

Martha's Vineyard Digs Geothermal Systems

June 25, 2007

Joanna R. Turpin



Brian Green's house contains a larger ddc system than most light commercial buildings. Panels everywhere display information on air handlers, tanks, valves, and every other piece of equipment involved in this extensive installation.

Most think of Martha's Vineyard as a pastoral place with pristine beaches, beautiful lighthouses, and quaint Victorian cottages that serve as second homes to those who can afford to come and play there during the summer. While that's true to a certain extent, the 20- by-9 mile island off the southeastern coast of Massachusetts is also home to many residents who are very concerned with how to better manage their resources and environment.

The thousands of day-trippers, vacationers, and seasonal residents who visit the island each year may not give much thought to things like electric bills or trash removal, but those who live here year-round are definitely concerned with these issues. To that end, islanders have developed stringent action plans centered on critical environmental concerns, including water quality, land use planning, sustainable island agriculture, waste reduction, and energy conservation and alternative energy sources.

One of those action plans involves becoming an all-electric island within 20 years. A local company that is working to bring that plan to fruition is Nelson Mechanical Design Inc., which is known as the area's green mechanical contractor.

The company advocates using geothermal systems to provide heating and cooling, pool and spa heating, and domestic hot water, which can result in substantially reduced energy costs, as well as help the island achieve its goal of becoming all electric.

GREEN SYSTEMS APPEALING

“The green market is taking off like a rocket ship here,” said Brian Nelson, co-owner, Nelson Mechanical Design. “We have a very well-educated, environmentally-conscious, forward-thinking market that is doing good-sized residential projects, ranging from 4,000 to 6,000 square feet, as well as light commercial projects. Because we are dependent on a ferry for everything, fuel costs are 20-30 percent higher than on the mainland. This has served to accelerate our thinking about making mechanical projects greener and less dependent on fossil fuel.”

Nelson, who's a master plumber as well as a mechanical engineer, can offer all the conventional plumbing and HVAC systems, but he takes every opportunity to educate clients about the advantages of geothermal systems. “With system efficiencies approaching 400 percent, geothermal systems can supplement or replace a home-owner's heating and hot water systems, saving 60-75 percent of their annual fuel consumption.” Thanks to his education efforts, geothermal systems have become at least one-half of Nelson's business.

The company offers both direct exchange and conventional glycol and open loop geothermal systems. Direct exchange uses copper refrigerant lines in the ground to extract or dispose of heat, while water source uses a black, plastic, high-density poly-ethylene (HDPE) pipe filled with a liquid such as water or propylene glycol to couple to the ground and extract or reject heat. Both are reliable, energy-efficient, albeit expensive systems.

One of the reasons why geothermal systems are so expensive is that local geology on Martha's Vineyard is "miserable," which means drilling and excavating costs are high. Nelson stated that the average total drilling costs are \$20 per foot for direct exchange and \$40 per foot for glycol-based systems.

The price difference between the two systems can be huge: Installation costs for direct exchange are roughly \$2,000 per ton and \$10,000 per ton for glycol. Add to this the difficulty of drilling the deeper, larger boreholes required for glycol-based systems, and the direct exchange geothermal system is definitely a less expensive option.

Nelson offers EarthLinked® direct exchange systems from ECR Technologies, noting that this type of geothermal system cuts the payback time to five to seven years, which is much more appealing to clients.



The flat plates from each direct exchange heat pump are connected to a hot water storage tank and a chilled water storage tank via Honeywell motorized diverting valves.

A LIVING SHOWROOM

Nelson doesn't just talk to his customers about geothermal technologies and green building techniques, he invites them to his 4,000-square-foot house to see how these systems work in action. His home, which was built in 1930, doubles as a showroom, so he can walk customers through and personally explain the benefits of direct exchange geothermal systems.

"My goal was to demonstrate all of the possibilities of ECR equipment, which include heating, cooling, domestic hot water, and dehumidification, as well as the inherent maintenance-free nature of geothermal systems," said Nelson. "I also wanted to maintain

the level of comfort I had established with my hydro-air HVAC system and show how geothermal could do this at a greatly reduced annual cost.”

Nelson’s geothermal system required 4,000 square feet of yard space, so that two horizontal 4-ton fields of copper tubing could be buried 6 feet below the surface. The fields are connected by way of a lineset to two ECR 4-ton heat pumps, which convert the stored solar energy in the yard to either hot or chilled water through flat plate heat exchangers in each heat pump.

The geothermal installation is slightly oversized, but given the heavy domestic hot water (DHW) demands from Nelson’s four children, he wanted the extra capacity for inexpensive DHW preheat (AET solar hot water panels were installed as preheat for DHW).

The flat plates from each ECR heat pump are connected to a hot water storage tank and a chilled water storage tank via Honeywell motorized diverting valves, which allow the ability to mix and match heat pump production with heating and/or cooling needs.

The storage tanks are connected to the existing air handlers through more diverting valves for either hot or chilled water. Nelson engineered custom coils from Heatcraft to optimize the water temperatures from the geothermal heat pumps. Eleven Taco “Loadmatch” circulators with internal check valves were used throughout the installation.

The direct digital control system is assembled around a Circon “UHC300” controller. This commercial level control allows Nelson to control heating and cooling production from each heat pump, optimize staging, provide variable-speed control for all the Loadmatch circulators, optimize the dehumidification/reheat flow levels based on room humidity levels, and trend real-time energy use. Web access allows Nelson to present this installation to his clients via their computers, while the trending feature provides confirmation of the computer projections of energy savings of these green systems.

Thermocouples were buried at a 6-foot depth in the middle of each geothermal field and temperature sensors were installed near the surface and in the heat pumps themselves.

A digital display panel mounted on the heat pumps shows clients the path of solar energy - from the sun warming the earth, to the

loop temperature underground, to the supply and return of the compressor, and finally to the supply and return of the flat plate heat exchangers. “This makes the entire process real to them and shows them the hidden inner workings of the geothermal magic,” said Nelson.

While first cost wasn’t a concern to Nelson, given that he wanted to use his home as a showroom, he did note that a direct exchange system sized to meet the heating and cooling loads of a 4,000-square-foot house would be \$20,000 to \$30,000 beyond the cost of an HVAC system. The cost for the entire HVAC system, depending on which features a homeowner asked for, would run between \$40,000 and \$50,000.

Nelson is thrilled with his new systems and shortly after startup, he removed his existing boiler and sold it to a young couple just starting out with their first house. “Even though the boiler was in brand new condition, I only wanted \$500 for it because I knew I was selling them a dinosaur. Down the road they will be geothermal customers. They’ve seen my confidence in going cold turkey, and that’s made them believers.”

Publication Date: 06/25/2007

Recent Articles By Joanna Turpin

Now Trending: HVACR

HVAC Contractors Are Bullish on 2017

Manufacturers Anticipate Exceptional Growth in 2017

Distributors Remain Confident About the Prospects of 2017

Ductless HVAC in High Demand



Joanna Turpin is Contributing Editor. She can be contacted at 480-726-7121 or joannaturpin@achrnews.com. Joanna has been with BNP Media since 1991, first heading up the company’s technical book division. She obtained her bachelor’s degree in English from the University of Washington and worked on her master’s degree in technical communication at Eastern Michigan University.

Copyright ©2017. All Rights Reserved BNP Media.

Design, CMS, Hosting & Web Development :: ePublishing