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Graham Hughes for The Globe and Mail

What lies beneath: Tapping geothermal heat in Montreal

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Next spring, a 35-storey mixed-use office tower and condo project will be built at the mouth of the Quartier-International district of Montreal. From the outside, the Altoría will glisten like other glass towers in Toronto and Vancouver – but what lies below its foundation will help define the next generation of urban offices.

On the building site, workers will soon begin boring up to 19 geothermal wells 400 feet deep beneath the development's foundation. When the Altoría's furnace starts up next year, it will draw heat from the earth during the coolest seasons and distribute it through the building's piping. In the summer, the system operates in reverse, removing heat from the building and pumping it into the earth.

Geothermal heating is a greener, cheaper and more efficient alternative to gas and electric furnaces. Compared to traditional systems, a geothermal furnace can cut heating costs by 44 per cent or more.

"We're expecting a significant saving in our energy consumption," says Richard Hylands, president of Kevric Real Estate, which initiated the Altoría project. "I think it would be irresponsible today to do a project of this scale that isn't geothermal heated and LEED certified."

For nearly a decade now, the strict guidelines of the LEED (Leadership in Energy and Environmental Design) building certification program have come to mark the greenest buildings in Canada.

"In the office component, we're aiming for LEED Gold and LEED [Certified] in the residential section," Mr. Hylands adds. The first 10 storeys of the Altoría are devoted to 230,000 square feet of Class A office space. Above this will sit 25 storeys of condos, ranging in size from 600 to 6,100 square feet.

There is a premium to building this way, explains Mr. Hylands, "but the energy savings will contribute to offsetting it, and the tenants will pay a little more rent since their utility bills won't cost as much.

"There's a big synergy between the office and residential components," he says. "An office building, even in the middle of winter, creates heat because of the lighting, computers and people. So there will be a way of transferring warmth from one to the other through heat exchangers."

The excess heat generated by the offices will be used to warm the building's swimming pool.

A geothermal furnace and pipes require less room than a traditional system, creating more floor space and higher ceilings, and it also eliminates rooftop chillers and smokestacks, reducing structural requirements, saving money and opening up the option for green roofs and rooftop terraces.

Since 1990, energy consumption in commercial buildings has increased by more than 35 per cent across Canada. Electricity prices have climbed even more, jumping 80 per cent since 2001.

Geothermal technology is one way to offset this cost – and perhaps no one knows this better than Sidney Ribaux, the co-founder of Montreal-based environmental group Équiterre. In early October, his organization and seven other non-profits moved into a new five-storey, 65,000-square-foot headquarters in Montreal's theatre district, dubbed the Centre for Sustainable Development.

Through a plate glass window in the building's lobby, visitors can see the geothermal controls and complex of pipes that carry heat throughout the building. This ambitious office project aims for LEED Platinum, the program's highest certification.

"Our engineers looked at geothermal heating as one of the first things to do in this project," says Mr. Ribaux. "With this system, we'll save about \$60,000 a year."

With its \$300,000 price tag, the geothermal system will pay for itself in five years, he adds.

But not every new office can tap into geothermal power – there may be subway lines or other infrastructure to contend with.

"Doing geothermal in the downtown core adds to the technical complexity and the design," says Mr.

Ribaux. "It required a lot of precautionary measures, which added a couple months to the construction phase." The building's engineers cut an experimental well before starting the others to test the temperature, and made thorough surveys to ensure they wouldn't hit anything as they drilled down.

Mr. Hylands is skeptical that the centre would be able to meet LEED Platinum without the help of the government and corporate subsidies it received. "But when you get that kind of funding, it's your responsibility to show others what's possible," he says.

Soon, the centre will offer guided tours of its eco-features and will install 15 information stations throughout the building, with one taking pride of place beside the lobby's geothermal controls.

Already the Canadian Green Building Council has held an event here, and other architects and developers are lining up. "The space is an incubator for ideas," Mr. Hylands adds, "and they're definitely doing that."

Ask an expert

Energy manager Marc-Antoine Joly, of CB Richard Ellis, answers questions about the viability of geothermal heat in office buildings.

Do geothermal systems help developers deal with energy cost escalation?

Newer pump controls and development of this technology continues to see gains. For every unit of energy put into the system, 4.0 units of energy are produced, either for heating or cooling. Traditional systems still struggle to make it past the 2.0 mark.

Do these systems have lower maintenance costs?

The average maintenance cost for geothermal systems versus traditional HVAC systems is about 4.5 times lower and typically sees 10 to 20 times fewer unplanned maintenance costs over its life.

Are there drawbacks to this technology?

The higher upfront capital cost is a limitation in these [economically unstable] times. The average cost of a geothermal heat pump is about \$5,500/tonne versus \$2,500 to \$3,000/tonne for traditional systems. It is worth noting that this type of investment is the least risky when looking at alternative markets; returns often exceed the 8% to 10% range.

Is there a growing trend in geothermal technology?

Geothermal is not only here to stay, but has become much more commonplace in the Canadian market, seeing an average growth rate of 10% or more over the last 20 years.