consumption[2].

Completion time for hydroelectric projects

The completion of a hydroelectric project can take around ten years, including the time needed to obtain permits, construct the project and bring it on line. The length of the process also depends on conducting preliminary studies, dealing with the results, and negotiating with local communities. New projects must therefore be planned on a twelve-year time frame, and all the risks must be carefully analyzed.

The easy availability of electricity and its very low price have been key factors in the energy choices of residential, commercial and small and large business consumers. They have also had a significant impact on the use of other types of energy.

2. Comprising 167.1 TWh in sales and 13.7 TWh in transmission and distribution losses.

3.2.2 Diversification as a way to meet the demand for electricity

Small hydroelectric power plants

In addition to sites where major hydroelectric projects can be developed, Québec has considerable potential in the form of smaller sites where water power can be harnessed at a competitive cost and can contribute to the economic development of Québec and its regions while helping to secure energy supply.

The first program to build small power plants was launched by the government in September 1990 and managed by the Ministère des Ressources naturelles. It led to the completion of 57 projects over a ten-year period, with an installed capacity of 250 MW.

Much of the work over this period was directed at restoring and re-harnessing a number of abandoned sites. In Québec, there is still potential for the development of this kind of power plant.

In May 2001, the Québec government designated 36 sites on public land as part of a new program to grant water power rights for small power plants of 50 MW or less. The government decided, in November 2002, to select only three projects to build power plants on sites where a dam already existed: the Quinze dam in the Abitibi-Témiscamingue region, and the dams on the Magpie river on the North Shore and the Matawin river in the Lanaudière region.

Only a small number of rivers are affected by the construction of small power plants. It is important to note that Québec has around 4,500 rivers, of which 525 have viable hydroelectric potential. To date, 63 of these rivers have been harnessed to provide hydroelectric power, including those used by autoproducers[3] and those with large dams built by Hydro-Québec.

Until now, the government has supported the pursuit of this energy source, provided that the sites are developed in a way that:

- leads to competitive production costs;
- receives support from a significant percentage of the population;
- respects the requirements of eco-tourism;
- complies with environmental protection regulations;
- generates appreciable local economic benefits.

Wind power

Wind power is a renewable energy source that has potential as a complement to hydroelectric power. The flexibility offered by hydroelectric generation can be used to compensate for the intermittent nature of wind power, and in return, wind power, once acquired by Hydro-Québec Production, could in certain conditions reduce the need to use the water stocked in reservoirs.

The history of wind power in Québec

Wind energy was first harnessed in Québec by wind generators on the Gaspé peninsula. Development began with the construction of the Hydro-Québec experimental farm at Saint-Ulric de Matane in 1998. The following year, two wind farms with a total capacity of 100 MW were built in the Cap-Chat and Matane sectors, jointly known as the *Parc éolien Le Nordais*. Since then, over 10 MW of capacity has been added and a further 99 MW will be installed at Murdochville by the end of 2005. In addition, following the announcement made on October 4, 2004, a wind generating capacity of 990 MW will be added between 2006 and 2012 in the Matane regional county municipality and other areas on the Gaspé peninsula.

3. Companies that also produce electricity for their own exclusive use.

In March 2003, the Québec government published the *Regulation respecting wind energy and biomass energy*, which requires Hydro-Québec Distribution to purchase wind power produced in Québec from an installed capacity of 1,000 MW. The call for tenders was issued on May 12, 2003 and the deadline for submitting a bid was set at June 15, 2004.

The names of the winning bidders were announced on October 4, 2004, and contracts could be signed by December 2004. Hydro-Québec Distribution has announced that it has selected eight projects with a total capacity of 990 MW. The average cost of the power produced is 6.5 ¢/kWh. The average total cost to acquire the power, including transmission costs (1.3 ¢/kWh) and balancing costs[4] (0.9 ¢/kWh), is 8.7 ¢/kWh. In all, a total production of 3.2 TWh is guaranteed by the successful bidders, based on an average capacity factor[5] of 36.6%. The wind farms will be brought into service between 2006 and 2012.

In comparison, the cost of the power produced at the La Romaine hydroelectricity generating plant (1,500 MW) is anticipated to be 8.17 ¢/kWh when the plant is brought into service in 2015, or around 7.0 ¢/kWh in 2007 dollars. The difference of 1.7 ¢/kWh in favour of water-powered production therefore constitutes an estimated additional annual cost of $54 million (in 2007 dollars) for the wind energy purchased.

On July 5, 2004, the Québec government announced that it intends to increase wind-generating capacity substantially in the short term. The government has asked Hydro-Québec to purchase as quickly as possible an additional 1,000 MW of wind power, bringing the total amount required by government to 2,000 MW.

The government has introduced two refundable tax credits to support the development of wind power. It has also taken steps to assess Québec's exploitable wind energy in a more precise way. Among other things, it issued a call for tenders on October 21, 2004, for a survey of Québec's exploitable wind energy potential and an assessment of the amount of wind power that could be integrated into the Hydro-Québec network. This type of analysis is essential to ensure that enlightened decisions are made concerning future wind power development in Québec. Given the intermittent nature of wind energy, its maximum potential contribution to Québec's energy portfolio must be assessed carefully to ensure that the stability of the electricity network is not adversely affected, in terms of either power or frequency. Generally speaking, a wind energy contribution of around 10% should not affect the stability of an electricity network such as Québec's.

Thermal production (natural gas, oil, biomass, cogeneration and nuclear)

Total installed thermal capacity in Québec is 2,592 MW, representing around 7% of total production from all sources. This contrasts with the situation in almost all other Canadian provinces and US states, since Québec generates most of its electricity from renewable resources.

Thermal production facilities (3% of production and 7% of installed capacity)

The five main thermal power plants in Québec are:

- Gentilly (nuclear, 675 MW);
- Tracy (steam turbine and heavy oil, 600 MW);
- Bécancour (gas turbine and light oil, 428 MW);
- La Citière (gas turbine and light oil, 280 MW);
- Cadillac (gas turbine and light oil, 162 MW).

The Gentilly plant provides base power and operates year-round. The Tracy plant operated for an average of 20% of its capacity in the period 1998-2002. The three other plants are used during peak demand periods only.

The rest of Québec's thermal production capacity is made up of:

- 24 small diesel-fired power plants of between 0.4 and 67 MW, all located in outlying regions and not connected to the Hydro-Québec grid;
- 14 private power plants that sell the electricity they produce to Hydro-Québec, consisting of:
  - 3 landfill site installations, totalling 30.5 MW;
  - 10 thermal power plants burning forest biomass residue, totalling 262.9 MW;
  - 1 natural gas fired copower plant, of 31.0 MW.

4. The cost of storage and shaping services to guarantee a stable electricity supply from wind farms.
5. The capacity factor is the number of hours in a year during which an electricity production unit is in operation, expressed as a percentage of the total hours in a year.

Following the adoption of the *Regulation respecting wind energy and biomass energy*, HQD issued a call for tenders on April 15, 2003, to purchase a block of energy from a 100 MW installed capacity of biomass generation. Two projects, totalling 39.4 MW, were selected, and the electricity they produce will be sold to HQD beginning in 2006.

Biomass is currently the only form of non-conventional energy used on a large scale in Québec. The total amount of energy produced from biomass, mainly for heating purposes, amounts to almost 10% of final energy consumption[6].

In Québec, only a limited amount of forest biomass is available to produce extra electricity. Additional salvage of branches and tree-tops from cutting areas becomes increasingly expensive, and has a major impact on the final electricity production cost.

In the area of agricultural biomass, the increase in the number of animals raised in Québec has led to an important increase in the available animal wastes. Indeed, using animal manure, plant residue or some specific plant crops to produce energy is attracting increasing attention and may in time offer solutions to particular energy challenges.

Urban biomass also has considerable energy production potential. Many waste materials can be re-used to produce energy. Currently, Québec re-uses a little over 3 million tonnes of urban biomass every year through salvage, recycling, composting and energy production, but this still represents less than 50% of the volume available in Québec.

Cogeneration is another thermal source used in electricity production. It is defined as the simultaneous production of two forms of energy from a single source, generally a fossil fuel. The most common example is the production of both electricity and steam from natural gas. The steam is used in industrial processes, and for water or space heating. Cogeneration has several advantages, including lower production costs and environmental impacts than a thermal power plant using the same fuel to produce electricity only.

The future power plant in Bécancour is a natural gas cogeneration project that will have a capacity of 507 MW of electricity and 256 tonne/hours of steam. The project was selected through a call for tenders by HQD, following the acceptance of the 2002-2011 supply plan by the Régie de l'énergie. The project has received all the required government authorizations, and will necessitate an estimated investment of around $500 million.

Over the last ten years, North America has experienced a boom in the use of natural gas to produce electricity. Ninety percent of all planned power plants will use natural gas, a fossil fuel that creates less pollution than most other sources of thermal power, such as coal or oil. The recent levelling-off of North American natural gas production and an increase in the price of crude oil have, however, caused a price increase that is considered structural by several experts. The price increase will have repercussions on the cost of producing electricity from natural gas.

Hydro-Québec has operated a nuclear power plant in Gentilly since 1983, with a capacity of 675 MW, producing 4.5 TWh of electricity each year. In 2001, Hydro-Québec commissioned a study concerning a possible extension of the plant's useful life from 2010 to 2035. A preliminary estimate sets the restoration cost at around $1 billion. Dismantling of the plant would cost more than $500 million, and a generating facility with similar capacity and power would have to be added to the network, at a further cost of approximately $2.3 billion. A decision will be made in late 2005. If the extension is rejected, the installed capacity of the Gentilly plant will have to be replaced by electricity from other sources.

Electricity imports

In recent decades, Hydro-Québec has been a net exporter of electricity.[7] However, mainly because of growing demand within Québec and the low rainfall[8] recorded in recent years, Québec no longer has an electricity surplus and must meet some of its needs by purchasing power on outside markets. Since September 2003, Hydro-Québec has been a net importer of electricity.

Most interconnections allow electricity to be exported or imported depending on the needs of the grids and the economic benefit of each transaction. Deregulation in the area of electricity production and the opening up of neighbouring markets on a non-discriminatory basis has led to an increase in the number of short-term transactions.

6. This assessment includes all wood heating and the energy generated by burning wood residues and pulping liquor from pulp and paper mills.
7. Excluding purchases of power from Churchill Falls in Labrador and from private producers within Québec.
8. Rainfall during the summer of 2004 has improved the situation to a certain extent for most Hydro-Québec reservoirs. However, caution is necessary and evaluations must be made over a long period.

The Hydro-Québec grid is linked to the grid in Labrador, to incorporate production from Churchill Falls. It is also linked to the grids in Ontario, New Brunswick, New England and the State of New York for purchases or sales of electricity.

The volume of imports is limited by the capacity of the interconnections that currently exist between Québec and adjacent Canadian and US jurisdictions. Hydro-Québec estimates the practical import capacity at 15.5 TWh (9 TWh during off-peak periods and 6.5 TWh during peak periods). HQP must share this capacity with HQD, since the Régie de l'énergie has authorized HQD to import up to 5 TWh during peak periods. Given this fact, HQP has an off-peak capacity of 9 TWh and a residual import capacity that can drop as low as 1.5 TWh during peak periods if HQD is already using the interconnections.

It is important to note that, because of the type of power plants used in neighbouring jurisdictions, the electricity imported into Québec is almost entirely generated from thermal sources[9]. In addition to fluctuating prices and a lower level of supply security, imports therefore involve the types of environmental impacts and greenhouse gas emissions associated with fossil fuel generation.

Energy efficiency and demand side management

Since the 1970s, successive governments have focused on the efficient management of the energy used by the Québec population. During this period, several actions have been taken and several programs have been established by the government, Hydro-Québec and other energy distributors. For example, the Bureau des économies d'énergie was set up by the government in 1977, and Hydro-Québec invested $538 million in energy efficiency measures between 1991 and 1996. The commercial programs launched during this period led to savings of 2.5 TWh per year, beginning in 1998. Currently, these mostly recurrent savings amount to 2.1 TWh each year[10].

The energy efficiency strategy adopted by the government in 1992 targeted a 15% reduction in the energy intensity[11] of the Québec economy by 2001. Recent statistics show an actual decrease of 12% over this period.

