By Dennis D. Laughlin

ZONING GEOTHERMAL SYSTEMS

Energy-efficiency mandates, tax credits and more direct user control make geothermal systems a viable prospect for the future of HVAC.

Developing new products and identifying lasting trends in the HVAC marketplace is as much art as it is science, with that development and identification often coming from discussions with front-line users and installers. As Wayne Gretzky once said: “If you skate to where the puck is, you will always be behind the play; you must skate to where the puck is going to be”—a principle that works as much for hockey as it does for green applications/installations.

Controls, zoning and geothermal applications appear to be growing as the search for energy-efficient methods to heat and cool homes—along with the energy-efficiency mandates that are driving this growth—continues to increase. What many contractors have observed is that the combination of these market trends are not unlike the powerful forces seen in the stock market during the quarterly “triple-witching” days when unusual momentum is provided to propel normally static markets. The effects of environment, cost savings and tax incentives do not just add to the customer’s desire to act, they actually amplify each other and create a great potential revenue opportunities.

According to a Sept. 20, 2010 TIME magazine article, titled “Digging Deep for Smarter Heat,” a 10%-13% growth in the market, which like many industries, was fueled by the tax credits. However, there is no disputing that the additional cost of a geothermal installation over conventional systems has been overcome by the improved coefficient of performance rates provided.

Geothermal installations are likely to be in homes with multiple-use patterns and most likely in homes where the quality of the indoor air environment is a priority. Homes of this nature tend to need multiple controls, and more often than not, homeowners considering this investment demand additional controls. Energy stewardship, in combination with comfort requirements, makes the introduction of controls with this technology a natural fit.

Controlling results
A Pittsburgh, PA, homeowner was unhappy with the heating system in the house, because even with the addition of a supplemental wood burner to the regular furnace, the second floor remained cool and operating costs continued to rise.

Brian Scanlon, Vice President of Western Pennsylvania Geothermal Heating and Cooling Inc., Saxonburg, PA, performed a load study that revealed a heat loss for the entire...
house of 73,000 Btu and total cooling load of 3.6 tons. This was further broken down to a heat loss of 52,000 Btu and a cooling load of 2 tons on the first floor, and a heat loss of 20,000 Btu and a cooling load of 1.6 tons on the second floor.

The older two-story home has a full basement and integral garage in the basement level. The supply duct runs that went to the second floor all were 6-in. runs that ran up through the outside walls. In the replacement world, design issues are often found that are not optimum, but they must be considered when developing a mechanical plan.

The initial proposal to the homeowner was to install two separate systems: a 4-ton package geothermal unit for the basement and first floor; and a 2-ton split geothermal unit for the second floor. However, this solution would have required running a new ductwork system throughout the attic for the second-floor system.

Eventually, a plan was configured that added a zoning system instead of a second geothermal system to cover the second floor. The zoned option saved the cost of a geothermal split unit, an air handler, a multi-circuit flow center, the extra power wiring, a 1-ton of loop field, an entire insulated ductwork system, and all of the accompanying labor. Instead, the only added cost included 6-in. retrofit dampers and a three-zone panel.

A 5-ton geothermal unit was installed and coupled to a vertical bore-hole loop configuration. New transitions to tie the new unit into the existing supply and return trunk lines were installed. In addition to the installation of a three-zone system, basement and wireless thermostats were used to keep the labor time to a minimum.

While this would not completely solve all of the issues with the second floor—the supply runs still ran through the outside walls—being able to direct more of the conditioned air to the particular area calling for it made a dramatic improvement.

The system has been installed for more than a year, and other than routine filter maintenance, everything continues to work as intended. The homeowner says the ability to individually control the temperatures of each floor has made the occupants much more comfortable, regardless of their location in the house. The ability to carry the wireless thermostat from room to room also helps manage the temperature anywhere in the house.
Zoning geothermal

As more and more homeowners, and by default contractors, continue to adopt this technology, new controllers and zoning systems continue to hit the streets. For example, a controller built for zoning applications is now available that features an added sensor input—allowing the controller unit to monitor the loop temperature.

The information tracked by the sensor has many uses. Operationally it is used as a decision point to determine when and if the unit needs to stage up. When the loop temperature reaches a critical point, the zone panel reacts by bringing on additional stages or turning off the compressor, depending upon how the contractor set it up. Loop temperatures are very important for proper operation. The loop-temperature sensor will assist in maximizing the performance of the geothermal unit as conditions and use patterns change.

When calculating the staging of equipment, additional data points can be very useful to indicate performance.

Geography also comes into play when determining the value of zoning geothermal installations. The largest concentration of installations continues to be in heating states above the Mason-Dixon Line. Generally, most units are sized by the cooling load. However, because of their heating predominance, geothermal installations are sized for heating. Often times this leads to a larger unit for cooling than would otherwise be designed. In these situations, having more real-time load information available to actively manage staging is a real comfort- and energy-management benefit.

The downside to having to size for a heating-load requirement is the fact that low-stage cooling typically meets the load requirement and high-stage blower capacity is seldom engaged. If a duct capacity adjustment is not provided, most of the cooling season will be spent with inadequate face velocity at the registers and the throw of conditioned air into the room is insufficient. If attempting to cool the second floor of a home with registers located in the floor, the effectiveness will be hindered due to low static pressure. In a zoned application, once the setpoint is reached on the lower levels, the first-floor runs can be closed to increase the supply static pressure to a level that provides the required velocity and throw at the registers.

Residential to commercial applications

Adding control features provides flexibility to the installation, which is a critical component of the replacement marketplace. Industry experts continue to cite the replacement market as 80% of the geothermal business, and commercial installations are starting to be seen.

Many national companies have adopted green standards and support the use of geothermal installations. These installations again are multi-purpose buildings with changing use patterns, many of which would benefit from better navigation of air flow and more finite controls that create demand signals.

Currently, the geothermal capture rate in the market
may be only 2%–3% of installations; however the growth rate is substantially increasing. The U.S. Energy Information Association measures the market delivery data in terms of aggregate tons and not unit numbers. This clouds the water a bit for the residential market, but it too continues to see increases. Figure 1 pn pg. 28 represents geothermal heat-pump shipments between 2003 and 2008–2009 increases are estimated at 13%, and all industry indications are that 2010 will follow the same guidance.

The increase in geothermal interest is not an aberration in the customary HVAC-product sales mix, but rather a trend. Industry sources call for a 10% market position within the next seven years; and the fact that the geothermal-application tax-incentive plan is in place through 2016 is powerful.

Zoning enables a contractor to help a homeowner add value to their property and custom-tune their comfort requirements. Although it appears slow, the HVAC game is one of constant change. Training staff to market and install geothermal technology is just like what Gretzky explained—skating to where the game is going to be played in the next few years.

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