Enwave's Deep Lake Water System: Keeping Toronto's cooling sustainable

When the City of Toronto needs to stay cool even during the hottest days of summer, it turns to the world's largest Deep Lake Water Cooling (DLWC) system. Combined with the John Street pumping station, Enwave's system transports cold water from the depths of Lake Ontario, via a network of pipes, to provide a clean, renewable, and reliable energy source to cool the residents and businesses of downtown Toronto.

Toronto-based Enwave Energy Corporation is a utility company with one of the largest district energy systems in North America. With a focus on sustainable district energy, including heating, cooling, hot water, combined heat and power, and geothermal energy systems, Enwave operates in Windsor, London, Markham, and Toronto in Ontario, and in Charlottetown PEI.

When the company was tasked with providing downtown Toronto with a district cooling system using renewable energy directly from Lake Ontario, it looked to replace local chillers used at customer sites, which were using an enormous amount of electricity.

> "When Enwave contemplated replacing the original DLWC heat exchangers, Alfa Laval's solution offered substantial energy and space savings, helping to justify the project."
>
> – **CAMERON LEITCH,**
> *Director – Solutions & Innovations*

THE SOLUTION

This task required building a DLWC system that could maintain the temperature of 180 buildings in the downtown core spanning a total area of 40 million square feet of real estate, while also being used as tap water for residents. These buildings include major sporting arenas, event spaces, o ice towers, hospitals, universities, hotels, banks, government buildings, data centres and residential buildings.

Water is most dense at around 4 °C, which is also an ideal temperature for comfort cooling. To take advantage of Toronto's strategic location alongside Lake Ontario, Enwave developed the DLWC system that retrieves water about 5 kilometres from shore, at the temperature of 4°C. From there, water is pumped through three massive pipes to a water filtration plant on Toronto Island, where it is treated to potable grade.

Once treated, water is transferred to the John Street Pumping Station in downtown Toronto. Here, the treated lake water cools the chilled water in Enwave's closed-loop cooling system and is distributed as municipal drinking water to customer's taps. From there, Enwave's chilled water travels through pipes that cool buildings around Toronto. The water then returns to John Street, where it is again cooled by new water, continuing the cycle.

THE EXPANSION

In 2019, Enwave and the City of Toronto announced a $100-million system expansion, adding a fourth pipe and 40 percent more capacity. That's when Enwave partnered with Alfa Laval to update the system's heat exchanger technology.

> "Enwave has a long history of working with Alfa Laval, and we knew that Alfa Laval had the expertise to deliver on a project of this scale and the service framework to ensure the investment continues to operate optimally."
>
> – **SHANE RAVINDRANATH,**
> *Director – Complex Projects*

From 2020 to 2022, the system was expanded and upgraded to include 21 Alfa Laval plate heat exchangers, replacing the 18 pairs originally installed. This upgrade required fewer plate heat exchangers to maintain the same capacity and reduce the overall footprint.

Enwave's state-of-the-art DLWC system is complemented by chiller plants and thermal storage assets to reject heat from buildings. The closed-loop system connects buildings in Toronto's downtown core through a network of pipes and a cooling substation at each customer site. The heat exchanger at each customer site removes heat from the building and returns the heat to the DLWC system.

THE BENEFITS

The DLWC system continues to expand and today services over 180 connected buildings in downtown Toronto, saving over 90,000 megawatt hours of electricity annually — a savings of approximately 80 percent compared to conventional cooling solutions. That's enough electricity to power a city of 25,000 residents.

This corresponds to 40,000 metric tonnes of CO_2 savings annually. By eliminating the need for cooling towers, the DLWC system saves 832 million litres of water every year — equivalent to 350 Olympic-sized swimming pools. Another bonus is that roof space atop city buildings is significantly reduced when replacing rooftop chillers and cooling towers with district cooling substations in the basement.

Enwave's DLWC system offers clean, low-carbon, renewable energy at scale. Customers not only save electricity but also see a significant reduction in water consumption by eliminating cooling towers. For connected customers, that means a further reduction in operational and maintenance costs — without the need to retrofit their space with additional equipment.

To date, the Enwave DLWC is the largest system of its kind in the world, using natural resources to provide renewable energy for Canada's largest city while ensuring optimal thermal efficiency.

Did you know?

Each Alfa Laval heat exchanger has a capacity of 8.5 megawatts, whisking away warmth and reducing the water temperature from 13°C to 5°C.

Learn more about how Alfa Laval's plate heat exchangers can increase energy efficiency, profitability and system optimization here.

WHAT'S NEXT?

In 2024, six additional heat exchanger units will be installed to further boost system capacity. The AHRI-certified technology will help Enwave secure its targets for power consumption and climate mitigation — and help meet the city's goal of reducing emissions to net zero by 2040.

"Enwave's vision is to be the partner of choice in the energy transformation to net-zero carbon. With great partners like Alfa Laval, we will continue to enable commercial access to sustainable energy solutions at scale."

– **CARSON GEMMILL,**
VP – Solutions & Innovations

Contact us today to learn more about our Energy Hunter program and how our experts can help you uncover unrealized opportunities for energy efficiency at your facility.