# HEAT WAVE

## LEADING DISTRICT ENERGY SYSTEM ADDS CHP TO THE MIX

When Ontario shut down the last of its five coal-fired plants in 2014, it effectively legislated further development of renewable power resources to meet provincial energy needs.

Since 2005, Ontario has procured 570 MW of small-scale Combined Heat and Power (CHP) projects by providing government incentives that encourage development of CHP. The Ontario Power Authority underwrites projects that support economic development, while reducing carbon dioxide emissions.

Another factor contributing to the rise of renewables: While the existing fleet of nuclear power plants supplies 60 percent of Ontario's energy, the nuclear fleet is aging and in need of costly updates in the billions.

**CUSTOMER PROFILE**

**Enwave Energy Corp.**

**Location:** Toronto, Ontario

**Application:** Demand Response

**Cat® Equipment:** G3516H gas generator sets (2), ISO Switchgear

On a local level, ever increasing electrical loads within Toronto—resulting primarily from population growth and higher connected loads per person—continue to add strain to the existing transmission infrastructure within Canada's largest city.

Against the backdrop of an overburdened urban energy grid, Enwave Energy Corp. provides district heating and cooling to over 160 commercial customers in downtown Toronto via a 40-kilometer (25-mile) network of underground pipes that provides steam and chilled water. Utilizing water drawn from Lake Ontario, a closed-loop Deep Lake Water Cooling (DLWC) system recycles energy from downtown buildings by pumping over 80,000 gallons of water per minute at its peak to over 70 large customers and depositing that heat into the City of Toronto's potable water system. Enwave currently has the capacity to air condition over 3.4 million square feet of office space, with ambitions to grow significantly.

Meanwhile, Enwave's steam heat system sells more than 1.6 million pounds per hour of steam to over 140 commercial, government, hospital, university and residential buildings in downtown Toronto, representing over 40 million square feet of real estate. Furthermore, they are expanding their heating district to include high-efficiency hot water.

Pearl Street Energy Center

### Gathering steam

Established 50 years ago, Enwave's Pearl Street Energy Center was one of the first steam plants built before the larger district energy system was established in downtown Toronto. Following a C$30 million modernization six years ago that added new, highly efficient boilers, the flagship plant in the heart of downtown Toronto supplies steam to all downtown hospitals, as well


as downtown condominiums and office buildings.

Earlier this year, Enwave increased the efficiency of the Pearl Street plant by adding two Cat® G3516H gas-powered generator sets. Electricity from the 4 MW power plant is exported to the grid based on the market electricity price as part of the Combined Heat and Power Standard Offer Program (CHPSOP 2.0), which provides government incentives to produce power at a lower cost than higher-priced grid power during times of greater energy demand.

Under a 20-year contract with the Ontario Power Authority, the gensets at the Pearl Street plant are expected to run up to 2,000 hours a year, particularly during the hottest and coldest days of the year when demand on the grid increases, says Kris Landon, Enwave's director of construction and project management.

"The government pays us to provide electricity when the cost to operate the generator sets is less than the cost of power from the grid—that's when we run these engines," Landon says. "And from what we've seen, that is usually during the summer peak days."

The Ontario Power Authority places high value on the heat component of

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CHP plants, and views electricity as a byproduct. CHPSOP 2.0 participants must demonstrate that projects can achieve a useful heat output percentage of no less than 30 percent annually, starting after the third contract year.

At Pearl Street, heat from the gensets' exhaust is captured and used to generate low-pressure steam and hot water, thereby increasing efficiency by 33 percent as a result of not having to use a separate source of natural gas to warm up the water.

"A lot of these conventional power generating plants in the province produce electricity and give off a tremendous amount of heat, but they just let that heat escape into the atmosphere through a cooling tower or up the stack after the combustion process," Landon says.

"In our CHP system, we generate electricity first and then harvest the heat out of the exhaust gas so that we're actually doing two things at the same time versus just running," he continues. "We're doing the two processes together, so we're saving on natural gas and emissions because we're doubling up on a process."

Because the Pearl Street steam plant runs continuously—hospitals and medical facilities in the northern part of the district energy system such as Toronto General Hospital use a tremendous amount of steam year round—Enwave never has a problem with the generator sets not running enough to adequately utilize the waste heat, Landon says.