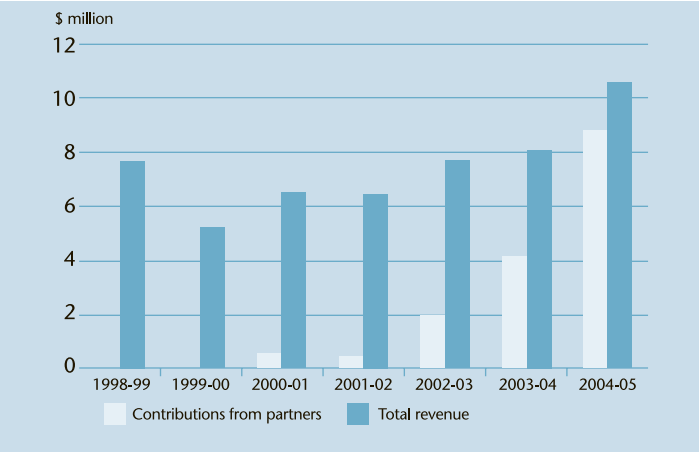
Beginning in 1997, the type of action taken in the field of energy efficiency changed. Mass programs were dropped, in particular after Hydro-Québec shifted to a more commercial form of operation. For example, in 2000 Hydro-Québec invested around $6 million in energy efficiency, mainly by promoting electro-technologies targeting more efficient use of electricity in the commercial, institutional and industrial sectors.

The Agence de l'efficacité énergétique, announced in the 1996 energy policy, was established in 1997. It falls under the authority of the Minister of Natural Resources, Wildlife and Parks, and has a board of directors made up of representatives from the various players involved in energy efficiency that is responsible for setting its objectives.

The Agency receives funding from various partners, and has been able to significantly increase its overall budget by establishing a new balance in the source of its financial resources. As a result, it now finances more actions and has improved its results. It has revenues of $10.5 million for the fiscal year 2004-2005, an increase of 30% over the preceding year.

FIGURE 1

Budget of the Agence de l'efficacité énergétique



Source : Agence de l'efficacité énergétique.

9. Excluding purchases from Churchill Falls in Labrador and private producers in Québec.
10. The savings decrease over time due to a number of different factors, including equipment at the end of its useful life that will not be replaced, the tendency of consumers to slip back into old more energy-intensive habits, etc.
11. Energy intensity is the most widely used measurement for assessing and comparing the energy needs of a country or sector of activity. It is the ratio between the cost of all the energy consumed and the gross domestic product. The higher the energy intensity, the greater the proportion of energy costs in the total production cost of products and services.

Overall, the actions of the Agency[12], which create measurable results in terms of energy savings, have reduced the annual consumption of energy in Québec by the equivalent of almost 1 TWh[13] as of March 31, 2004. This represents an annual saving of around $40 million for consumers.

The implementation of the 1996 energy policy also led to the introduction of a new regulatory framework enforced by the Régie de l'énergie. The creation of the Régie and the introduction of a provision concerning energy efficiency in Bill 116, adopted in June 2000, encouraged regulated energy distributors to refocus on energy efficiency, and they submitted overall energy efficiency plans for approval by the Régie[14]. For the year 2003-2004, the plans will involve the following investments:

- $41.8 million by Hydro-Québec Distribution;
- $5.0 million by Gaz Métro, and $2.0 million by its Energy Efficiency Fund;
- $0.4 million by Gazifère[15].

These investments account for between 0.4% and 0.8% of these distributors' sales.

The Régie de l'énergie, in its advisory report on energy security in Québec, recommended increasing Hydro-Québec Distribution's minimum energy saving target from 1.46 to 2.1 TWh by 2010. When the report was tabled, the Québec government asked Hydro-Québec to go beyond the figure proposed by the Régie, and in October 2004 Hydro-Québec announced a new target of 3 TWh for the period up to 2010. Its total energy efficiency investments for the period 2003-2010 are expected to be in the region of $1 billion.

In addition to helping improve Québec's energy consumption, these actions in the field of energy efficiency have a significant economic impact.

It is important to note that actions taken in the field of energy efficiency involve several players, such as the Régie de l'énergie, energy distributors, the Agence de l'efficacité énergétique and its partners, and consumers. However, without collaboration from consumers, no measure can produce significant results. Indeed, society-wide promotional campaigns have produced excellent results in other areas.

There are many interesting possibilities for controlling energy demand. However, it depends mainly on consumer choices, and requires changes in behavioural patterns that are not easy to establish and take time to implement.

The development of technology, equipment, processes and standards also offers possibilities for improving energy performance. This type of development often requires a substantial level of investment, and its cost-effectiveness must be evaluated in each case.

Demand side management also implies a need to set up rate structures, in particular for electricity, to shift consumption to particular times in order to reduce the distribution costs of the utility and the amounts paid by consumers. Over the long term, these changes in behaviour can reduce the amount of electricity needed to meet consumer demand in peak periods.

3.2.3 The reliability of the electricity transmission grid

The power blackout that affected the north-eastern United States and Ontario on August 14, 2003, as well as the 1998 ice storm in Québec, highlighted the importance of a reliable electricity transmission grid.

Québec is relatively well protected against the type of cascading blackout that affected the north-eastern portion of the continent, since its exchanges with neighbouring grids are asynchronous[16]. This is the main reason why the Québec grid was not affected by the blackout. Since 1998, the year of the ice storm in Québec, HQP and TransÉnergie have invested almost $900 million in securing the electricity transmission grid within Québec. Over the last ten years, a total of $1.3 billion has been invested by Hydro-Québec to make the Québec grid more secure.

Hydro-Québec is also an active partner in the North American Electric Reliability Council (NERC), an organization responsible for ensuring the reliability of the electric transportation system in North America. Hydro-Québec is a member of the Northeast Power Co-ordinating Council (NPCC), which is one of the ten NERC regional reliability councils.

12. Including the actions of its partners, its promotion and delivery agents, and its clients.
13. Savings in oil, natural gas and other forms of energy have been converted into the equivalent amount of electricity.
14. Unlike electricity and natural gas distributors, the distributors of petroleum products are not subject to the provision of Bill 116 that requires the Régie de l'énergie to take energy efficiency measures into account when approving supply plans.
15. Gazifère is a natural gas distributor in the Outaouais region.
16. An asynchronous exchange is one where the electric current must be converted before being exchanged, creating a form of buffer between two neighbouring grids.

3.2.4 Space heating: using the right energy in the right place

Electricity occupies an important place in Québec's energy profile, representing over 40% of final energy consumption (excluding biomass). In the residential sector, the per-person electricity consumption is roughly twice as high in Québec as in Ontario, mainly because of the widespread use of electricity for space heating.

Because of the limited penetration of natural gas on the Québec consumer market, and the pervasive presence of electricity, natural gas represents only 14% (excluding biomass) of final energy consumption in Québec. Excluding biomass, Ontario consumes over twice as much gas as Québec as a percentage of total consumption.

Diversification of heating equipment to include sources of energy other than electricity would have a favourable impact by reducing the pressure on electricity generating facilities at peak times.

3.2.5 The regulatory framework and competitive supply

The situation and prospects of the energy sector in Québec, North America and the world have evolved considerably since the mid-1990s. Some parameters have changed, and new issues have been raised by energy market deregulation, notably greater awareness of the question of sustainable development, especially in the industrialized world, and the strong growth in energy demand in many Asian countries.

The Régie de l'énergie

The Régie de l'énergie was established on June 2, 1997, following a commitment made in the 1996 energy policy. Its mission is to reconcile the public interest, consumer protection, and fair treatment of Québec's electricity carrier and energy distributors. It aims to ensure that energy needs are met in a way that is consistent with sustainable development and equity for individuals and groups.

To achieve its objectives, the Régie sets or modifies the conditions and rates governing electricity transmission and distribution, and those governing the supply, transportation, delivery and storage of natural gas by distributors.

Incentive measures or mechanisms have been introduced for natural gas distributors and others are planned to improve the performance of both the electricity carrier and the distributors.

The most of the Régie's major decisions are made following public hearings during which energy sector representatives and members of the general public can make their views known.

Consumers who are dissatisfied with the actions of a body regulated by the Régie can submit complaints concerning rates and conditions of service, and the Régie can force the application of the corrective measures it determines.

The Régie also has powers to monitor and control the price of gasoline products. It establishes a weekly minimum reference price for each administrative region. Every week, the Régie completes and publishes a survey of prices at the pump.

One of the goals of the 1996 energy policy was to preserve and even improve the comparative advantage of low electricity prices in Québec and to take advantage of the potential for selling electricity in the north-eastern part of the continent. To implement this objective more effectively, the Québec government included a number of related provisions in the 1996 energy policy and, in June 2000, enacted Bill 116, *An Act to amend the Act respecting the Régie de l'énergie and other legislative provisions*, which also introduced a competitive element for the supply of future electricity needs[17].

Bill 116 was the last stage in the implementation of a regulatory framework for the open transit of bulk electricity through Québec's transportation grid. It also finalized the functional separation of electricity production, transmission and distribution activities at Hydro-Québec. Three main divisions were established: Hydro-Québec Production, Hydro-Québec TransÉnergie and Hydro-Québec Distribution.

Given that electricity transmission and distribution remain natural monopolies, Hydro-Québec TransÉnergie and Hydro-Québec Distribution are subject to scrutiny by a regulatory body, the Régie de l'énergie. Hydro-Québec Production works in a competitive marketplace and is not under the jurisdiction of the Régie.

Bill 116 also introduced the concept of "heritage pool electricity" (165 TWh) reserved for the supply of markets in Québec. This block of energy is supplied by Hydro-Québec Production to Hydro-Québec Distribution at a low average cost of 2.79 ¢/kWh. It is important to specify, however, that electricity consumption in Québec is now equivalent to the block of heritage pool electricity, and that further needs will have to be met at market prices, which are much higher. The cost of electricity from new supply sources is higher than the cost of electricity from Québec's existing generating facilities. This is particularly true for new hydroelectric resources, for which development costs are much greater, given that the best sites were exploited first.

Electricity prices in Québec are based on averages - in other words, they take into account the low costs of the past (heritage pool electricity) and the higher costs for new supplies. Prices therefore increase gradually, in line with costs.

Bill 116 therefore harmonized the regulation of the Québec electricity market to bring it into line with practices in North America, while preserving the social contract in Québec. Québec consumers continue to benefit from low electricity rates (heritage pool electricity), while the inter-financing of certain rate categories gives an added advantage to residential customers, in keeping with one of the provisions of the Act.

Another provision requires the electricity distributor to prepare, every three years, but with annual updates, a supply plan over a ten-year time frame that specifies the actions that will be taken to meet demand, taking energy efficiency measures into account. If power is needed in addition to heritage pool electricity, Hydro-Québec Distribution must issue a call for bids to meet the needs of the Québec market. All energy sources and producers may compete for the bids, unless the Québec government instructs Hydro-Québec to purchase a block of energy from a specific source.

