



North American pioneer
in CO2 cooling technologies using natural refrigerant

DATA CENTER CASE STUDY

Client : Bell Canada

“In 2012, Carnot worked with Bell to create a cooling system that would maintain its business-critical data centers. Rigorous discussions with the customer, excellent results in the laboratory, and innovative machine characteristics allowed us to give birth to our first cooling system. Now, we have taken passion, rigor, and innovation one step further with AQUILON™.”

CHALLENGE

Remove HCFCs and HFC with a highly cost effective cooling technology

As in many countries in the world, **HCFC are going to be removed** in Canada (99.5% by 2020) and **HFC will be phased down** (see table below). With an exponential growth in data traffic comes the need for clean and efficient cooling technologies to expand data rooms. In 2012, telecommunications companies like Bell Canada were facing a big challenge: most of their cooling system (being used in their server rooms) were using either HCFCs or HFC. **They needed to find a sustainable and cost-effective alternative system.**

Year	2019	2024	2030	2036
Percentage of reduction (%)	10	35	70	85

Table: Canada HFC phasedown

SOLUTION

Rigorous development and meticulous laboratory testing conducted to the demonstration of an **innovative, proven and robust cooling system** named Aquilon™, which runs now in **free cooling for more than 90% of the year.**

Innovative cooling system which runs 90% of the year in free-cooling

UNIQUE PROVEN TECHNOLOGY

The AQUILON cooling technology developed combines :

INDUSTRIAL CALIBRE CONSTRUCTION.

- 01 Stainless steel piping assembled with orbital welding. Use of semi hermetic piston compressor.
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UNIQUE TFC «FREE-COOLING» PATENTED.

- 02 The unique TFC «free-cooling» patented by Carnot Refrigeration Inc. allows cooling in the room without the need of a compressor to run, with no pump, and no fresh air added to the room. The unit runs in free cooling for more than 90% of the year.
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BEST PERFORMANCE

- 03 The unit comes with a VFD on the compressor, electronic valves and ECM motors to assure the best performance on the market and the best precision there is.

TWO AQUILON 15
DOWNFLOW UNITS



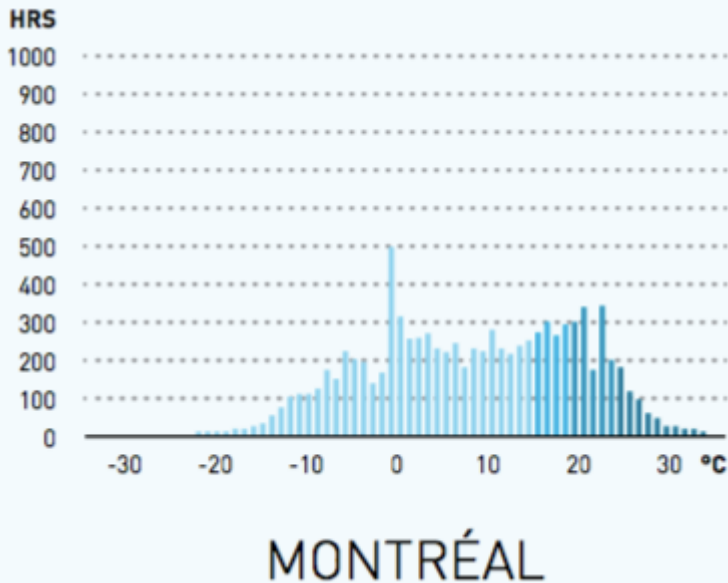
RESULTS / BENEFITS

Six major benefits have been proven following the 4 years demonstration program.

- 01 **Elimination of any future phase-outs** by using R-744, a natural refrigerant
- 02 **Significant decrease of Bell Canada's energy consumption** related to the cooling (150,000 kwh / AQ15 unit, with an air return of 24°C)
- 03 Improvement in **reliability and efficiency**
- 04 **Reduction of maintenance costs** (due to its simplicity)
- 05 **Positive cost-benefits ratio** and overall profitability (ROI: 3 years)
- 06 **GHG reduction** of 15 tons / AQ15 unit

Bell Canada currently runs 44 AQUILON™ units across their 20 data centers. AQUILON™ CRAC unit has been a field tested solution in many data center across Quebec and Ontario, and has proved its reliability and efficiency.

The unit has enable a decrease in energy consumption for cooling that can reach up to 80%¹ (compared to previous similar projects consumption). A suitable alternative to synthetic refrigerants in the data center industry is now available at a competitive price.



FREE COOLING OPERATION

MECHANICAL MODULATION

SUBCRITICAL OPERATION

TRANSCRITICAL OPERATION

kW [kW] TOTAL POWER CONSUMPTION FOR 80% LOAD
pPUE POWER UTILISATION EFFECTIVENESS

Notes: Data for Aquilon-15 17.2 TR (60.5 kW), model shown above, based on fluid temperature of 75°F (24°C) and outdoor temperature of 95°F (35°C). Data for models Aquilon-50 50 TR (175 kW) and Aquilon-30 30 TR (100 kW) also available upon request.



CARNOT

REFRIGERATION

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