



# Québec hydropower: the largest source of renewable energy in the North American market

By Thierry Vandal,  
President and Chief Executive Officer, Hydro-Québec

**H**ydro-Québec is one of the largest power generators in North America, with hydropower installed capacity and available supply of over 40,000 MW. Our Strategic Plan calls for the development of new hydropower projects and the integration of a considerable quantity of wind power to maintain a high-quality electricity supply for our customers.

Since 2000, a total of 5,216 MW of new hydropower generation has been commissioned or is currently under construction. Hydropower represents about 16 per cent of the world's electricity generation. In Canada, about 60 per cent of electricity is generated from hydropower. Hydro-Québec generates almost a third of the electricity in Canada, and a full 98 per cent of our output comes from hydropower.

## Generating clean, renewable, reliable energy

Hydropower generated in Québec offers numerous advantages. It is the only source of renewable energy in North America capable of providing reliable, base-load and peak-load electricity on a large scale.

Hydropower installations with reservoirs are flexible, responding rapidly to variations in electricity demand. Water is stored when demand falls and released to produce electricity when demand rises. Water can also be run through turbines to compensate for variations in wind power production. Having hydropower as an energy base actually encourages the development of intermittent sources of renewable energy, such as wind power.

From an economic point of view, hydropower offers an alternative to the price volatility of fossil fuel and contributes to energy security. The advantages of hydropower do not end there. Generating electricity from water doesn't produce any pollutants that affect the quality of the air we breathe. As a result, hydropower does not contribute to atmospheric problems such as smog or acid rain.

In the fight against climate change, hydropower makes an important contribution. Hydroelectric generating stations with reservoirs emit 40 times fewer greenhouse gases (GHGs) than natural-gas power stations and 100 times fewer emissions than coal-fired generating stations. According to life cycle analysis, GHG emissions from a reservoir generating station in a northern region are comparable to those from wind generation and less than a quarter of those from photovoltaic solar generation, for equivalent energy output. Thanks to the extensive use of hydropower, the electricity sector in Québec accounted for only 2.7 per cent of GHG emissions in the province in 2007.

## Helping Québec's neighbours reduce their carbon footprints

Hydro-Québec is working with its neighbours to make more of its hydropower available to their markets. The 2009 commissioning of a 1,250-MW interconnection with Ontario will allow Hydro-Québec to increase energy deliveries to Ontario, but also to New York State and the US Midwest. With its partners Northeast Utilities and NStar, Hydro-Québec is currently studying a project for a 1,200-MW direct-current line into New Hampshire to increase energy exports to New England.

Since 2001, more than 39 million metric tonnes of greenhouse gas emissions have been avoided in northeastern North America as a result of electricity exports from Québec alone. This is roughly equal to the annual emissions of close to 10 million automobiles.

## Building new electricity transmission infrastructure

Ensuring that clean energy reaches its export markets requires increased investment in electricity transmission infrastructure. Currently, market rules in place in North America are designed to ensure that the appropriate parties pay for the cost of building or upgrading transmission. This ensures a level-playing field among all power generators and wholesalers.

Hydro-Québec has constructed and operates the largest electricity transmission grid in North America with 33,244 km (20,657 mi.) of lines, 515 substations and 16 interconnections with neighbouring markets.

Large-scale generation of hydropower and exports to regions with fewer renewable resources goes a long way to lowering GHG emissions. However, to further reduce our carbon footprint, we have to use energy much more efficiently in other economic sectors.

## Electrifying public and personal transportation

Public and personal transportation account for about a quarter of greenhouse gas emissions in North America. In Québec, the transportation sector accounts for more of Québec's GHG emissions than any other sector: 36 million tonnes in 2007, or 42 per cent of total GHG emissions.

If a majority of our personal vehicles and public transit were powered by electricity, GHGs associated with transportation would decrease, as would urban pollution and smog.

Hydro-Québec is well placed to contribute to the electrification of transportation. It generates clean and

renewable energy, operates a reliable grid and has access to world-renowned expertise and promising technologies. Our transportation electrification action plan has four main focuses: financial support for the development of electrical infrastructure for public transit; development and marketing of advanced technologies; test-driving and experimenting with integration of electric vehicles into the power grid; and planning of support infrastructure for vehicle charging.

Hydro-Québec is currently participating in feasibility studies conducted by various public transit authorities to determine exactly what electrical infrastructure is needed and what Hydro-Québec's level of investment might be in this infrastructure. Certain public transit systems – the Métro in Montréal, for example – already run on electricity. But more could be done to bring electrified streetcars, commuter trains and trolleybuses into our urban landscape.

As for personal transportation, in Québec it would cost seven times less to run a car on electricity than it does now to fuel it with gasoline. Hydro-Québec's distribution grid could handle the increase in demand brought about by electric vehicles. A single hydro generating station the size of Eastmain-1 could provide the electricity for a million electric vehicles (3 TWh per year).

Hydro-Québec is partnering with various car manufacturers, including Ford, Mitsubishi Motors Toyota and Renault-Nissan, to test and use various electric and plug-in hybrid vehicles before they are marketed on a large scale. The studies underway are designed to determine the recharging performance of vehicles, particularly under northern conditions, and the driver experience and overall satisfaction. Renault-Nissan Alliance, the Québec government, Hydro-Québec and city administrations have established a working group to study various aspects of charging infrastructure required for electric vehicles.

However, electric vehicles will only be successful if the engine technologies, the batteries and the electronic components meet

market needs. Hydro-Québec's research institute, IREQ, has done extensive work to improve the performance and reduce the cost of lithium-ion batteries. Hydro-Québec patents the advanced materials it develops and then grants licences to battery manufacturer suppliers. Sony has recently launched a battery incorporating chemical components developed by Hydro-Québec.

### Contributing to the fight against climate change

To ensure continued sustainable economic growth, the world doesn't only need more energy – it must also reduce GHGs. We need to be more efficient in our energy consumption and ensure that regions with sources of renewable energy have the transmission infrastructure necessary to export that clean energy to areas still dependent on fossil fuels. The use of clean and renewable energy must also make its mark in sectors of the economy such as transportation that have traditionally been dominated by fossil fuels, especially in regions like Québec where the energy sector is already low-emitting. In a world where the threat of climate change is fast becoming a reality, sustainable hydropower, the most flexible and reliable renewable energy, is one of the means to move towards a low-carbon economy. □

*Manic-5, a 1,596MW generating station on the Manicouagan River, was commissioned in 1970-71*



Photo: Hydro-Québec