

Emerson and Hydro Quebec reach 10,000 hours of testing on large scale CO₂ heat pump

Eco-friendly heat pump solution reduces greenhouse gas emissions and improves energy efficiency while offering load flexibility to building operators

QUEBEC – Prominent Canadian utility Hydro Quebec and Emerson have achieved 10,000 hours of testing on a large-scale heat pump system. Manufactured by Vilter, an industrial solutions division of Emerson, the heat pump utilizes CO₂ (R-744) as a refrigerant and provides high-efficiency, simultaneous heating and cooling for large buildings such as schools, hospitals, office complexes and industrial facilities. Leveraging the Emerson best-in-class portfolio of automation and controls technologies, the heat pump can be combined with thermal storage to form an integrated solution with demand response functionality, allowing building operators to reduce energy consumption during peak demand events.

As organizations take strides to ensure business operations are sustainable, one of the priority areas for improvement is within the building sector, which according to the International Energy Association, accounts for 30 percent of total energy consumed around the world, or 3100 Mtoe, including 55 percent of global electricity consumption and 28 percent of CO₂ emissions. With global building floor area expected to double by 2070, the decarbonization and electrification of heating and cooling systems will play an important role in achieving net zero emissions by 2050.

From a utility perspective, the electrification of buildings will have a significant impact on the electricity grid, most notably an increase in peak demand on the transmission system. “In the context of the energy transition, demand-side flexibility has been identified as a key requirement for the future utility grid,” said Dr. Hakim Nesreddine, Senior Researcher and R&D Leader at Hydro Quebec. “Building space and water heating is a valuable source of flexibility when smart-controlled heat



The Emerson CO₂ heat pump in operation at the Hydro Quebec Energy Technologies Laboratory in Shawinigan, Quebec produced 99.6 percent less Greenhouse Gas (GHG) emissions in testing.

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– *Wayne Wehber
Vice President of Technology
Vilter Manufacturing*

pumps are integrated and combined with thermal energy storage”. To address challenges related to grid expansion and transmission congestion, Nesreddine believes heat pump demand flexibility can be supported with peak pricing and utility demand response programs.

The heat pump system has been in operation since 2020 at the Hydro Quebec Energy Technologies Laboratory (LTE) in Shawinigan, Quebec, Canada. Emerson and Hydro Quebec have collaborated to optimize the performance and control of the heat pump in a simulated environment with real building load conditions. “Thorough testing is an important part of our product development process at Emerson, and the 10,000 hour milestone gives both us and our customers confidence in the solution” said Wayne Wehber, Vice President of Technology for Vilter. “The efficiency advantages of heat pumps for heating and cooling offer a significant opportunity to improve sustainability in facilities and support the global green energy transition”. To date, the 1.3MW system installed at Hydro Quebec has produced 99.6 percent less GHG emissions than comparable boiler/chiller technologies for savings of 2476 tons of CO₂.

Designed for large commercial space heating and cooling, domestic hot water production, and industrial process heating and cooling applications, a single Emerson CO₂ Heat Pump (See Brochure) can simultaneously generate up to 1.70 MW of heating and 1.30 MW (~370 TR) cooling. The technology utilizes the Vilter™ high pressure low displacement (HPLD) single screw compressor, which has a maximum design pressure of 138 bar (2000 psia) and displacements of 128 to 243 cfm at 3,600 rpm (capable of running at 4,500 rpm). The heat pump solution features an Emerson control system, which includes built-in artificial intelligence and demand response capabilities. From an efficiency standpoint, the solution can produce a combined coefficient of performance (COP) of 6.4.

“As a leading technology innovator, we recognize the value of ecosystem collaboration,” said Ryan Garrah, President of Emerson Canada. “The partnership with Hydro Quebec is an excellent example of how industry stakeholders can combine strengths and expertise to develop sustainable solutions.”



Emerson and Hydro Quebec engineers reviewing the hydronic system at the Hydro Quebec Laboratory in Shawinigan, Quebec.

For 155 years, Vilter Manufacturing has provided high-quality, efficient solutions for industrial refrigeration, oil and gas, and district heating applications. Vilter’s portfolio of sustainable technologies (heat pumps, renewable natural gas, carbon capture and sequestration) helps customers reduce carbon emissions and improve operational performance.

[Learn more about Vilter heat pumps](#)

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