17. Hydro-Québec retains the exclusive right to produce hydroelectricity in power plants greater than 50 MW.

3.3 Fossil fuels

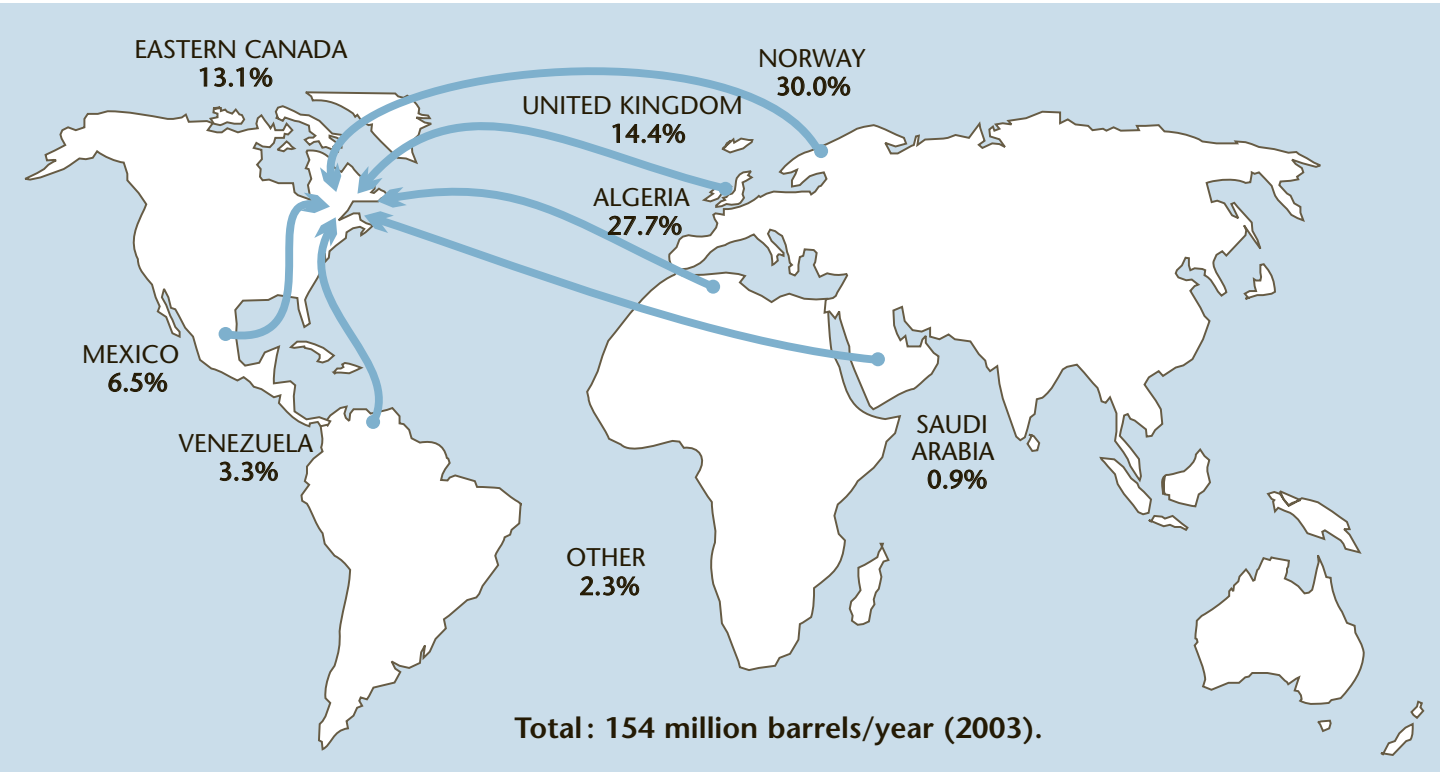
3.3.1 Supply dependency

Fossil fuels (petroleum products and natural gas) account for over 50% of Québec's energy consumption, and represent a key element in Québec's economy. In the field of transportation, for example, they are practically the only energy source used.

The oil crises of 1973 and 1979 emphasized the risks related to volatile prices and, in some countries, led to rationing and the adoption of strict measures to limit consumption. In future, reserves will be solicited increasingly by demand from the global market, while production will decline. This is likely to push prices upwards.

MAP 1

Québec's petroleum supplies



Sources: Data: Statistics Canada, map: Ministère des Ressources naturelles, de la Faune et des Parcs.

Between 1990 and 2000, Québec purchased practically no Canadian petroleum. Almost all the crude oil bought by Québec refineries came from abroad, mainly from the United Kingdom, Norway, Algeria, Venezuela and Mexico.

Since 2001, Québec has once again started to buy Canadian crude oil from Newfoundland and Labrador. In 2003, 13% of the petroleum consumed in Québec was from Canadian sources.

Québec is dependent on these sources of supply, and subject to the effects of the world economic and geopolitical context. It cannot influence international crude oil prices. For this reason, it is clearly advantageous to maintain and even increase the range of sources from which it purchases oil in order to ensure a secure supply. In the event of a breakdown in foreign supply, access to the resources of Western Canada can be gained by reversing the flow in the Sarnia-Montréal pipeline, which offers a form of insurance policy.

The natural gas consumed in Québec comes from the sedimentary basin of Western Canada, and is transported through a single network belonging to TransCanada PipeLines (TCPL). Québec distributors and consumers constitute a captive market, and currently have no access to alternative, competitively priced supplies. The challenge here is to secure the natural gas supply while ensuring that transportation costs are fair and reasonable.

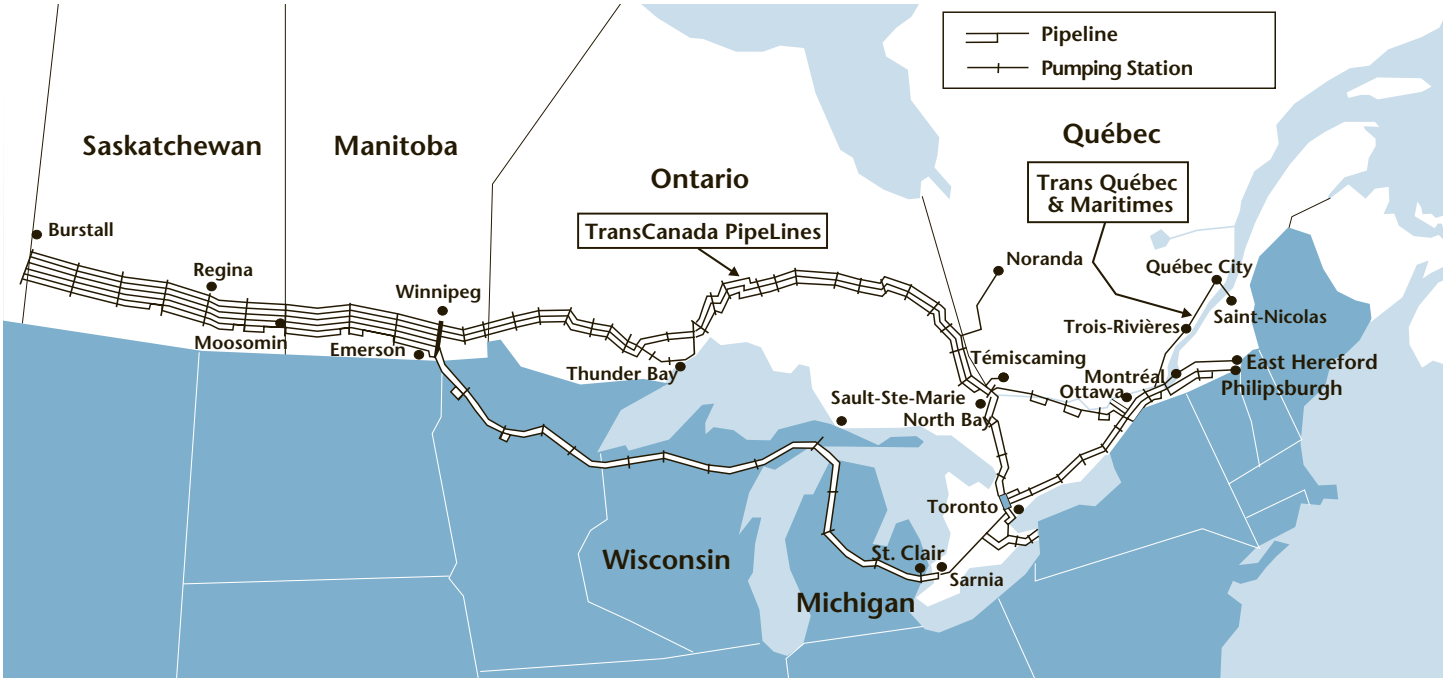
Future access to new production basins in Eastern Canada would help diversify Québec's supply sources. In the short term, however, the most promising option would be to import liquefied natural gas by tanker ship.

It is important to note that Québec is located at the far end of the TCPL pipeline, a situation that tends to push the province's gas transportation costs upwards.

Québec also has a large natural gas distribution network covering a large portion of its territory. Natural gas is therefore available to residential clients, institutions, stores and small and large businesses in most regions of Québec, including Saguenay–Lac-Saint-Jean, Mauricie, Outaouais, Abitibi-Témiscamingue, the Laurentians, Montérégie, Centre-du-Québec, Chaudière-Appalaches and so on. The potential for expansion is considerable.

MAP 2

Natural gas transportation and distribution networks in December 2002



Source : Ministère des Ressources naturelles, de la Faune et des Parcs.

Eventual access by Québec to imported liquefied natural gas would create competition with the natural gas from Western Canada's sedimentary basins, of which Québec is presently a captive customer. In principle, this should allow Québec's natural gas consumers to pay lower prices. The difference between the continental market price and the international market price will depend on several factors, including the global and continental balance of supply and demand and changes in natural gas production, transportation and storage costs.

3.3.2 Diversifying supply: liquefied natural gas

Over the last ten years, the development of new technologies has led to a 30% reduction in the cost of liquefying and transporting gas in the form of liquefied natural gas (LNG). The cost reduction, along with the increase in natural gas prices in recent years, has made LNG more competitive compared to conventional natural gas.

The construction of an on-shore terminal for LNG tankers would help diversify the gas supply and increase Québec's natural gas storage capacity. This type of infrastructure would tend to limit the forecast increase in gas prices caused by demand across North America.

Liquefied natural gas

Liquefied natural gas (LNG) is natural gas that has been cooled to minus 160 °C. Unlike co-generating power plants that emit large amounts of heat that can be recovered as a by-product, LNG unloading and re-gasification terminals generate a large cooling capacity that, given its low cost, could be made available for use in the agrifood sector.

3.3.3 Diversifying supply: exploration and extraction

In 2003, as part of the Government Online initiative and to foster the dissemination of geoscientific knowledge, the Ministère des Ressources naturelles, de la Faune et des Parcs inaugurated its new Petroleum and Gas Geoscientific Information System known by its French acronym SIGPEG. Using the system, it is now possible to search the Department's documentary base for reports and lists of drilled wells, compilation maps, geo-referenced data and seismic profiles in Québec, and to place online orders for the Department's products. The new electronic store provides easy access to the Department's geoscientific information for oil and gas exploration companies and researchers, and contributes to the development of Québec's fossil fuel potential.

Based on recent discoveries in the United States and in neighbouring Canadian provinces, it seems likely that Québec has major fossil fuel reserves within its territory that could help diversify supply. Hydro-Québec has been mandated by the government to assess the fossil fuel potential in collaboration with the private sector. The target areas are the St. Lawrence Estuary and Gulf, Anticosti Island and the Gaspé peninsula.

The sedimentary zone suitable for petroleum and gas exploration covers an area of over 200,000 km^2, in other words 13% of Québec's territory. The zone is the same age and contains the same types of deposits as the geological formations containing many oil-rich deposits that lie along the continent's former eastern coastline, stretching from Texas to Newfoundland and Labrador, via the Québec sedimentary basin.

Within this zone, the St. Lawrence lowlands and the eastern Gaspé peninsula have been the main focus of exploration work. Three small gas finds have been made so far. Two are now exhausted, the first at Pointe-du-Lac and the second at Saint-Flavien, and both have been converted into natural gas storage sites.

The impermeable geological formations found in these two locations make them suitable for seasonal natural gas storage. These are the only two sites in Québec where natural gas is stored in underground geological formations during the summer for use the following winter.

The third gas find, the most recent in Québec, is located on the Gaspé peninsula in Galt township, roughly 25 kilometres west of the town of Gaspé. Because there is no gas distribution network, the natural gas extracted is transported by tanker truck to various users. Work is currently under way to increase the proven reserves at this location.

The "Old Harry" geological structure

One of the geological structures found in the Gulf of St. Lawrence, the "Old Harry" supergiant structure, is located roughly 80 km north-east of the Magdalen Islands. It could contain recoverable reserves of up to 4 to 5 trillion cubic feet of natural gas, or the energy equivalent in petroleum, in other words enough to meet Québec's natural gas consumption for 20 to 25 years on the basis of current needs.

3.3.4 Development of oil and gas potential in the Gulf of St. Lawrence

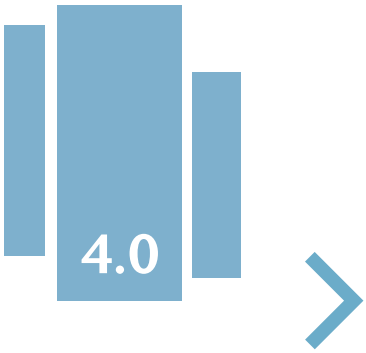
The Québec government has, for several years, been trying to reach an agreement with the federal government to allow fossil fuel exploration and production activities to proceed in the Québec portion of the Gulf of St. Lawrence. The agreement sought by Québec would be based on four principles: territorial integrity, the sharing of tax revenue, the collection of royalties, and joint management of activities based on compliance with existing rights and the legislation in force in Québec.

The Ministère des Ressources naturelles, de la Faune et des Parcs co-chaired an expert committee that published its report in March 2004. Its task was to sum up current knowledge drawn from seismic surveys[18], to identify related environmental issues and to outline possible solutions. Overall, the report acknowledges the importance of fossil fuel exploration and development in the Gulf of St. Lawrence. Among other things, it highlights the need to gain more knowledge, change the legal framework and draw up mitigation measures to reduce the environmental impact of the work.

In early 2004, Québec's Minister of the Environment asked the Bureau d'audiences publiques sur l'environnement (BAPE) to hold public hearings at which individuals, special interest groups and experts could comment on the potential impact of seismic surveys on the environment in the St. Lawrence Estuary and Gulf. The government will analyse the report, scheduled for publication in the fall of 2004, to gain a more in-depth view of the situation.

