



Tapping into the potential of hydropower to reduce greenhouse gas emissions

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

According to recent forecasts from the US Energy Information Administration, world net electricity generation will increase by 87 per cent between 2007 and 2035. Over the same period, the International Energy Agency's *World Energy Outlook* foresees that hydropower will likely continue to account for approximately 16 per cent of the world's total electricity generation. Most of the increase in hydropower generation will occur in non-OECD countries such as Brazil and China, where remaining potential is highest, with development continuing as well in Canada, the European Union and Turkey.

There are a number of reasons why this generating option will continue to play such a key role in meeting customers' electricity needs around the globe.

Concentrations of greenhouse gas (GHG) emissions in the atmosphere will remain on the increase if the world's energy demand continues to be met with fossil fuels, especially those extracted from oil sands. The major environmental challenge we face today is to replace the fossil fuels used to generate electricity — particularly coal — and the oil used in ground transportation, in order to improve air quality and reduce GHG emissions.

Towards cleaner electricity generation

Coal is used to generate half of North America's electricity. This poses a real environmental problem and a real public health problem. In the greater Central Valley region of California, one out of every six children carries an inhalator because of respiratory problems. Continuing to fuel our cars with oil is only making matters worse.

Throughout the world, efforts are being made to generate more electricity from renewable energy sources. Reducing the environmental footprint of the energy sector has become a topic of discussion for the general public, civil society and governments. Energy companies are increasingly turning to renewable energy to meet their customers' needs.

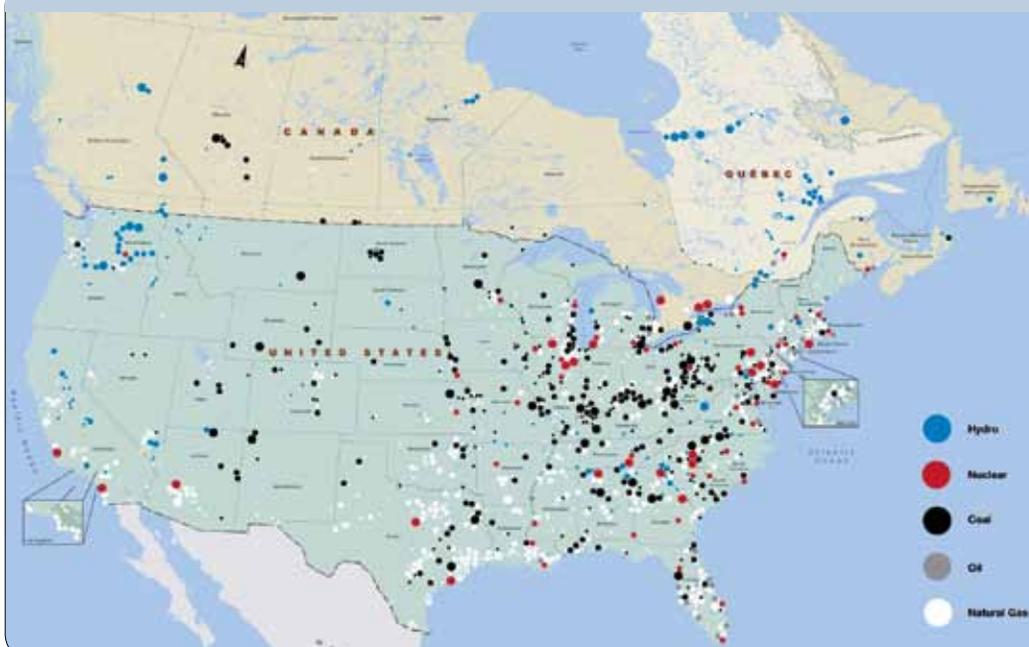
Ensuring air quality and reducing greenhouse gas emissions

In Québec, hydropower is the cornerstone of electricity generation. Our great advantage is to have a baseload energy derived from water resources, which are renewable. Unlike thermal power plants fired by coal or natural gas, hydropower generating stations do not emit pollutants that contribute to phenomena such as smog or acid rain.

While all electricity generation creates GHG emissions, whether directly or indirectly, Québec hydropower ranks as one of the lowest-emission generating options per kilowatt-hour. Emissions from reservoir generating stations in Québec are comparable to those produced by wind generation and represent about a quarter of those from photovoltaic solar facilities, mainly because of the processes involved in manufacturing wind turbines and solar panels.

A gas-fired power plant produces about 40 times more GHG emissions than one of Hydro-Québec's reservoir generating stations

Electricity generation in the United States and Canada



and a coal-fired plant, about 100 times more.

All natural aquatic areas emit greenhouse gases. Generally speaking, emissions from northern reservoirs return to the level observed in natural lakes within 10 years. Therefore, even though the flooding of large areas of land leads to an increase in GHG emissions, this is a temporary phenomenon.

From 2003 to 2009, a large-scale scientific study was carried out to measure net GHG emissions from a reservoir located in a northern region. The study's goal was to compare the emissions of the natural environment prior to the reservoir's creations and those of the Eastmain 1 reservoir after impoundment. Results show that, among all generating options, hydropower boasts one of the lowest levels of GHG emissions.

Replacing oil with clean electricity in ground transportation

Worldwide, the two largest sources of GHG emissions are electricity generation and transportation. Public and personal transportation account for about a quarter of GHG emissions in North America.

The situation is somewhat different in Québec, however. Thanks to our hydropower development, the electricity sector accounted for a mere 0.5 per cent of Québec's GHG emissions in 2008, compared with 43 per cent (36 million metric tons) for the transportation sector. While oil has dominated the ground transportation sector for the last century, electricity will play an increasingly important role in both personal and public transportation from now on. Ensuring a cleaner power mix in the transportation sector is essential if we are to significantly reduce our carbon footprint.

The electric car is a promising development in our industry. Many models are hitting the market: the Nissan LEAF, the GM Volt, the Mitsubishi i-MiEV, the Ford Focus, and the list goes on. Hydro-Québec is partnering with various car manufacturers — including Ford, Mitsubishi, Toyota, and Renault-Nissan — to test and use electric and plug-in hybrid vehicles before they are marketed on a large scale. These demonstration projects have been designed to determine the charging performance of vehicles, particularly under northern conditions, as well as driver experience and overall satisfaction.

Battery materials are the key to a successful future for electric cars and buses. Lithium ore phosphate shows a great deal of promise for increasing the stability and safety of lithium-ion batteries and reducing their cost.

Paving the way to a sustainable energy future

To ensure continued sustainable economic growth, the world must use its energy more efficiently and concentrate on the development of all forms of renewable energy: hydro, wind, solar, biomass, geothermal, etc. There are no bad choices among these energy sources, and different regions will specialise in those sources that are in line with their natural resources and make sense for their markets.

Regions with a strong resource base for generating clean, renewable electricity can export more of that energy to neighbouring regions. For example, between 2008 and 2010, Hydro-Québec's net electricity exports avoided the emission of 41 million metric tons of GHGs in North America. That is the equivalent of the annual emissions from about 10 million vehicles.

A low-carbon economy is not only possible, it is a necessity. Hydropower, the most flexible and reliable renewable energy, is key to this sustainable energy future. □

A team of 80 experts from Université du Québec à Montréal, McGill University and Environnement Inc. collected and analyzed some 100,000 measurements as part of this unique research program. The results of the study can be found at <http://hydroforthefuture.com/energie/2/one-of-the-cleanest-generating-options>.

