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Northern Waters

A realistic, sustainable and profitable plan to exploit Quebec's blue gold

By F. Pierre Gingras

Northern waters and energy hold a special place in our national mythology and daily economic reality, particularly since the major hydro-electric work at James Bay in the 1970s. Quebec's environmental and energy policies were manifestly transformed after our northern rivers were harnessed. The impact was also positive on various other sectors of society, ranging from public finances to industrial development and including social and economic progress in Aboriginal communities.

Despite these considerable achievements in exploiting Quebec's blue gold, one question remains: are we yet making the most of this natural resource, which is increasingly rare in various areas of the world and is likely to rise in value in the coming decades?

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We are indeed lucky to have some of the largest renewable freshwater reservoirs on the planet, even more so in comparison with our small population size. Elsewhere in the world, particularly among our neighbours to the south, people would be willing to pay considerable sums to access a small part of this water.

The debate over exporting large quantities of northern Quebec water has nonetheless never really taken place, for understandable reasons. The only minimally detailed proposal that was ever discussed was that of the so-called "Grand Canal," first made in the 1960s then revived by a group of business people in the 1980s.

It was a grandiose project, along the scale of the pyramids of Giza, involving the construction of a massive dam closing James Bay and a long canal diverting the accumulated freshwater to the Great Lakes. Several nuclear power plants would have been required just to pump the water, and the cost of the project at the time was estimated at \$100 billion, which would be \$175 billion today – three times the annual budget of the entire Quebec government!

What has always been missing to allow for a proper rational discussion of this opportunity was a technically realistic, sustainable plan to develop the resource, a project that doesn't involve massive changes to the ecosystem and that would be financially viable. The goal of this paper is to summarize just such a project, which we are calling the Northern Waters complex.

Capturing and diverting the seasonal floods of three rivers

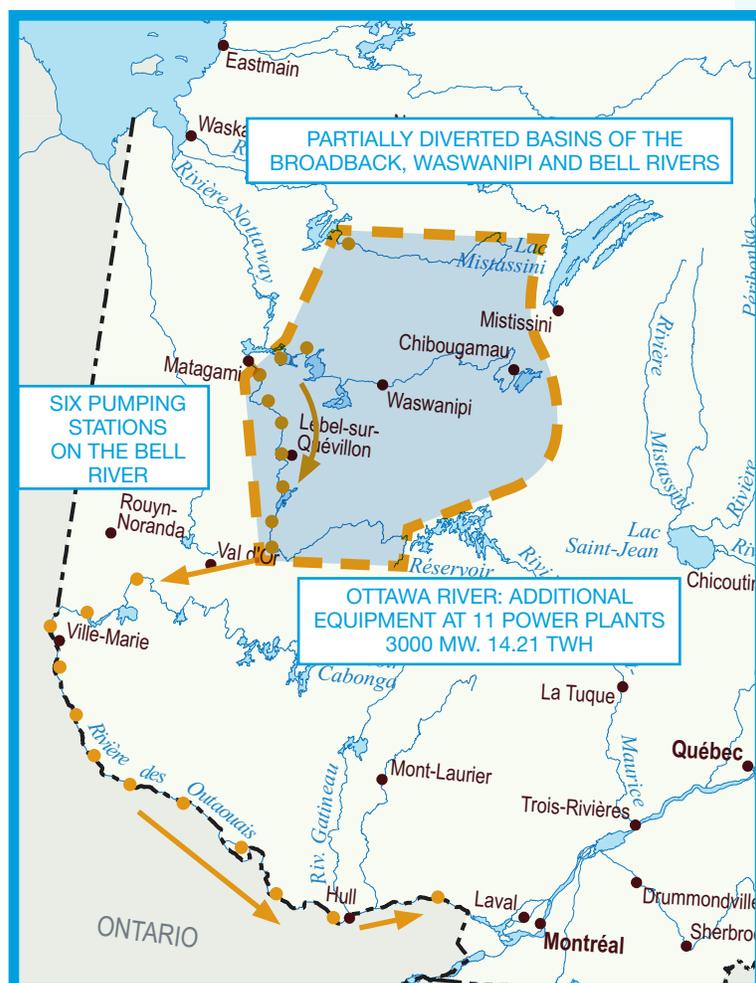
The image that comes to mind for most people when discussing the idea of bulk water exports is either the pharaonic type of project mentioned above or the diversion and depletion of a major river with the obvious consequences on the environment. But there is a third option, which would be to use only the surplus water generated by seasonal flooding. This represents 50% of the annual flow of rivers in Quebec.