18. A seismic survey is the first step in oil and gas exploration. It involves using echography in an underground scan. An impulsion sent from the surface of the ground or water produces sound waves that refract and reflect underground. As they pass from one layer in the ground to another, they change direction. By analyzing the echoes of the sound waves on the surface, it is possible to identify rock formations likely to contain fossil fuels.

ECONOMIC AND REGIONAL DEVELOPMENT



4.1 The issues

From 1999 to 2002, an average of approximately $2.3 billion was invested each year in the energy sector, of which 80% went to the electricity sector. In 2003, investments in the production, transmission and distribution of electricity injected $2.8 billion into the economy, almost $500 million more than in the previous year. In addition, the oil refining industry is expected to invest around $2 billion between 2002 and 2006, among other things to introduce new processes to produce ultra low sulphur fuels.

In all, Québec's energy sector generated around $8 billion of economic activity in 2003, representing 3.6% of the economy as a whole, and accounted for almost 41,000 jobs.

Hydroelectric development has considerable potential for stimulating economic growth and clearly has strategic value. Between now and 2008, the facilities currently under construction will attract investments of $5.4 billion, create around 21,500 direct and indirect jobs (in person-years) and $4.4 billion in economic and tax benefits, a considerable portion of which will benefit outlying regions.

Québec still has substantial untapped hydraulic resources. They present a potential for investment, jobs and revenue that will benefit Québec as a whole.

Similarly, Québec is considered to have strong potential for wind power. The 1,000 MW call for tenders issued by HQD in May 2003, the results of which were announced on October 4, 2004, and the additional 1,000 MW of wind power that Hydro-Québec must acquire, represent several hundred jobs, investments totalling over $3 billion in Québec, and the establishment of a cutting-edge industry that is attracting growing interest worldwide.

With regard to fossil fuels, if the exploitable potential were to be confirmed, it would generate substantial economic benefits for Québec, as well as hundreds of jobs on the Gaspé peninsula and in the Magdalen Islands.

Québec's fossil fuel potential has not yet been comprehensively estimated. Although the first oil exploration well was drilled in 1860, there are still fewer than 800 wells in the province. In contrast, more than 1,000 wells are drilled every month in Alberta, for a total of between 12,000 and 15,000 per year. Québec's relatively modest efforts so far in sectors upstream of the petroleum and gas industry can be explained by a number of factors, including its complex local geology, the fact that the most promising sedimentary basins are located in marine environments, and the absence of a bilateral Canada-Québec administrative agreement on the development of oil and gas potential in the Gulf of St. Lawrence.

The discovery of the first significant, commercially viable oil or natural gas deposit in Québec would generate a lot of interest from large exploration companies, which have the funds required to launch large-scale exploration programs and are constantly on the lookout for new investment opportunities. This interest would be strengthened among other things by a decline in the number of deposits currently being worked in Western Canada, the disappointing performance of some East Coast deposits, and the high anticipated cost of obtaining supplies from the Mackenzie Delta deposits, which are not yet connected to North American markets. Québec also has the advantage of being located near large markets, and it already possesses strategic transportation infrastructures.

The question is therefore how and to what extent Québec could trigger interest in its oil and gas potential and encourage the major exploration companies to implement large-scale exploration programs in Québec, both on land and at sea, alone or in partnership with smaller companies or Hydro-Québec Pétrole et gaz, which already have oil and gas exploration permits covering an area of some 4 million hectares.

Economically, a more diverse range of energy sources would allow companies to use different types of energy to meet their needs, and would give them a competitive edge in Québec. It is more interesting to invest and do business in areas with a more balanced supply of energy forms. This would foster industrialization and generate significant economic benefits.

Energy efficiency

Energy efficiency and demand management can help control growth in demand and, in the medium and longer term, reduce pressure on the energy supply. The government is convinced that efforts to improve energy use should more than ever continue. There are several energy saving options available, and targets could be set.

It should be remembered that the current low electricity prices in Québec are not conducive to energy efficiency.

Funding for energy efficiency measures, especially for those under government responsibility, is a major issue. The available avenues should therefore be examined.

Energy efficiency, a labour-intensive sector, also offers possibilities for development and wealth creation in all regions in Québec. It involves all forms of energy, and its benefits are mainly local.

4.2 Electricity

4.2.1 Large hydroelectric projects

Québec currently ranks fourth worldwide[19] for available hydroelectric production, after China, Brazil and the United States. Its potential for further economically viable hydroelectric development is one of the highest in the world. As mentioned above, it represents almost 20,000 MW.

The construction of hydroelectric facilities generates significant economic benefits in outlying regions. Purchases of products and services by Hydro-Québec totalled $2.3 billion in 2003, of which $2.1 billion, or 93%, went to Québec. The purchases supported almost 15,200 direct and indirect jobs at Québec suppliers and their supply networks.

Hydro-Québec policy calls for purchases to be made throughout Québec, at the lowest possible cost. This geographic distribution of purchases and economic impacts depends on the location and type of each project.

4.2.2 Small hydroelectric power plants

The 57 projects for small power plants in the 1990s were completed in most administrative regions of Québec and generated mainly local economic benefits. In all, the projects resulted in investments of over $500 million and supported almost 7,000 direct and indirect jobs (in person-years) during the construction phase.

Québec still has considerable potential for sites where small hydroelectric power plants (50 MW and less) could be operated cost-effectively.

Small power plants create jobs and involve purchases of materials, equipment and services from the local area, during both the construction and operating phases. In addition, they generate electricity at highly competitive rates.

Hydroelectric production, especially in small power plants, is considered by most experts to create little or no pollution and negligible - or non-existent - emissions of greenhouse gases. This is a clear advantage compared to several other sources of energy. In addition, this type of facility is advantageous in terms of other environmental impacts.

The development of small power plants could provide an opportunity for a community to take charge of its own economic development. Community stakeholders are invited, through their regional county municipalities, to help plan small power plant projects in their areas, in partnership with private businesses, and to share the benefits by forming limited partnerships. These public-private partnerships can create significant, regular and ongoing financial benefits for the community.

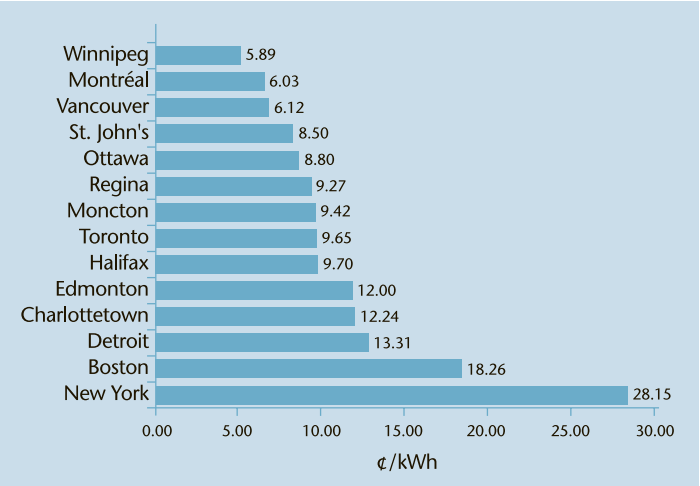
19. Including production from Churchill Falls in Labrador. However, if only production in Québec is taken into account, Québec ranks fifth, behind Russia.

4.2.3 Electricity rates

Québec consumers enjoy highly competitive electricity rates. The average cost of electricity for residential customers is the second lowest in North America, just behind Manitoba.

FIGURE 2

Comparison of North American electricity prices
Residential clients (May 2003)



Source : Hydro-Québec.

Comparisons should always be made with the best rates, so as to be able to adjust where necessary and maintain or improve the comparative advantage.

4.2.4 Energy as an element of industrial policy

In Québec, electricity is a major element in companies' location decisions. Electricity in Québec is sold at advantageous prices, and price changes are predictable. The energy is delivered via a strong, reliable transmission network, and offers high wave quality.

These benefits have generated a large amount of industrial activity based on intensive electricity use. An example would be the metal casting and aluminium smelting sectors, which have developed extensively in Québec, triggering considerable socio-economic growth especially in the regions and creating thousands of durable high value-added jobs. The wave quality has also attracted technology firms able to offer high quality jobs.

The present regulatory framework, under which new electricity supplies are purchased at constantly increasing market prices, has caused the government to rethink the conditions for economic development based on intensive electricity use. The advantages of this type of industrial development must be set against the need to maintain lower tariffs for all other consumer categories and the benefits available from lucrative exports of electricity to other countries. At the same time, the government needs to consider the fact that this type of industrial development can place undue pressure on the growth of the electricity generating stock, and any slowdown in power generating development will have an impact on electricity-intensive industries.

For some regions of Québec, ongoing unavailability of natural gas could prevent certain investment projects from proceeding, thus hindering economic development in the regions.

It is important to diversify energy supply sources, in order to give companies a wider choice and better energy security. These two elements could also influence the decisions of other firms to come to Québec.

Just as electricity promoted industrialization in Québec, access to other sources of energy such as natural gas would also allow for the development of other industries. At the same time, diversification of energy sources would attract investments, especially in the industrial and manufacturing sectors.

In addition, diversification would promote the creation of a more diverse and stable industrial fabric, thus consolidating both the economy and employment. If they had access to different sources of energy, companies would have a much wider choice at more competitive prices.

Ultimately, access to new energy sources could lead to the development of new industrial niches, in the agrifood and resource processing sectors for example.

4.2.5 The place and role of the regions and Aboriginal communities

The Québec government hopes to contribute to regional development by exploiting the energy, mining, forestry, wildlife and recreational resources of its regions. It intends to use the economic activities generated by the presence of these resources to foster investment and job creation.

Québec also believes the Aboriginal communities have an extremely important role to play in the development of regional natural resources. Its goal is to foster social and economic development in the communities by offering them an opportunity to participate more fully in the resource development process.

To achieve this goal, the government uses a number of means, including the signature of agreements with Aboriginal communities and nations. The agreements in question can be framework agreements, declarations of mutual understanding and respect, special agreements or sector-based agreements. Examples include the Agreement Concerning a New Relationship Between the Gouvernement du Québec and the Crees of Québec (the *Peace of the Braves*), the Partnership Agreement between Québec and the Inuit on Economic and Community Development in Nunavik (the *Sanarrutik* agreement) and the Agreement-in-Principle between the First Nations of Mamuitun and Nutashkuan, the Gouvernement du Québec and the Government of Canada. A ministerial committee presided by the Québec Premier has also been formed to supervise hydroelectric development efforts in Northern Québec.

Generally speaking, the agreements are designed to foster economic and social development in the communities concerned without hindering the general development of Québec. Their purpose is to give the Aboriginal population more authority over their own development through better sharing of resource management responsibility in the regions. They also address social development issues and ancestral values.

The current regulatory framework allows the private sector to respond to calls for tenders from Hydro-Québec Distribution and become involved in hydroelectric generating projects of 50 MW or less. This type of facility could be an interesting way for communities to take responsibility for their own economic development.

4.2.6 Taking advantage of export opportunities

Exports are a major source of collective wealth. Indeed Québec's economy has been able to grow in large part because of its exports, which have helped create jobs, attract investments and generate revenues for the government in a variety of fields, thus improving the well-being of the population in general. The energy sector is responsible for a significant percentage of these results.

In the electricity sector, Québec has a definite advantage due to its vast hydraulic reservoirs, which, combined with the network's extensive interconnections to markets in the United States and neighbouring Canadian provinces, have enabled it to take up some interesting business opportunities. For example, Hydro-Québec is able to purchase electrical energy from neighbouring markets at lower prices during certain periods, and then resell it later to neighbouring networks at higher prices. If rainfall conditions permit, and once Québec's own energy security has been guaranteed, Hydro-Québec Production's unused supplies can be exported (net export sales) to neighbouring markets.

Electricity exports have therefore made a significant contribution to our collective wealth in recent years. They have also had an extremely positive impact on environmental quality in the north-eastern part of the continent by reducing the need for polluting energy sources such as oil-powered and coal-powered power plants.

Exports can help us achieve our economic, social and environmental goals and balance our budget. In the last four years, for example, the government has derived approximately $1.7 billion in profits from electricity exports, and has used these revenues to finance public services in the health, education, social services and other sectors. In Canada, Alberta, with its oil and natural gas, is an excellent example of the positive impacts of energy resource development and exports on the economy and the funding of public services.

One of the attractions of the electricity sector is the contribution of exports to collective wealth. It is therefore important to consider the relevance and best ways of producing the flexibility required to ensure that, once Québec's own electricity needs have been met, any remaining supplies can, under favorable conditions, be exported.