"The biggest thing with CHP is that you need a thermal host, and our thermal host is ourselves so we control that completely," he adds. "This plant operates 24/7, 365 days a year. So the Cat G3516Hs were a perfect match for us—they are highly efficient and reliable, and the biggest engines we could put down here in the basement."

The cold water from the DLWC system is utilized to cool the generator sets, thus negating the need for space-eating radiators or cooling towers on the roof of the three-story building.

"The fact that we have a 4 MW plant installed in downtown Toronto is


**"It's the dependability that we've come to expect from Caterpillar, and our Cat dealer."**

**KRIS LANDON**
Director of Construction and Project Management
Enwave Energy Corp.

Kris Landon

unbelievable," Landon says. "And the deep lake water cooling is the reason why it can be done, because we don't need any of that excess equipment."

**Toromont provides technical expertise**

The Pearl Street Energy Center has a cutting-edge process automation control system that connects to intelligent field instruments.

All of the boilers and ancillary equipment installed in the steam plant have to work seamlessly with the automated control system, Landon says. Because the primary purpose of the facility is to provide reliable steam service to Enwave's critical hospital customers, incorporating CHP into the control system can't negatively impact any of the operations of the Pearl Street plant.

"The CHP project was a very complicated installation—we put some very large engines into a very small place, and we had tremendous support from our partners at Toromont Power Systems and Caterpillar throughout the entire process," Landon says. "Everybody understood what our time and technical constraints were.

"Toromont really stepped up and brought in all their expert personnel to get these pieces of equipment up and running and hit our aggressive project deadlines," Landon continues. "Their technicians were very reliable, as they provided us with plenty of help right through our commissioning process to make sure that we had no problems or issues."

The Cat dealer will provide regular preventive maintenance on the generator sets as part of a five-year Customer Support Agreement. Enwave is counting on the technical expertise of Toromont technicians to provide timely service when needed.

"These Cat engines have to be operational because we could see the run-time hours on the CHPSOP model increase," Landon says. "So these engines need to be continually operational for us to hit the required hours and derive the full economic benefit from this system.

"We've had no complaints or problems at all," he says. "It's the dependability that we've come to expect from Caterpillar, and our Cat dealer."


## ENWAVE ENERGY CORP.

Enwave was originally established more than 20 years ago as a non-profit cooperative, known as the Toronto District Heating Corporation, with a mandate to provide efficient, environmentally friendly heating to institutional and government buildings in downtown Toronto.

In the two decades that followed its creation, the company tried to keep pace with the burgeoning growth of Toronto's downtown core by expanding its steam service to include users in the commercial and entertainment sectors. However, its not-for-profit corporate structure and restrictive legislative covenants made it difficult for the company to raise the capital needed to support financial growth.

In 1998, the company's chairman initiated a restructuring plan that ultimately gave rise to the private, for-profit entity called Enwave. Privatization brought the financial discipline to make the company profitable and the capital and resources to develop Deep Lake Water Cooling (DLWC)—an innovative method of air-conditioning buildings which recycles energy, utilizing cold water drawn from Lake Ontario.

By the time DLWC was commissioned in 2004, Enwave had become a market leader in sustainable energy. With the financial support of its new shareholders, Enwave was no longer just a district heating company, but a fully-integrated sustainable energy services provider.

Today, Enwave Energy Corporation operates in 12 cities across North America. In Toronto, they own and operate three modernized steam plants, and a number of cooling plants which support the state-of-the-art DLWC system in downtown Toronto. The district energy system has received numerous awards, including the International District Energy Association's system of the year award in both 1999 and 2011. Enwave also operates large district energy systems in Chicago, New Orleans, Houston, Los Angeles, Las Vegas and Seattle, London (Ontario), Windsor and Charlottetown (PEI).

Enwave Toronto provides heating and cooling services to more than 160 customers in downtown Toronto. The centralized steam heating system started in the 1970s at the Pearl Street steam plant, and steadily expanded over the years through mergers with other district energy systems.

With 40 kilometers of pipes buried deep in the municipal rights-of-way, Enwave distributes steam and chilled water with unsurpassed reliability to more than 51 percent of the potential market in Toronto.

Enwave's Toronto customers include all downtown hospitals; government and institutional buildings; sports, convention, and entertainment facilities; hotel, residential, and commercial complexes; telecommunication hubs; and the Windsor Casino.

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