From Wire to Tap

Are we flushing energy down the drain?

By Carol Maas

Meeting Canada's climate change commitments will take more than changing light bulbs, and the next frontier of energy savings may well lie with water. Local and provincial governments are only beginning to recognize the critical nexus between water and energy. This link was most recently recognized in Ontario's *Green Energy and Green Economy Act* (GEA), which explicitly links energy efficiency and water efficiency—a first in Canada. As much as half of municipal electricity demand is to power water and wastewater treatment plants and pumps. In addition to the municipal energy demands for water, heating water in the home is the second-largest source of residential greenhouse gas (GHG) emissions.

The link between water and energy

From source to tap and back again, energy is used to pump, treat and heat water. For years water conservation practitioners have recognized the potential for energy savings associated with reduced water use. However, the water-associated energy savings in Ontario was typically estimated using case-specific values.

A new report from the POLIS Project on Ecological Governance, entitled The Greenhouse Gas and Energy Co-benefits of Water Conservation, marks the first Canadian study to quantify the energy and GHG savings achievable through water conservation measures. Perhaps more importantly, a simple methodology is now available to help communities and organizations estimate the energy and GHG savings associated with reduced water use.

Towards a new methodology

Analysis of historical energy, chemical and water-use data from over 70 water and wastewater facilities in Ontario was used to develop electrical energy intensity factors (the energy required to extract, treat, and distribute one cubic metre of water, and to collect and treat one cubic metre of wastewater). Energy intensities of municipal water provision ranges from 1.0 to 1.4 kilowatt hours per cubic metre, with higher energy intensities in smaller systems resulting from less efficient pumps and friction losses.

A portion of the electrical energy demand cannot be reduced by water conservation measures, including energy used for lighting and wastewater treatment processes that are dictated by solids loading as opposed to flow. Approximately 50 to 60 per cent of the total electricity demand for water and wastewater treatment and pumping is directly related to the volumetric flow rate and will, therefore, be reduced by more efficient use of water.

The energy intensity values impacted by flow rate can be used to estimate the energy savings associated with reduced water use. The energy savings can then be converted to GHG emissions savings based on the power generation mix prevalent in each province.

Sound difficult? This entire methodology has been distilled down to a table of simple energy intensity factors that can be extracted from summary tables (*available at poliswaterproject.org*) and applied to water savings.

How much energy can we save?

The opportunity for energy savings through reduced water use is best illustrated by taking a closer look at case studies of water conservation applied at different geographical and political scales.

Community A municipal case study in the City of Guelph explored the energy reductions elicited by implementing a community water efficiency plan. Guelph is a medium-sized community of 115,000 people served primarily by groundwater sources. Significant population growth is anticipated in coming years, placing increased pressure on local water resources. The City is known for its progressive policies, and has recently approved a Water Conservation and Efficiency Strategy.

Energy intensity factors applied to the water savings targets outlined in the strategy generated impressive results. By 2025, a 20 per cent reduction in

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municipal water use could power half of Guelph's existing wells and, at today's electricity prices, save more than $2,700 per week in water and wastewater electricity expenditures. The study demonstrates that water conservation led to reductions of GHG emissions comparable in magnitude to other innovative energy policy initiatives, such as powering more than half of the distribution system with clean energy.

Provincial Improving province-wide water efficiency by 20 per cent in 20 years could save an estimated 1.6 billion litres of municipal water every day. This volume of water could roughly support the projected growth in Ontario over the same time period, obviating the need for infrastructure expansion.

A 20 per cent increase in water efficiency by 2029 could liberate a whopping one-third of the entire energy saving opportunities currently identified in the province's municipal sector. This finding suggests water conservation could offer municipalities as much or more opportunity for energy savings than lighting, management of peak energy demand, use of landfill gas and clean energy projects. The energy saved in the municipal and residential sectors combined could power close to 90 per cent of homes in the city of Toronto—the clean energy equivalent of 1,200 windmills.

By 2025, a 20 per cent reduction in municipal water use could power half of Guelph's existing wells and, at today's electricity prices, save more than $2,700 per week in water and wastewater electricity expenditures.

This goal is attainable with the right mix of policy, incentives and commitment by individuals, business, and municipalities. To achieve an increase in efficiency in the residential sector, average per capita water demands would need to decrease from 260 litres per capita (LCD) to 208 LCD—an achievable goal given that new, water-efficient homes have been demonstrated to use only 150 LCD indoors with off-the-shelf technology.

Opportunities for action

To slow the progression of climate change and decrease reliance on new energy infrastructure, significant mitigation efforts will be required in all sectors. Unfortunately, there will be fewer and fewer opportunities for achieving direct energy savings from rapid payback initiatives such as compact fluorescent light bulb change-out programs. Water-efficient technologies offer energy savings on par with typical energy efficiency and green energy solutions in practice today, highlighting the largely untapped opportunity of water conservation to help meet energy reduction and climate change targets in Canada.

Ensuring every community, business and, most importantly, every new home, is equipped with water-efficient fixtures and technologies and is informed of the importance and benefits of conserving water, simultaneously addresses the intersecting challenges of climate change, energy security and water scarcity. Technologies and programs required to affect measurable water savings are widely available, and will be complemented by Canadian companies offering emerging clean technology and services related to water conservation and efficiency.

Perhaps the most important conclusion is to emphasize the need for water and energy practitioners, researchers and policy makers to move beyond silos of expertise. When we think water, we should think energy, and vice versa. These two resources are fundamental for all life; when we waste water we are truly flushing energy down the drain. W

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