4.3 Fossil fuels

4.3.1 Fossil fuel exploration and development

If confirmed, the presence of exploitable fossil fuel deposits would offer extraordinary development opportunities for the resource regions of eastern Québec. For example, the potential economic impacts of the Old Harry structure in the Gulf of St. Lawrence would be considerable, involving investments of $1.5 billion over the exploration period and an estimated $4 billion for development.

This estimated impact would benefit the Gaspé peninsula region in particular, whose economy has run into problems in recent years. However, the environmental features specific to the Gulf of St. Lawrence would also have to be taken into account. As mentioned earlier, it was for this reason that the government asked a committee of experts and the Bureau d'audiences publiques sur l'environnement to identify the conditions in which future seismic surveys should be carried out.

In addition to strengthening its energy security, Québec would also benefit in several ways from fossil fuel exploitation in the Gulf area, including the development of local expertise and strategic infrastructures, and the reassertion of its jurisdiction in the Gulf of Saint-Lawrence.

For example, Nova Scotia and Newfoundland-and-Labrador have so far both enjoyed considerable economic benefits from the development of fossil fuel resources within their territories, to the tune of $22 billion in investments and 3,000 direct jobs.

4.3.2 Gasoline prices

Québec has three refineries, owned by Ultramar, Shell and Petro-Canada, with a total combined refining capacity of 455,000 barrels per day. Québec's refining production exceeds its needs, and the refiners use their surplus capacities to position themselves advantageously on neighbouring markets. The refineries are expected to increase their capacity in the future, enabling the refiners to make the most of available export opportunities. They are able to take advantage of these opportunities primarily because of their ability to produce petroleum products at competitive prices, in accordance with current standards.

In 2003, investments in the refining industry totalled $349.4 million, an increase of 34.0% over the preceding year and the highest level of investment since 1989. The increase was due largely to the addition of petroleum desulphurisation units in Québec's three refineries, to comply with new environmental standards.

The three refineries also installed equipment to convert heavy fractions into more sought-after fuels.

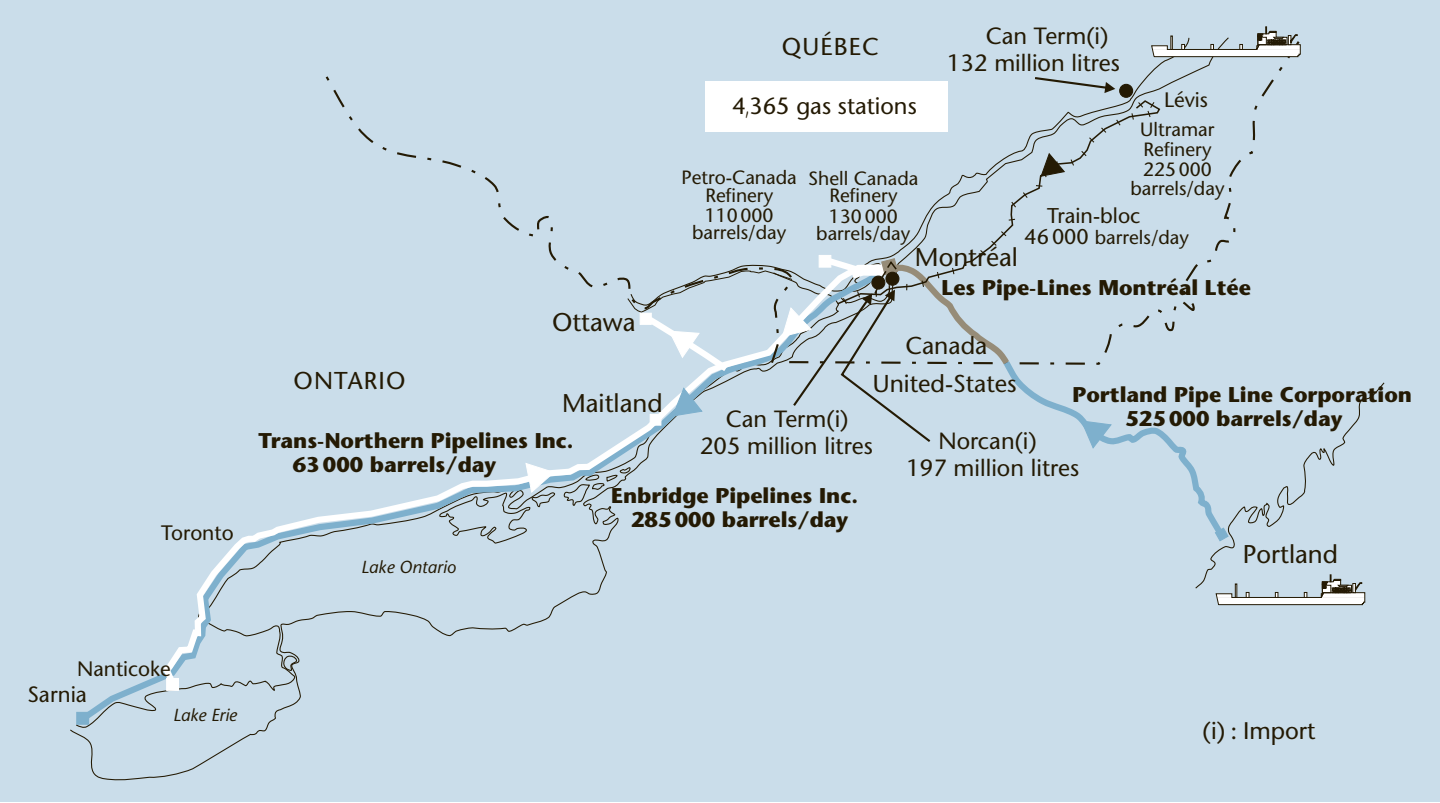
There is a strong synergy between the refining sector and the petrochemical sector. Both benefit from certain location factors, including access to competitively priced raw materials brought in by rail from the Atlantic and Western Canadian basins.

Some refinery products are used as raw materials by the petrochemical industry.

The Québec government has set up an Issues Table for the refining and petrochemical sectors, whose primary goal is to consolidate and reinforce the two sectors and help them work together in order to achieve a critical mass and a level of competitiveness on which to base their future development. The sectors are currently responsible for more than 3,000 direct jobs in Québec, and in 2001 they produced shipments worth more than $1.75 billion.

MAP 3

Oil transportation and refining infrastructures and petroleum product distribution networks in Québec



Source : Ministère des Ressources naturelles, de la Faune et des Parcs.

Non-energy-related uses of oil

Oil is used for a number of non-energy-related purposes, in addition to its primary use as fuel. For example, petroleum products are used as raw materials in the petrochemical industry, as lubricating oil and grease, in asphalt, and in special naphtha-based products, waxes and paraffins. In 2002, nearly 1.1 million tons of oil equivalent products were consumed for these purposes, accounting for 6.7% of total petroleum product consumption.

Québec's petrochemical industry is concentrated in the Montreal area. In 2001, there were two major plants in operation, owned by Pétromont and Petro-Canada.

In Québec, gasoline prices at the pump are based mainly on refinery wholesale prices, which themselves are strongly influenced by crude oil prices on the international markets.

Fuel prices therefore react to market forces. Their frequent fluctuations are basically due to outside phenomena over which Québec has no control, such as geopolitical tensions in the Middle East, terrorist activity or anticipated activity, tightening of production quotas by OPEP, and declining worldwide crude oil and petroleum stocks. There are also a number of other key factors, including planned refinery turnarounds for seasonal maintenance, unplanned shutdowns, weather conditions, reserves and speculation at various levels.

According to the Act respecting the Régie de l'énergie, the Régie has the power to oversee, inspect and investigate the sale or distribution of petroleum products, and every three years it establishes an amount per litre as operating costs, to be borne by gasoline and diesel retailers.

The government amended the Act respecting petroleum products and equipment (APPE) in 1997, with the goal of avoiding abusive practices in the sale of gasoline and diesel fuel. Every week, for every administrative region, the Régie estimates a minimum reference price for the three types of gasoline and for diesel fuel[20].

Québec faces a major challenge in its attempts to oversee gasoline prices, that of maintaining a long-term fuel market able to operate unhindered in normal competitive conditions.

In the year after it sets a per-litre amount as the necessary and reasonable operating costs to be borne by a retailer in order to trade effectively in gasoline or diesel fuel, the Régie de l'énergie must report to the Minister of Natural Resources, Wildlife and Parks on the impacts of its pricing and commercial practice measures on the retail gasoline and diesel trade. The Régie's report enriches the government's reflections on the operations of this extremely competitive market.

Evolution of retail gasoline sales in Québec

The retail gasoline situation has evolved since October 2000 with the birth of a new group of stakeholders composed of mass merchandisers or hypermarkets. Generally speaking, they build high-volume gasoline plants and adopt low price policies.

The mass merchandisers' gasoline price policy, combined with the tendency of retailers to harmonize their prices with those of their competitors, should, under current legislation, keep gasoline prices as close as possible to the minimum reference price.

4.3.3 Natural gas

Alberta's natural gas reserves are showing signs of depletion and experts are predicting a levelling off or even a decline of Canadian production in the medium term.

At the same time, natural gas consumption is increasing in Canada, and even more so in the United States, given their greater dependency on this energy source and their reliance on it to fuel the new electricity power plants.

As a result, the tightening of supply and demand has placed upward pressure on prices. Most of the experts predict that this increase will be structural, in contrast to the temporary price hikes observed in past following variations in seasonal temperatures or other factors.

It is therefore important to consider different natural gas sources and especially the emergence of liquefied natural gas in North America. Construction of a facility to provide this type of supply in Québec would enable the province to support the petrochemical industry's potential in Montreal. The new infrastructures could also lead to the development of a regional cooling industry[21], especially in the agrifood sector. Also, the regasifying process could be combined with an electricity producing facility that produces steam as a by-product (cogeneration plant), using the steam to heat the liquefied natural gas. Any surplus steam could be diverted to local industries.

Construction of a methane terminal would require an investment of between $600 and $700 million. Beyond the immediate results, however, the positive long-term impact of such a project on our economic development would be extremely important.

Québec is located at the eastern extremity of the TCPL gas pipeline. A drop in the volumes transported by TCPL due to competition from other pipelines, combined with changes made by the National Energy Board to pricing methods, have forced natural gas consumers in Québec to pay increasingly higher transportation costs for supplies of Canadian gas. The indications are that this trend will be maintained for the foreseeable future.

The construction of methane terminals would be beneficial for Québec only if, as a result, its consumers were to gain better access to natural gas at a more competitive price.

20. The Act now establishes a presumption of abusive practice designed to prevent retailers from selling their fuel below the current minimum reference price for their region.
21. In the immediate vicinity of the methane terminal.

4.3.4 Propane

In 2002, according to a recent study[22], the propane industry in Québec was responsible for 1,200 direct and indirect jobs in storage and wholesale activities[23]. The industry serves approximately 150,000 clients in Québec, and in recent years has invested between $12 and $15 million dollars annually to maintain and develop its infrastructures.

The share of propane in Québec's energy profile remained virtually stable throughout the 1990s, declining only slightly from 0.9% to 0.8%. However, the propane market grew significantly in the early 2000s, in the major sectors of economic activity.

The ice storm convinced many consumers to go back to propane or to start using it for certain purposes. The industry's efforts to create new outlets also helped trigger an increase in consumption, and future new technological developments are likely to enhance propane's share in the energy profile.

In July 2003, the Minister of Natural Resources, Wildlife and Parks formed a government-industry task force to examine the issues facing the propane industry, review the current situation and identify possible solutions that would enable the industry to continue to prosper.

Propane can help ensure energy security in emergencies such as blackouts due to weather, ice or violent winds. It is extremely useful as a source of energy for temporary heating, portable drying devices and other one-time energy needs. It also serves as a complement to natural gas.

In the outlying regions, propane fulfills a variety of purposes, especially in the agricultural sector. For example, it is used to dry cereals and heat hog houses and hen houses. It is easy to transport and store, and does not require such costly distribution infrastructures as electricity and natural gas.

As a source of energy, propane is relatively clean, easily available and can be used for a variety of purposes. In some regions where natural gas is not available, it has become essential. It therefore plays an important economic role, especially in the outlying regions.

4.3.5 Fuel Oil

In 1981, 43% of homes in Québec used light fuel oil[24] as their main source of energy for heating. By 1990, however, this figure had fallen to 18%, and has stabilized at around 12% over the last few years. This situation is due mainly to price structures and government programs to encourage conversion to electricity.