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There are three rivers in the James Bay basin, just north of the Abitibi region, which have not been developed for hydro-electric power: the Broadback, Waswanipi and Bell (see map below). The Northern Waters project would capture the seasonal runoff and gather it in basins before it flows into the northern lowlands. Compared to the Grand Canal project, 85% of pumping efforts would thus be eliminated.

The surplus waters would then be diverted via the natural riverbeds through a series of six pumping stations along the Bell River up to the Val d'Or pass, which is the highest point before the waters can flow by gravity down the Ottawa River valley. The pumping stations would be arranged to limit the submersion of the surrounding lands and respect the elevation of the many lakes which the Bell River creates along its way.

From this, the additional average flow of 800 cubic metres of water per second (CMS), which is slightly more than the Saint Maurice River, would flow into the Ottawa River down to the Saint Lawrence just above Montreal. It would be exploited by adding more power facilities to the existing dams on the Ottawa River or through a more intensive use of existing plants which are not running at full capacity. This would involve very modest civil engineering works compared to past Quebec projects – without flooding the surrounding landscape. Using its existing infrastructure, Hydro-Quebec would have a very lucrative new mission.



Quebec map: © Gouvernement du Québec

“The Northern Waters energy could contribute in large part to making the project viable – before negotiating any sale of freshwater.”

The net energy produced (calculated by subtracting the energy used to run the pumping stations from the new energy produced in the turbines) would be more than 14 terawatt-hours (TWh) annually. As a comparison, the four dams in the North Shore's Romaine complex, which are now at the public consultation stage, will add an average annual production of 8 TWh. The Northern Waters energy could contribute in large part to making the project viable – before negotiating any sale of freshwater.

Freshwater for 150 million people

The main benefit of the Northern Waters project would be for Quebec to export a large quantity of freshwater – without one drop having to leave the province. Current treaties between Canada and the United States and between bordering states and provinces regulate the water level and establish a certain flow in the Saint Lawrence, under the International Joint Commission. The flow of 800 CMS from an alternative source into the Saint Lawrence River would theoretically reduce the amount of water required from the Great Lakes by as much.

There are several possible scenarios. Part of the newly available quantity of water could be used to regulate the level of the Saint Lawrence River and Great Lakes, which has been dropping in recent years. Ontarians and Americans may also choose to use a certain quantity for their freshwater consumption needs. The surplus could be delivered to the Midwest and South via a detour through the Chicago Canal and Mississippi River.

The diverted water corresponds to a daily volume of close to 70 million cubic metres. On the basis of an average daily consumption of 0.45 cubic metres per inhabitant, and not counting other factors such as losses in the distribution process, the project could theoretically serve the needs of some 150 million people, which gives an idea of its magnitude.

The debate over the necessity for populations in the Great Lakes area to use large amounts of the freshwater from these great reservoirs in the medium term has already begun and could lead to a major political conflict between Canada and the United States. The Northern Waters project would be an ingenious way to resolve this problem on a commercial basis, with financial benefits deriving from the major renewable water resources of Quebec.

A project that respects the environment

The environmental impact of the Northern Waters project is estimated to be relatively small. As mentioned, the project would capture seasonal surplus waters only and not upset ecosystems by completely diverting and draining the rivers involved. The 800 CMS diverted correspond to just 6.3% of the total flow into James Bay and a maximum of 2% of Quebec's freshwater. There is thus no reason to fear a major advance of saltwater from Hudson Bay toward the south.

Considering that ocean levels may rise in the coming decades due to global warming, the Northern Waters diversion may have the positive effect of offsetting this by turning Quebec's freshwaters back into the continent.

