by Jesse Baltutis

The Water-Energy Nexus

Our Common Future

The vast amount of water rushing over the Niagara Falls – as iconically Canadian as the beaver or lumberjack – is also one of Ontario's largest sources of electricity. This fact may be lost on many tourists who visit the falls in droves each year. Yet, the falls remain an important electricity source, and provide a stark example of how millions of Canadians rely on water, in the form of hydropower, to meet many of our everyday energy needs.

Hydropower is but one source that supplies Canadian energy needs. Yet, regardless of the electricity source – whether it is coal, nuclear, natural gas, or renewables, such as geothermal heat or concentrated solar power – all remain inextricably tied to the use of water within the electricity production process. This is the case for energy production around the world. From the sprawling oil sand deposits of Alberta, to the geothermal fields in the Great Rift Valley of central Kenya, water is central to the production of energy.

Interconnected Relationship

Yet, the water-energy relationship is not as one-sided as one might think. Without water, energy production is near impossible. On the flip side, without energy, the production of potable water that our society relies on, pumped beneath our feet through mile after mile of pipes that make up the water distribution networks found in our cities and towns, would be impossible. Nor would the hot water flowing from taps and showers in our homes be available without the energy to heat the water, which accounts for, on average, one-quarter of household energy consumption.

In the absence of significant efforts to conserve water resources, it is likely that water use and embedded energy inputs associated with its use

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will climb in the years ahead. This comes with potentially severe impacts on community prosperity and social equity, the economy, climate change policies and goals, food security, and the healthy functioning of watersheds, without which water resources and the energy derived from them may be seriously jeopardized. In a world where almost 800 million people do not have access to clean water, and over one billion still lack access to electricity, the time to recognize the intimate connection between water and energy for improved management of these interlinked resources has arrived.

The water-energy nexus refers to the interconnections between water and energy production. Though manifested in a variety of ways, it is most evident in the relationship witnessed when water is used to process and refine fuels; to generate hydroelectricity; to act as a steam condenser in thermal electric power plants; in the construction, operation, and maintenance of electricity generation facilities; and to dispose of energy sector wastes. It is also the relationship between energy used to provide sufficient quantities of high quality water for municipalities, industry, and agriculture, and the energy required to pump large amounts of water for distribution, collection, re-treatment, and release through the entire human-use cycle.

As much as hydropower exemplifies water used in the production of energy, perhaps the most obvious example of energy used for the production of water is found in desalination plants. Though desalination is often viewed as a panacea for supplying arid regions with unlimited quantities of potable water, there are huge energy – and financial – implications. According to a recent report by the Pacific Institute, desalinated seawater can cost upwards of $2.43 per cubic metre. The report goes on to note that this cost may indeed rise as the price of energy increases. This is in sharp contrast to nominal amounts paid for water in municipalities relying on fresh water from lakes, rivers, or aquifers: these costs range from no charge for the first 10 metres in the Town of Vernon, B.C., to $0.28 per cubic metre for water in the City of Nanaimo, B.C.

Emerging Challenges in British Columbia

Like many jurisdictions across Canada and indeed around the world, British Columbia's interconnected water and water-derived energy resources are showing signs of being under increased stress. Population growth, climate change, and increased industrial activities are together pushing the limits of secured access to water and energy resources. A number of emerging challenges in the province illustrate the intimate connections between water and energy:

- sharp projected increases in the natural gas industry's demand for water and energy resources;
- local or regional droughts that have triggered temporary restrictions on water withdrawals and led to reductions in hydroelectricity production;
- continued increases in urban populations that could push demands for water beyond the point that current sources can supply;
- catastrophic events, such as forest fires, that threaten to damage lands around drinking water reservoirs to the point where municipalities must spend millions to build new water treatment plants; and
- increased potential for incremental drawdown of water from hydroelectric reservoirs for purposes other than hydro production.

Opportunities exist for financial savings and deferred capital expenses when water and energy are viewed, together, through the lens of sustainable management and efficiency. Such opportunities must not be lost in the hubris of warning signs and cautionary remarks about the negative consequences of failing to consider the intimate connection between water and energy policy development.

In the B.C. community of Abbotsford-Mission, the water utility is faced with the challenge of supplying water to a growing population, projected to double within 20 years. The reality of rising populations sees many municipalities wrestling with the tricky question of supply and demand. To meet this growing demand, new water sources are often sought out. In the case of Abbotsford-Mission, one potential new source is Stave Lake, a hydroelectric reservoir north of Mission. Capital costs required for building an expanded distribution system to access the new source, and the infrastructure required for pumping water uphill to a new water treatment plant put the project at an estimated $300 million.

However, large infrastructure projects replete with high price tags are not necessarily a *fait accompli* for Canadian communities grappling with increasing water demands. According to a 2009 study at the University of Victoria's POLIS Project on Ecological Governance, commissioned by Abbotsford Mission Water and Sewer Commission, a 45 percent reduction in water use is not only achievable but would accommodate the region's growing population. Such water conservation targets can defer the construction of expensive and energy-intensive water projects, saving municipalities millions on construction and operation costs. Conserving water conserves energy, which in turn saves taxpayers money and reduces greenhouse gas emissions.

Coordinated Approach Required

In the face of mounting pressures on our water and energy resources, the challenge of ensuring access to these resources for future generations requires addressing how decisions regarding one resource may impact another. More effective governance of our interlinked water and energy resources should be a top priority for all levels of government. This includes ensuring that water and energy policy initiatives are coordinated at the provincial level so that the objectives of any one policy do not undermine the objectives of others.

It also includes ensuring that there is adequate space for local and regional

authorities to play a meaningful role in decisions that will directly affect their ability to deliver water (and related energy services) to communities.

There are a number of immediate actions governments can take now, within pre-existing policy-making structures, to improve the management and conservation of water and energy assets, setting the stage for improved governance in the years ahead. These actions include:

- publish accurate, timely reports on water use across all sectors of the economy;
- appropriately price water and energy resources to encourage conservation, where principles of equity apply if and when higher pricing of our water and energy resources is implemented;
- promote resource recovery to conserve water and energy, and recognizing existing "waste" resources are reused for their water and power potential; and
- prioritize watershed health and function to improve prospects for water resources being conserved and protected.

Prosperous and healthy environments and economies require clear and consistent policies that consider the full spectrum of how our communities, food systems, and energy production processes co-exist and operate within the bounds of ecological limits. Improved governance of our water and energy resources – to ensure consistency between different policy objectives, and to utilize local and regional knowledge in the decision-making process – is a key building block for a progressive and ecologically responsible future.[1] MW

1 For more information on the water-energy nexus, see *From Stream to Steam: Emerging Challenges for BC's Interlinked Water and Energy Resources*, a co-publication by the University of Victoria's POLIS Project on Ecological Governance and the Canadian Centre for Policy Alternative, written by Ben Parfitt, with Jesse Baltutis and Oliver M. Brandes.

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