In many cases, oil has become a secondary energy source that is used extensively in many regions of Québec. It is therefore able to compete with other forms of energy for space heating and heating in general.

A decline in the use of fuel oil could lead to reduced availability if suppliers no longer had the critical mass they require to provide a good quality service.

Optimal use of fuel oil depends on the use of new, more efficient technology that would allow the sector to contribute more effectively to Québec's energy portfolio.

In March 2004, the Minister of Natural Resources, Wildlife and Parks formed a government-industry task force to review the current situation, examine the issues facing the fuel oil sector and identify possible solutions that would enable the industry to consolidate its position in Québec's energy profile.

Lastly, the availability of fuel oil increases the competition between the various forms of energy, and is an undeniable benefit for consumers. Many clients depend on regular supplies of heating oil, and the use of heating oil helps limit electricity consumption at peak times.

22. *Étude de la filière économique du propane au Québec*, a study of the propane industry carried out by Marcon DDM in Montreal.
23. Not to mention jobs in the retail sector.
24. Commonly known as heating oil.

4.4 New technology, innovation and expertise

4.4.1 Québec's role on the international stage: dissemination of its energy expertise

The main fields of expertise of Hydro-Québec and its industrial partners are hydroelectricity production and long distance high voltage transmission, as well as electro-technologies.

Québec's electricity industry (excluding Hydro-Québec) is composed of engineering consulting firms, professional service firms and large project construction firms, as well as specialist producers and suppliers of components, tools and instruments for power plants, transmission grids and distribution networks. According to a 2003 study[25], approximately 1,000 ompanies in Québec work in areas related to hydroelectricity, with a combined turnover of some $8.1 billion and a workforce of 23,800 employees (in person-years). The impact on Québec's economy is therefore considerable.

Increasing the pace of hydroelectric development in Québec would help maintain the expertise acquired by Québec's electricity industry and enable it to survive, while allowing it to export its technologies and expertise.

In the natural gas sector, Québec also exports its expertise to the rest of Canada and abroad, mainly through the Natural Gas Technology Centre. The main fields covered by the Centre are natural gas distribution and equipment efficiency, including the marketing of water heaters as well as the development of air heating systems and emergency intervention equipment.

4.4.2 Wind energy

In May 2003, to take into account the economic, social and environmental concerns of the Québec government, Hydro-Québec Distribution launched a call for tenders for 1,000 MW of wind energy, including provisions to maximize economic spin-offs in the form of jobs and investments in the Matane regional county municipality (RCM) and the Gaspésie-Îles-de-la-Madeleine administrative region. The retained projects will have to fulfill a number of requirements, including the following:

- The wind parks must be implemented in the Gaspésie–Îles-de-la-Madeleine region or the Matane RCM;
- Nacelles must be assembled in these two regions;
- Minimum regional content levels must be included in each project: 40% for the first portion of 200 MW in 2006, 50% for the 100 MW delivered in 2007 and 60% for the remaining 700 MW.

The government's purpose in making the call for tenders was to foster the emergence of an industrial base in the wind energy sector. The eight retained projects were announced on October 4, 2004. They will lead to estimated investments of $1.9 billion. The additional 1,000 MW announced on July 5, 2004, should help consolidate the industry.

4.4.3 New technology and innovation

The development of new technologies and new energy resources has a significant impact on Québec's competitive position in the current context of economic globalization. Indeed, countries such as Japan, Germany, the United States and many others invest heavily in this area.

Throughout the world, concerns about energy security, especially for fossil fuels, and the growing concern about environmental protection, have triggered major research and development efforts in the energy sector.

Technological progress has helped lower oil and natural gas exploration and production costs. The development of electro-technologies and gas technologies has led to the use of electricity and natural gas in applications for which these forms of energy would previously have been unsuitable or non-competitive. Now, however, their use often helps reduce energy consumption, lowers costs and cuts back on harmful emissions and greenhouse gases.

Thanks to the R&D effort, some significant progress has also been made in the energy efficiency of various forms of energy and all types of use, but especially for motor vehicles, space heating and air conditioning, lighting and household appliances, as well as for certain industrial processes.

In the last few years, research and development investments in Québec's energy sector have averaged approximately $200 million per year. Hydro-Québec is responsible for about half these investments, and its share is, of course, concentrated in its principal commercial activities.

With regard to natural gas, the Natural Gas Technology Centre (NGTC), created in 1992 by Gaz Métro and Gaz de France, has a team of approximately ten researchers and an annual turnover of between $2 and $3 million. Its mandate is to provide natural gas distributors and consumers with innovative technologies that are both efficient and environmentally friendly. The NGTC is the only private natural gas research centre in Canada.

25. *Comité sectoriel de la main-d'œuvre de l'industrie électrique et électronique, l'industrie électrique au Québec - situation comparative 1999-2003* - a study of the electricity sector manpower carried out by ADEC Consultants Inc., Ville Saint-Laurent.

Since 1991, the ministère des Ressources naturelles, de la Faune et des Parcs has given financial support to more than 290 projects, mostly concerned with renewable energy sources, through its energy technology development support program (ETDSP)[26]. Overall, the Ministry has invested some $24.7 million dollars in the program.

In the energy sector, Québec has made some significant R&D efforts, especially in the areas of electro-technologies, biomass use and biofuel development, hydrogen technologies, wind energy and energy efficiency, as well as in some electric vehicle technologies. The use of other energy sources such as geothermics and solar energy, or the use of reverse meters, could also be explored in the future.

One of the major concerns relating to technological development is the extent of the financial commitment required.

In Québec, the technological innovation and development sector provides some 1,500 jobs for researchers, engineers and technicians, and generates significant benefits for the economy.

A critical mass of researchers, along with appropriate financing, allow for a level of technological development that will support the economy in the long term by fostering optimal use of Québec's energy resources, the competitive capacity of its firms and the diversification of its energy industry.

A number of socio-economic and sustainable development progress factors are closely tied to innovation and technological development in the energy sector, including:

- Optimal resource use;
- Better knowledge of resources and processing techniques;
- Job creation and specialized manpower training;
- Maintenance of a critical mass of researchers;
- Minimization of the environmental impacts caused by energy systems;
- Opening of new energy export markets and related technologies.

Furthermore, coordination of all those concerned is vital to maximize the economic benefits of technological development.

26. No further commitments have been made under the ETDSP since 2003-2004, and its budget has not been renewed.

4.4.4 Biofuels and biogas

The relative scarcity of oil, the declining number of newly discovered deposits and the growing concern for environmental protection have triggered a worldwide effort to develop new fuels. In addition to their better environmental performance compared to conventional fuels, the new fuels are expected to spawn industries that will impact significantly upon the economy.

Ethanol

Canada's total production of fuel ethanol is 180 million litres per year (Ml/y), accounting for nearly 0.5% of all motor vehicle fuel sold in Canada every year. Most Canadian ethanol is produced by a plant owned by Commercial Alcohols Inc. in Chatham, Ontario, with a capacity of 150 Ml/y. It and the other plants currently in operation in the country cover numerous markets, including the motor vehicle fuel and industrial markets.

In Québec, Tembec has a plant in Témiscamingue that produces 17 Ml/y of ethanol by processing waste liquors from its pulping process. It consumes all its own production.

The fuel ethanol market in Québec, still in its infancy, is currently around 10 Ml/y. Québec does not currently produce fuel ethanol, but meets its needs through imports from Ontario, Brazil and the United States.

Fuel ethanol is of particular interest to Québec, where the transportation sector accounts for 39% of total greenhouse gas (GHG) emissions - a considerably higher percentage than that for Canada as a whole (25%). This is due to the significant role of hydroelectricity in Québec's total energy consumption profile, which means the transportation sector's contribution to GHG emissions is proportionally higher than elsewhere. Greater use of ethanol in Québec's fuel market would help the province to reduce its GHG emissions and secure its energy supplies.

Commercial Alcohols Inc. could open a fuel ethanol plant in Varennes. The new plant would have a capacity of 120 Ml/y and would require an investment of roughly $100 million.

The maximum potential consumption of ethanol in Québec, based on a 10% mix ratio, would approximately 800 Ml/y.

Environmentally speaking, there would be some clear benefits to be gained by replacing the cereal products currently used to produce fuel ethanol with forest biomass or special cultures. Research is currently underway in Québec on this subject.

Biodiesel

Biodiesel is a fuel produced from various types of agrifood waste, including animal fats and recycled frying oils.

Following trials carried out as part of the BIOBUS demonstration project in Montreal, Rothsay has decided to invest $14.5 million in Québec to produce 35 million litres of biodiesel every year, with the possibility of doubling the amount to 70 million litres in the future.

An evaluation of methods to analyze the oxidation stability of biodiesels is currently underway at the Oléotek laboratory in Thetford Mines. The testing method selected could ultimately be included in Canadian standards for biodiesel mixes and Québec standards for petroleum products.

The Conseil québécois du biodiesel was created in early 2004 to promote the use of biodiesel. Its goals are to develop, coordinate and encourage research and development in the biodiesel field.

Biogas

The materials that can be used to produce biogas include household waste, treatment station sludge, farm effluent and agrifood effluent.

Biogas generated in sanitary landfill sites (SLS) are a major source of air contamination. These sites emit large quantities of methane that contribute to the greenhouse effect.

There is a huge market in both Québec and Canada for farm waste, including pig slurry. In Québec alone, the available volume of waste is sufficient for a theoretical potential of 150 MW of electrical energy[27]. Québec currently has several demonstration projects for the production of biogas from pig slurry.

It is also possible to use biogas generated by anaerobic[28] decomposition of accumulated waste in SLSs. An estimated 50 MW of electrical energy[29] could be generated by burning the biogas from just ten of Québec's largest SLSs.

If nothing is done to stimulate biogas use, it will simply be burned on waste gas burners. It could, however, serve as a local energy source. In addition to electricity, it could be used for numerous purposes, including cogeneration of electricity and steam on sanitary landfill sites. It could also fulfill some of the energy needs of industrial and institutional clients located near the sites, or could be injected into the natural gas transportation and distribution networks.

Emerging energy sources are likely to play an increasingly important role in the coming years, helping to diversify energy use in Québec, create jobs and attract investments.

4.4.5 Energy efficiency and the economy

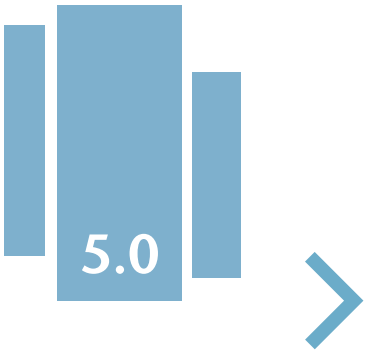
As well as contributing to energy security, Québec's energy efficiency initiatives have significant economic impacts. For example, the energy distributors anticipate nearly $50 million in energy efficiency investments in 2004 alone.

The Agence de l'efficacité énergétique acts as a catalyst for investments in a variety of sectors with a view to reducing energy costs while stimulating job creation and economic activity in general. For every dollar invested by the Agency to encourage energy efficiency measures, the Agency's clients and partners invest an average of seven dollars. A large percentage of these investments would never have been made without public intervention.

The energy efficiency sector is also known to be relatively labour-intensive, especially in comparison with other energy sectors. Every one million dollars invested in the sector creates more than 11 jobs (in person-years). An interesting feature of energy efficiency is that its spin-offs tend to be local in nature because investments are so decentralized.

27. Or direct thermal generation of 500 MW.
28. Decomposition of organic matter without air.
29. Or direct thermal generation of 200 MW.

SUSTAINABLE DEVELOPMENT



5.1 The issues

The concept of sustainable development requires conciliation or arbitration of the social, environmental and economic aspects in order to meet present needs without compromising the ability of future generations to meet their own needs.

In the energy sector, the concept of sustainable development translates into the need for a balance between meeting energy requirements that are essential to economic and social development and controlling environmental impacts.

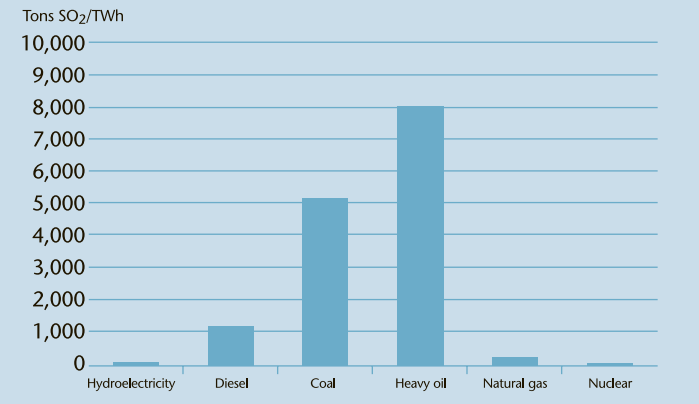
5.2 Main concerns

5.2.1 Air pollution

Energy-related activities ranging from production to consumption release varying levels of atmospheric pollutants, the best known of which are carbon monoxide (CO), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), ammonia (NH_3), sulphuric acid (H_2SO_4), volatile organic compounds (VOCs) and fine particulate matter[30]. These emissions vary significantly according to the primary energy source, as shown by the figures below, which are based on the life cycle[31] of the various electricity generating sources.