The environmental impact in the floodwater catchment basin would be limited by the maximal use of the naturally existing bodies of water, thereby submerging a total surface area of less than 1100 square kilometres for the entire complex. Given the quantity of water diverted compared to the volume of the reservoirs, mercury would not be a problem either since it only leaches in high concentrations out of recently submerged lands when the water is dormant for long periods. The environmental impact on the Ottawa River would also be minimal, since its flow would be kept stable and well below natural flood levels. Finally, there is the crucial and well-known fact that hydro-electricity is a non-polluting, renewable form of energy that does not produce greenhouse gases.

Clear financial benefits for Quebec

If the Northern Waters project could be implemented immediately and paid in 2007 dollars, its total cost would be in the order of \$8.5 billion. Taking inflation and financing costs into account, the total cost is estimated at \$15 billion in current dollars at the end of 2022, when the project will be completed. We're therefore light-years away from the \$175-billion Grand Canal project. As a comparison, the cost of the Romaine complex is estimated at \$6.5 billion.

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Developing the Northern Waters complex would be facilitated by the proximity of the Abitibi, Temiscamingue and northeastern Ontario regions. A good proportion of the workers would be able to reside in the construction area, and services could be provided largely by regional companies. The impact and extent of transportation lines would similarly be relatively modest.

The profitability of the Northern Waters project is unquestionable. The minimum annual revenue from the sale of energy produced (14 TWh) on the Quebec market in 2018 is estimated at close to \$2 billion, which is 14% of the amount invested. By accounting for the additional value of energy sold during peak periods, whose market rate estimates in 2018 are admittedly based on speculation, another \$300 million can be added annually to this revenue. Export sales are not counted here, but could bring even more revenue.

Further income would be available from pollution credits if the energy produced by the Northern Waters project is exported and replaces energy from thermal power plants. Such credits recently sold in Europe for 20 to 25 euros per tonne of greenhouse gas rejected. Each megawatt eliminates the emission of some 10 000 tonnes of gas. If such a credit system were functional here in 15 years, the additional revenue could reach several hundred million dollars per year.

The revenue generated by exporting freshwater would be the result of complex negotiations between state, provincial and federal governments. At best, we can hypothesize the value of water. A first estimation method would be to calculate the cost of desalinating an equivalent quantity of saltwater. At the current cost of about \$0.85 per cubic metre, this suggests the spectacular amount of more than \$20 billion for 25 billion cubic metres of water diverted annually by the Northern Waters complex.

Another way to estimate this value would be to assume that each of the 150 million people whose needs could be served by the project would pay the very reasonable rate of \$50 per year. In this case, annual income from the exports would be \$7.5 billion. Whatever the outcome of negotiations, and given the probable increase in the value of water in the coming years, this revenue from the sale of water would contribute significantly to the financial health of the Quebec government and the general prosperity of Quebecers.

Next steps

This document summarizes the results of a preliminary study carried out in recent years by a small team of specialists on the various technical, environmental, financial and legal aspects of the Northern Waters project. If public leaders choose to verify the feasibility and profitability of the project, this preliminary study can serve as a basis for more detailed technical and impact studies involving independent engineering firms, as was the case for the La Grande complex. The populations concerned and environmental experts should also be consulted and involved from the beginning.

The Northern Waters project proposes developing Quebec's blue gold in a realistic and environmentally respectful manner. The project would be viable even if it were limited to its hydro-electric dimension. By adding water exports, it would allow Quebecers to generate wealth thanks to the increasing demand for a rare resource found in abundance on our territory, exactly as oil exporting regions do. Given the project's considerable benefits, limited environmental impact and reasonable costs, it deserves objective and open-minded analysis.

The Author

F. Pierre Gingras is a specialist in industrial engineering. He worked for 31 years in the construction of hydro-electric projects, including 17 as division manager for the planning and estimation of major projects. He was therefore intimately involved in the Manicouagan, Aux Outardes and James Bay complexes, in addition to his contributions to the refurbishment of many other works. He also directed evaluation and concept studies for a multitude of other projects. Since his retirement in 1997, Mr. Gingras has remained active in the field and contributed to studies for over 50 projects with various consultants, developers and Aboriginal councils. Collaborating with various experts, he sometimes takes part in the presentation of briefs submitted to the provincial government's public hearings office on the environment, the Bureau d'audiences publiques sur l'environnement (BAPE).

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