

# Geothermal-Radiant Warms New Building

**T**he gently sloping, ridge-defined agricultural area in East Drumore, Pa., is known for its 200-year-old barns and local Amish farmers who still plow fields with horse teams. But this township, located in the Southeast corner of the state, is embarking on a mission to modernize its infrastructure, as evidenced by the recently approved 4,500-panel, 15-megawatt solar energy farm, which will soon be the largest on the East Coast.

Just a few miles from the solar farm, the township has also invested in a new 16,000-square-foot municipal building, which features office space, radiantly heated garage bays for the township's fleet of heavy equipment, and a large wash bay (dump trucks last much longer if they're given a hot spray-down after spreading salt on icy roads all night).

When deciding what kind of system to install, Vince Youndt, owner, Vertex Mechanical Inc., Stevens, Pa., thought that a geothermal-to-radiant system would be a good match.

## Geothermal Flexibility

Since 2002, Vertex has been installing geothermal equipment in a wide variety of applications, both residential and commercial. "I love geothermal, and I love radiant," said Youndt. "It's not often we get to do both on the same project. The two technologies complement each other very well, especially when you throw in a little extra thermal mass." Indeed, the heavy concrete slab and a big buffer tank were ideally suited for Youndt's design.

"This will be a heavily used commercial facility that can't afford downtime. In the winter, weather tests the mettle of any heating system, especially one where large, overhead doors open and close as equipment is moved," said Youndt. "The system has to take that in stride, while maintaining consistent comfort levels and the controllability required for office spaces."

The clean mechanical room houses two 10-ton ClimateMaster TMW water-to-water geothermal heat pumps that supply water to the slab of the 12,000-square-foot garage space. The 4,000-square-foot office area includes four bathrooms with showers, a kitchen, and meeting rooms. Since these spaces need air conditioning as well as heat, they're conditioned by two four-ton ClimateMaster TTS water-to-air split systems. The smaller units rest on top of the TMW cabinets, and refrigerant lines run through the ceiling to air handlers above the various rooms.





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- 1 Lead installer Tyler McCarty sweats together a custom manifold for a remote floor pocket.
- 2 Tyler McCarty and technical support manager Mark Elmer mount a Taco Viridian circulator to the radiant manifold, which feeds the remote floor pockets in the system.
- 3 Mark Elmer uses a press tool to hook up the hot water generator pipes to a ClimateMaster TTS split system.
- 4 Installation manager Dean Landis shows the proper use of a wire tie tool.
- 5 Vertex technician Jay Burkholder monitors footage marks on the pipe to ensure that all circuits are to the correct length.

To provide a large portion of the domestic water demand during the months when the cooling systems are engaged, desuperheaters on the smaller units dump Btu into a 50-gallon Bradford White water heater.

All four ClimateMaster units share a 25-ton, horizontal slinky exchange field. The jobsite excavator dug up the exchange field while working on leveling the area for the building's slab. Vertex crews then installed the loops, fused the field, and ran the pipe into the mechanical room before it was backfilled.

Along with a handful of smaller circulators are four large high-tech circulators. Taco's new variable-speed ECM (electronically commutated motor), web-enabled pumps perform a variety of different tasks. The largest of the four, a VR20, serves the long slinky loops. Large zone valves open and close each of the five underground loops, so the Taco iWorX controls that Youndt chose can stage the geo field according to the demand.

"When I'm on site, I can hook up the Viridian pump to my laptop to change parameters and view performance data," said Mark Elmer, technical services manager, Vertex. "If I'm back at the shop, I can connect via the web and do the same from a remote location." The ECM motor uses up to 80 percent less energy than a comparable traditional pump — another chief reason Vertex specified the new Delta P equipment.

### Toasty Trucks

Much like a boiler, cold-starting big diesel engines all winter can decrease the lifespan of heavy equipment. East Drumore Township now has enough heated garage space for all of its valuable machinery. In the winter, an outdoor design temperature of 9°F was used, and the bays will remain between 55° and 60°F.

"To push the efficiency of the geothermal system even further, the two 10-ton ClimateMaster units input Btu to a 120-gallon Bradford White buffer tank. The tank acts as a giant flywheel for the hydronic system, allowing us to match the capacity of the geo units to the in-floor system's demand," said Elmer. "Using the buffer tank also means that we can always hit the system's optimal run-time and decrease the frequency of start-ups."

From the buffer tank, water goes out to six large zones. Another Viridian pump easily handles all the circulation to the 12,000 lineal feet of Watts Radiant PEX tubing. As zones open and close, the variable-speed pump ramps up and down to perfectly match the flow required.

Near the Viridian, six 1-inch Taco Zone Sentry zone valves con-

trol water movement into the extensive slab. One-inch PEX delivers the water to six remote manifolds in the garage bays. The manifolds gang anywhere between three and 12 half-inch PEX loops together. Each loop of Watts RadiantPEX+ oxygen barrier tubing is 300 feet long.

The manifolds were fabricated at Youndt's shop, and he utilized a unique method to protect them. Before the slab was poured, a small space was framed out to provide an in-floor pocket for the manifolds. A temporary quarter-inch plywood lid was placed on top of the box for the concrete pour. Once the floor was cured, the inside of the box was insulated, and the plywood was replaced with painted quarter-inch steel. The easily accessed manifolds are protected from equipment, tools, and personnel. Spaced at 12-inch centers, the radiant loops are sealed in the middle of the 6-inch-thick slab.

"With the amount of pipe we used on this job, I wanted to get the longest rolls possible," said Youndt. "The fewer times we have to change spools, the better."

### Brains of the Operation

"The outdoor design temperature for the cooling system is 91°F," said Youndt. "An outdoor reset is part of the new iWorX control system, which ties everything together nicely for the ultimate in energy efficiency and allows us to use the lowest possible water temperature."

iWorX is a web-based building control and monitoring system. Designed for the light commercial market and high-end residential markets, it serves buildings up to 50,000 square feet. "What makes iWorX different from other systems is that you don't need special tools or software to do the installation or commissioning," explained Elmer. "Programs are resident in the controller. By changing the control parameters for the specific HVAC equipment, engineering time is eliminated, and installation costs drop."

Aside from controlling conditions inside the building, iWorX monitors the temperatures of the individual geothermal exchange loops. If not all loops are needed to meet the demand, the controls system selects the coolest loops in the winter, and the warmest in the summer, opening those zone valves that give the geothermal units the best water temperature available.

"From the beginning of the design process, to the project wrap-up, we worked with the township to keep initial and operating costs as low as possible without compromising quality and comfort," said Youndt. "The township can certainly take pride in the new facility." 