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Jay Scott

Saving Energy in a Cold Climate

Western New York is known for its brutal winters, with large volumes of natural gas and fuel oil consumed for heating.

A technical feature this month focuses on the City of Lockport (N.Y.) Housing Authority's efforts in the summer and fall of 2014 to replace an outdated HVAC system at its administration building about 30 miles (48 km) north of Buffalo.

The project has proven significant because the new system handled extreme cold conditions in 2015 while supporting New York state's carbon reduction goals and reducing summer peak-electricity consumption.

The old HVAC system was struggling to efficiently handle six administrative offices, a conference room, two group ancillary spaces, and a central entry atrium and reception office. Despite natural gas being relatively inexpensive, the Authority felt a geothermal installation was reasonable to consider, given the heavy heating and cooling loads, the outdated HVAC plant, and abundant open space adjacent to the building.

A GEOTHERMAL INSTALLATION "would give us advantages by improving comfort and establishing zone control for our employees, mitigating climate change by reducing on-site emission to close to nothing, and saving energy and operation costs over the long term," the Authority's director said.

While conventional design would have called for 14 individual heat pumps, one for each of the 14 zones, the availability of variable speed ground source heat pump technology enabled a different design approach. Four 5 ton (18 kW) units were used, with one 3 ton (11 kW) unit serving the conference room exclusively.

The roof insulation was upgraded from an R-13 fiberglass to an R-38 high-density foam. The upgrade enabled the size of the geothermal system to be reduced.

EACH HEAT PUMP UNIT had a variable speed scroll compressor with a variable frequency drive (VFD)—also known as an inverter—that slows or speeds up the scroll compressor. By using the inverter, the compressor can reduce speed and turn down capacity as low as 15%, or over-speed up to 117% from the nominal 3,600 rpm to deliver more heat on colder days.

The Housing Authority tracked energy use between 2013 and 2015, accounting for all factors before and after the installation.

It especially adjusted for the record cold of February 2015.

"Therefore, the normalized difference between the adjusted total of 242,837 kWh in 2013 and the 97,403 kWh in 2015 was attributed to the performance improvement through the geothermal, a 60% reduction," the authors write.

Enjoy the issue.

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