FIGURE 3

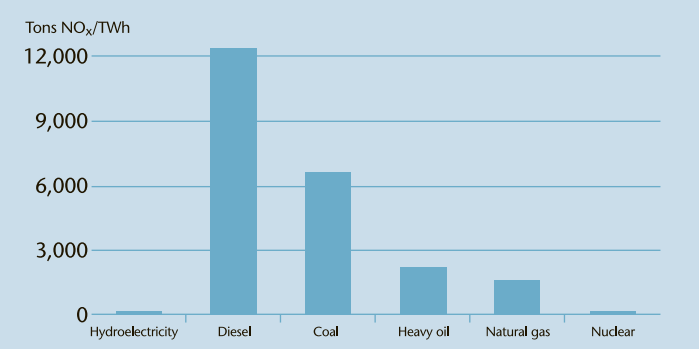
SO_2 emissions by power generating source



Source: Hydro-Québec.

FIGURE 4

NO_x emissions by electricity generating source



Source: Hydro-Québec.

For most energy sources, the pollutant emissions vary by use and by consumer sector. Analysis of the available data shows that the industrial and transportation sectors are responsible for most air pollution in Québec. As the following table shows, in three of the four cases they produce 90% of the principal pollutant emissions.

TABLE 4

EMISSIONS OF MAIN POLLUTANTS IN QUÉBEC (2000)

	Transportation	Industry
	%	%
Fine particulate matter	17.1	32.6
Sulphur dioxide - SO_2	7.6	88.3
Nitrogen oxides - NO_x	84.6	10.3
Carbon monoxide - CO	75.7	13.5

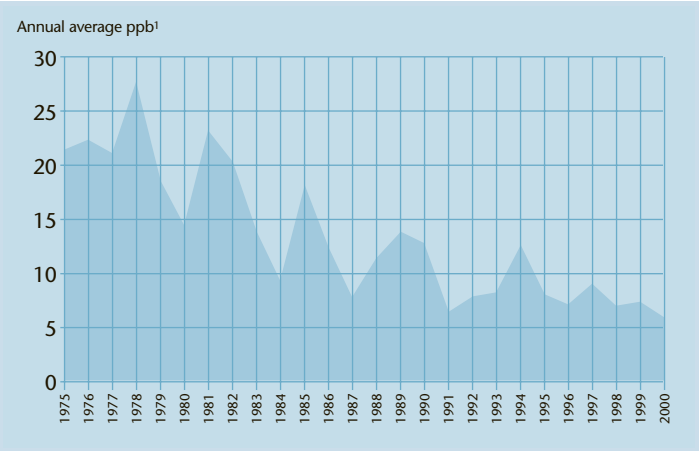
Source: Environment Canada - *National Pollutant Release Inventory, 2004*.

In Québec, thanks to the importance of renewable energy in the energy profile, combined with the industry's overall effort and the introduction of anti-pollution devices into cars, atmospheric contaminants have been contained and have actually declined significantly since 1975. The following figures illustrate the change.

30. Fine particulate matter is airborne microscopic dust and droplets smaller than 2.5 micrometers in diameter. They are composed mainly of sulphates, nitrates, carbon, organic matter, minerals from the soil, and metals. They are one of the main components of smog.
31. The concept of life cycle takes into account emissions associated with land use changes, manufacturing of the materials required for production and construction of factories, operations and the dismantling of factories.

FIGURE 5

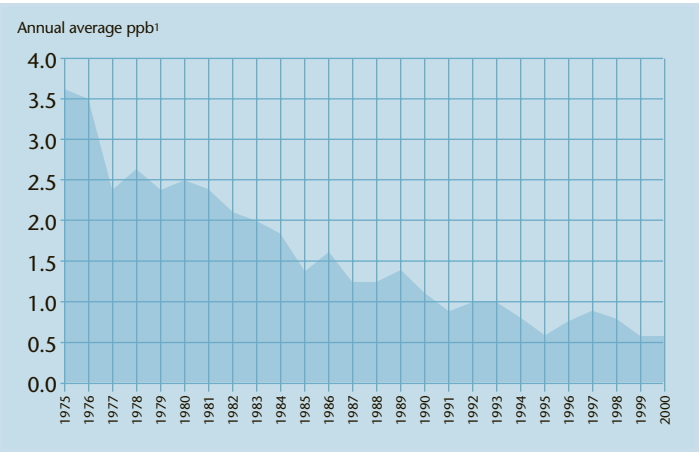
Changes in concentrations of sulphur dioxide in Montréal (1975-2000)



1. ppb: part per billion.
Note: The data were obtained from the Pointe-aux-Trembles station.
Source: Ministère de l'Environnement du Québec.

FIGURE 6

Changes in carbon monoxide concentrations in Montréal (1975-2000)



1. ppb: part per billion.
Note : The data were obtained at the Décarie station.
Source: Ministère de l'Environnement du Québec.

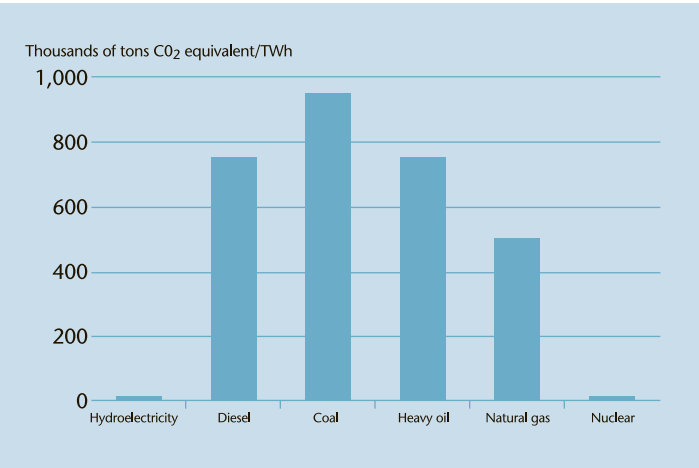
5.2.2 Greenhouse gas emissions (GHG)

The energy sector is the main producer of GHG in Québec. In 2000[32], it was responsible for 70% of emissions, mostly from the industrial and transportation sectors, due to the burning of fossil fuels.

The main GHGs resulting from energy production and consumption activities are carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). According to a life cycle analysis, all electricity-generating sources release varying levels of GHGs, as shown by the figure below:

FIGURE 7

Greenhouse gas emissions by electricity generating source



Source : Hydro-Québec.

Greenhouse gases

Carbon dioxide (CO_2), the principal GHG, is essential to life on Earth. However, at a certain concentration in the atmosphere, GHGs such as CO_2 constitute a risk for the climate, specifically by pushing planetary temperatures upwards.

GHGs have global or planetary effects, unlike atmospheric pollutants whose effects are often local.

Important steps towards reducing GHGs have been taken as a result of the Kyoto Protocol. Canada ratified the Protocol in the fall of 2002, and committed to reducing its GHG emissions by 6% from its 1990 levels in the period 2008-2012.

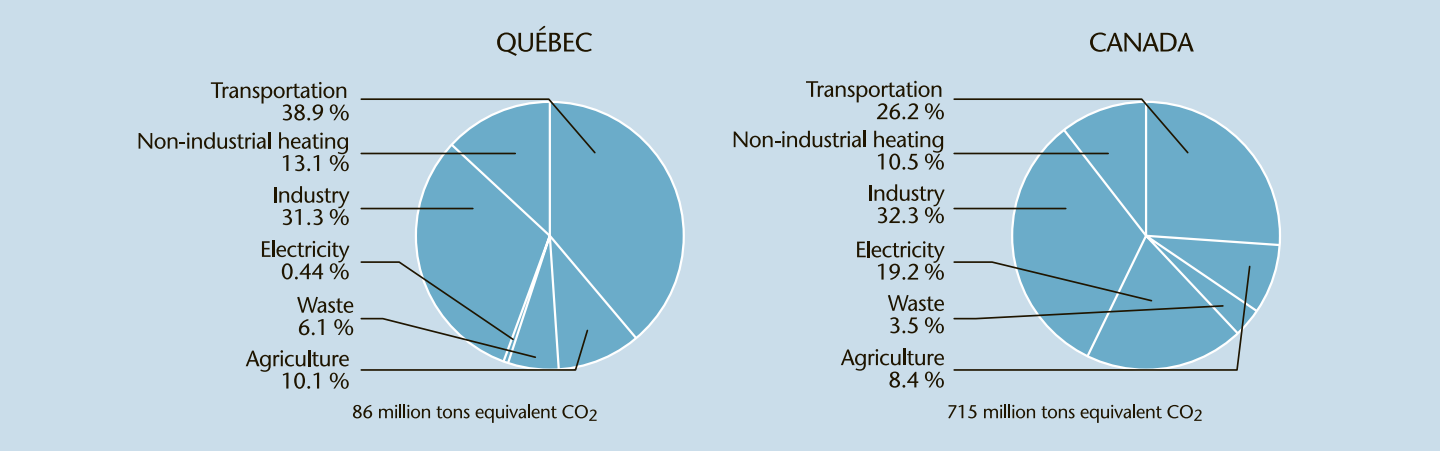
32. Ministère de l'Environnement du Québec, September 2002, *Inventaire québécois des gaz à effet de serre 1990-2000.*

It is important to note that the Kyoto Protocol provides great flexibility for individual countries in terms of the policies and measures they use to meet their GHG objectives. The Canadian government has decided to set objectives by sector rather than by territory. Québec, like other Canadian provinces and territories, has not yet defined specific targeted objectives.

The Kyoto Protocol notwithstanding, some regions have already adopted GHG reduction goals. For example, regional objectives were set at the Conference of New England Governors and Eastern Canadian Premiers.

FIGURE 8

GHG emissions by sector in Québec and Canada (2001)



Sources: Ministère de l'Environnement du Québec and Environment Canada.

However, this willingness to limit GHG emissions must be linked to the government's responsibility of ensuring the energy security of Quebecers and avoiding compromising the competitiveness of Québec's economy. It is important to understand that using thermal plants to produce electricity is not contrary to the Kyoto Protocol. Several Canadian provinces and other countries are developing natural gas power plants to reduce their emissions in general, including GHGs.

5.2.3 Other environmental and social impacts

Like most human activities, energy exploration, production and consumption have varying levels of environmental and social impacts in urban, rural and natural areas. Energy can, for example, affect plant life and wildlife, land quality, watercourse flow and navigability, landscapes and the communities hosting projects.

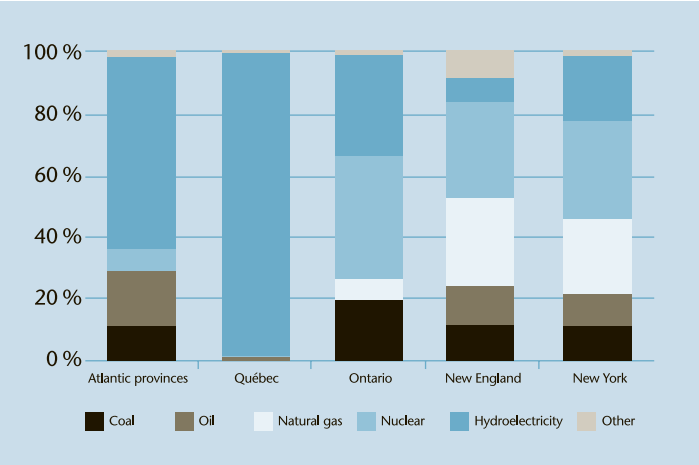
To reduce these possible impacts, governments have adopted environmental standards that today constitute the foundation of major development projects, fostering the application of new technologies and the introduction of cleaner fuels.

5.3 Québec in North-Eastern America

In the north-eastern region of North America, most electricity is produced from thermal sources. As illustrated in the figure below, however, Québec differs from its neighbours by the extent of its hydraulic generating resources.

FIGURE 9

Electricity production by source in North-Eastern North America (2001)



Note: Electricity production in the Atlantic provinces includes electricity produced at Churchill Falls, which is essentially purchased by Québec under a long-term agreement.

Sources: Statistics Canada and the US Department of Energy (DOE).

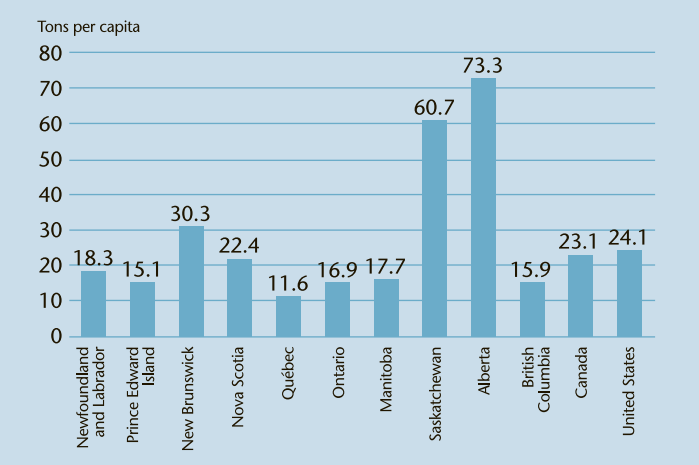
Looking to the future, Québec possesses certain tools that could enable it to play a leading role in facing the challenge of climate change. For example, it has abundant potential for the development of renewable energy sources. In a context characterized by "continentalization" of the energy market and globalization of environmental issues, Québec could, in the medium and longer terms, help the border provinces and states to deal with their electricity supply problems by using sources that are less harmful to the environment.

5.4 Renewable energy

Because of its renewable energy sources, Québec is able to play a leading role in North America in the battle against GHGs. With emissions of 11.6 tons of GHGs per capita in 2001, Québec's performance is demonstrably superior to that of the rest of Canada[33], which recorded emissions of 26.7 tons. As for the United States, their national GHG emissions per capita were 24.1 tons.

FIGURE 10

GHG emissions per capita and by province (2001)



Hydroelectric production[34], particularly where it involves small power plants, is an activity that most experts believe releases few or no pollutants and negligible quantities of GHGs. This is an undeniable advantage over certain other energy sources.

By 2012, Québec will have a wind power capacity of at least 2,000 MW and its electricity production capacity from biomass is expected to continue to increase in the coming years.

This gives Québec several advantages in its effort to reduce GHG and other atmospheric emissions considered harmful to human health and ecosystems, both in Canada and at the continental level.

33. Excluding Québec.
34. At the International Conference on Renewable Energies (Renewables 2004) held in Bonn in June 2004 and attended by 154 countries (including the United States and European countries), "hydropower", large or small, was cited as a renewable source of energy.

5.5 The role of energy efficiency

Because of the influence of energy consumption on pollutant and greenhouse gas emissions, energy efficiency has a major role to play in reducing atmospheric pollution and mitigating the effects of climate change. This is also true for the development of renewable energy sources. Energy efficiency is a beneficial solution that will reduce energy consumption without altering the quality or standard of living of users.

Most often, energy efficiency measures are voluntary and produce economic, financial and environmental benefits.

Such measures can be applied to all sources of energy and all sectors affected by the problems of climate change or pollutant emissions, and can help reduce emissions of GHGs and pollutants not only from fossil fuel combustion, but also from industrial processes.

Even for electricity, which in Québec is essentially hydraulic, energy savings can reduce GHG and atmospheric pollutant emissions by limiting pressure on Québec's production resources and reducing short-term imports that are almost all thermally generated.

It is important to remember that, for consumers, energy price levels are a major incentive in the decision to adopt energy efficiency measures. Higher energy prices, by increasing the economic impact of energy efficiency measures, are more likely to encourage consumers to adopt energy-saving behaviours and measures, for example by using more efficient equipment.

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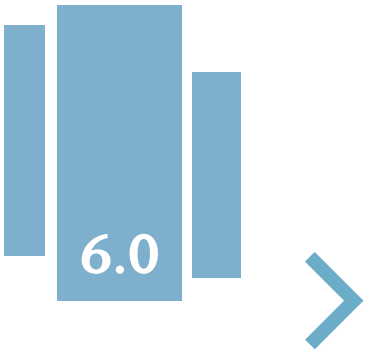
CONCLUSION



Conclusion

By launching the consultation process on a new strategy for the future and security of energy in Québec, the government hopes to raise public awareness of the major energy issues facing Québec, and share its thoughts on those issues. Following several years of reflection and debate in Québec, the publication of this document is the first step in a process in which the population is invited to play an active role.

To ensure that its decisions are properly informed, the government hopes for an open reflection on Québec's energy future and the role the energy sector will play in Québec's economy. This process will provide an opportunity for all parties to express their opinions, make proposals and influence the future energy orientations and initiatives of the Québec government.

In the coming months, this process will provide a remarkable opportunity for Québec to achieve its dual goals of energy supply security and sustainable development. The government hopes the consultations will inform the general public while allowing to identify potential avenues for solutions and for projects that will create wealth for all regions of Québec in a concerted and harmonious manner, while guaranteeing a secure energy supply for all Quebecers and meeting the requirements of sustainable development.

ANNEX:
DATA ON THE ENERGY SECTOR

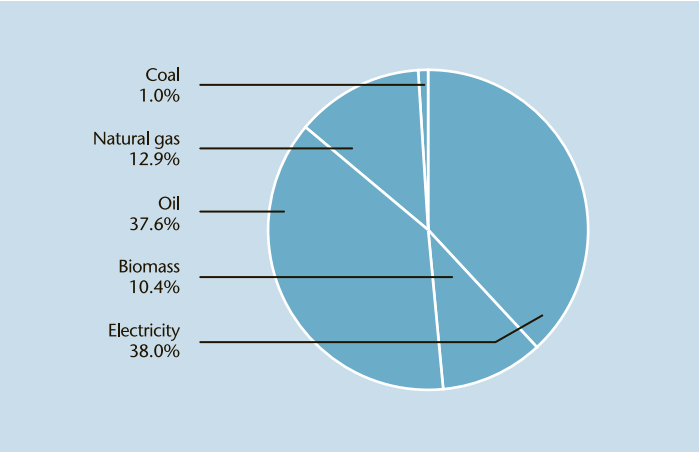
Production and consumption

Electricity is a major component in Québec's overall energy consumption (38.0%). Oil is equally important (37.6%), mainly because of its use in the transportation sector. The widespread use of electricity for space heating, triggered by low electricity rates and the low cost of electrical equipment coupled with the limited availability of natural gas, mean that gas is used to meet only 12.9% of Québec's energy needs. Roughly 80% of this natural gas is consumed by the industrial and commercial sectors.

Since the 1970s, government policies have encouraged the use of electricity for residential heating purposes, as a consequence of the electricity surplus created by the major hydroelectric schemes and programs to convert residential heating systems.

FIGURE 11

Energy consumption in Québec (2002)

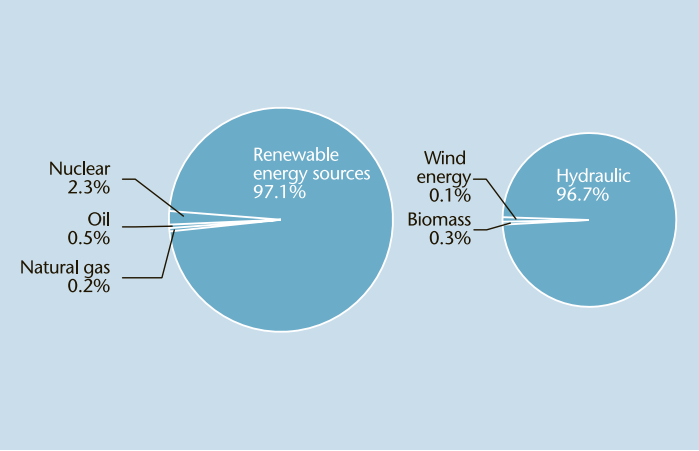


Sources: Ministère des Ressources naturelles, de la Faune et des Parcs du Québec and Statistics Canada.

Electricity generating facilities in Québec are mainly reliant on renewable energy sources (97.1%), since hydroelectricity, including power from Churchill Falls in Labrador, accounts for 96.7% of total production, and biomass and wind energy for 0.3% and 0.1%, respectively. The remaining electricity is produced by oil-fired (0.5%), natural gas-fired (0.2%) and nuclear (2.3%) power plants.

FIGURE 12

Electricity production in Québec, by source (2002)



Sources: Ministère des Ressources naturelles, de la Faune et des Parcs du Québec and Statistics Canada.

Uses of various forms of energy

Québec's energy use is largely determined by two key factors: our substantial space heating needs, and the importance of resource processing in Québec's economy.

Québec's northern location creates a significantly higher consumption of energy than, for example, Ontario. Almost one-fifth of all the energy consumed in Québec is used for space heating.

Québec also has a relatively large manufacturing sector, and Québec's abundant hydroelectric resources have been used to support the development of the resource processing industry. Manufacturing, as a whole, accounts for roughly two-fifths of total energy consumption.

In contrast to the rest of North America, Québec not only has a high heating demand, but also meets a large part of this demand through the use of electricity. Combined with the high electricity consumption of the manufacturing sector, this means that electricity accounts for a large proportion of total energy consumption (over 40% if biomass is excluded)[35], compared to the Canadian average (25%, excluding biomass).

The electricity market in Ontario is completely different. The use of other types of energy for space heating means that peak winter demand for electricity is lower. However, a more intensive use of air conditioning means that Ontario's summer peak demand (24,753 MW during the summer of 2003) is practically the same as the winter peak demand (24,937 MW during the winter 2003-2004).

If Québec is compared to Ontario, its per-capita consumption of electricity is roughly double in the residential sector and triple in the manufacturing sector.

This situation can be explained by the low electricity rates enjoyed by Québecers, which have encouraged the use of electric power for space heating, especially in the residential sector, and have led to a type of industrial development based on electricity-intensive processes. The low cost of electricity compared to the other types of energy available has encouraged a more intensive use of electric power by consumers.

In addition, and as is the case in most industrialized countries, transportation is a major item in total energy consumption. Since transportation still relies almost exclusively on petroleum products, oil is still a significant component of Québec's energy consumption, with roughly the same importance as electricity.

TABLE 5

ENERGY CONSUMPTION IN CANADA
TOTAL NET ENERGY AVAILABLE FOR CONSUMPTION (2002)

	Total consumption[a]	Breakdown of total consumption			
		Coal	Oil[b]	Natural gas	Electricity
	Millions of TOE[d]	%	%	%	%
Québec	37.2	1.1	42.0	14.4	42.5
Atlantic provinces	11.8	1.0	68.7	3.0	27.2
Ontario	60.0	5.4	37.2	36.6	20.8
Manitoba	6.0	0.5	38.2	35.1	26.1
Saskatchewan	8.4	0.8	36.9	45.0	17.3
Alberta	29.8	0.1	34.0	51.1	14.8
British Columbia	23.1	1.6	43.0	33.0	22.4
All of Canada[c]	176.3	2.4	40.6	32.0	25.0

a. Biomass excluded.
b. Including propane and butane.
c. Including federal territories.
d. Tons of oil equivalent.

35. To ensure a valid comparison with the other Canadian provinces, biomass must be excluded from the figures for energy consumption in Québec.

List of acronyms

BAPE	Bureau d'audiences publiques sur l'environnement
FERC	Federal Energy Regulatory Commission
NERC	North American Electric Reliability Council
OPEC	Organization of Petroleum Exporting Countries
SOCOM	société en commandite (limited partnerships)
AEE	Agence de l'efficacité énergétique
VOC	volatile organic compounds
NGTC	Natural Gas Technologies Centre
DOE	United States Department of Energy
GHG	greenhouse gases
LNG	liquefied natural gas
HQD	Hydro-Québec Distribution
HQP	Hydro-Québec Production
SLS	sanitary landfill site
LPEP	Act respecting petroleum products and equipment
LRE	Act respecting the Régie de l'énergie
MRC	municipalité régionale de comté (regional county municipality)
NPCC	Northeast Power Co-ordinating Council
NEB	National Energy Board
ETDSP	Energy Technologies Development Support Program
TCPL	TransCanada PipeLines

List of symbols

¢/kWh	cents per kilowatt hour
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
°C	degrees Celsius
H_2SO_4	sulphuric acid
kWh	kilowatt hour
km	kilometre
km^2	square kilometre
MW	megawatt
M$	million dollars
Ml/a	millions of litres per year
N_2O	nitrous oxide
NH_3	ammonia
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
ppb	parts per billion
SO_2	sulphur dioxide
TWh	terawatt-hour

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