

GREEN MECHANICAL CONTRACTOR

Uncommon Geo

Triple-tank design, desuperheater with large ΔT boosts system efficiency and loop life

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Ed Begley Jr.:
Blow to the wallet grabs people's attention

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Uncommon

Under the shade of one of Berks County, Pa.'s, largest beech trees lies what is arguably one of the county's most beautiful homes. Set in the center of a secluded three-acre lot, the 5,500-sq.ft., limestone home is stately in appearance, yet its expertly installed, unseen technology belies its traditional good looks.

When Tom and Denise Shaw decided to build their new home, they were adamant about the location, and though the home — with four children and two dogs — would need to be larger, they wanted a “size three” carbon footprint. The Shaws also wanted a property that would be sufficiently removed from nearby commerce and industry.

They eventually found the perfect property, though it had some “baggage.” The old house was about as loose with Btus as homes can be — generously sharing heat all winter long and entirely open to heat and humidity during the summer

months. After two years in the home, the Shaw family was ready to start from scratch.

The house was torn down and, in its place, a new foundation would expand the home's footprint, in size, but not in energy consumption.

Tom Shaw insisted on a geothermal system to meet all heating and cooling needs. Maintaining indoor comfort was the main consideration, but environmental sustainability was a big factor in the decision as well.

Through the general contractor, Lititz, Pa.-based Simeral Construction, the Shaw family was introduced to Vince Youndt, owner of Vertex Mechanical. Vertex's geothermally conditioned shop is located 20 minutes away in rural Stevens, Pa.

SYSTEM AT A GLANCE

The home's mechanical system consists of two ClimateMaster geothermal heat pumps, drawing from a 7-ton exchange field. The basement mechanical room is home to a 4-ton



TRIPLE-TANK DESIGN, DESUPERHEATER WITH LARGE ΔT BOOSTS EFFICIENCY, LOOP LIFE

Geo

Tranquility 27 water-to-air packaged unit, which handles the first floor and basement.

Next to it, a 3-ton Tranquility indoor split system is connected to a Trane air handler in the attic. This unit services the second floor and master suite. Both heat pumps have domestic hot water generation capability.

“We’ve found that using two systems, a packaged and a split, is a recipe that really works,” adds Youndt. “It allows us to use a single flow center, and keeps the exchange fluids in the basement.”

SEALED UP TIGHT

“We have a reputation for building a truly custom home,” says president of Simeral Construction, Andy Lehman. When the Shaws first spoke with Lehman, they were considering remodeling the existing house. “The more we looked at the project, and the magnitude of the work involved, the more evident it became that starting over was the better choice.

“A tight building envelope has always been a goal of ours, not just since the green movement,” added Lehman.

The Shaw home is no exception. Low-E Argon-filled windows diminish heat loss through the home’s glass. R-19 fiberglass batting was placed in the 2x6 walls and blown-in cellulose was used to insulate the attic, while caulk, house wrap and taped seams provide an excellent envelope beneath the home’s stone and cedar exterior.

Very familiar with geothermal technology and its use with residential construction, Simeral managers prefer to use geo systems whenever possible. According to Lehman, eliminating the noisy, exposed, less efficient outdoor condensing units is a huge plus.

“We did our first home with geo over 14 years ago, and haven’t had a single reason to reconsider our preference for the technology since then,” says Lehman. “We’ve always had good experiences with Vertex. We usually work together on a project three or four times a year.”

Cover Story

Contractor Vince Youndt selected Taco circulators and mixing valves.

UNIQUE HOT WATER SYSTEM

“Usually, when a desuperheater is being used, the geo unit is connected directly to a water heater, pulling water from it, and dumping back into it. That’s not the case with any of the units we install,” says Youndt.

A typical Vertex installation includes two tanks. In this case, three tanks are used. At the Shaw home, unlimited hot water was the goal. Two 50-gal. Bradford White indirect units (acting as buffer tanks) are piped between the desuperheaters and an 80-gal. Bradford White, LP-fired water heater. “We could have used a single 80-gal. buffer tank, but it actually costs more than two 50-gal. tanks,” says Youndt. “Why pay more for less capacity?”

Ground water comes into the indirect tanks only, which the desuperheaters begin to heat by casting off excess Btus. The LP water heater draws heated domestic water from the indirect tanks.

This configuration allows for a much higher ΔT for the desuperheater, further decreasing the load on the ground loop. It also lowers the ΔT for the water heater. Additionally, there’s the added benefit of having much more hot water on tap.

“ClimateMaster lists the double (or in this case triple) tank method as one of the recommended configurations,” says Youndt. “It works very well, though I’ve rarely seen anyone else use it quite the way we do.”

WHAT BOILER?

The somewhat uncommon domestic supply has one more secret. It doubles as a boiler, in its ability to provide hot water for a hydronic system.

Off the domestic supply riser, a tee, equipped with a Taco iSeries mixing valve, creates a loop to a small brazed-plate heat exchanger. Using low-temp radiant heat, half-inch PEX loops warm the floor in the master suite, roughly 500-sq.ft.

“The master suite is over the garage, so we wanted something to take the chill out of the walnut flooring in



the bedroom, and the ceramic tile in the master bath,” says Youndt. The plated, staple-up radiant loop’s mix temperature is about 100°F. It’s not meant to heat the room, only warm the floor. An outdoor reset control doesn’t turn the system on until the temperature drops below 50°F. The reset control gently increases circulated system fluid temperatures from 85°F at the beginning of the heating season, to higher fluid temperatures as outdoor temperatures drop.

SIGNATURE EXCHANGE FIELD

With three boreholes, the exchange field is under the home’s front yard. Like every Vertex installation, the HDPE loops are fused together at the wellhead manifold before entering the building’s foundation.

The 7-ton geo-exchange field consists of 8-in. holes drilled to 350-ft. by Sensenig & Weaver Well Drilling, Denver, Pa. Once the 1¼-in. U-bend pipes were dropped, the holes were backfilled with bentonite grout for maximum heat transfer.

“We do something else a little different with our geo installations,” says Youndt. “Instead of having wells dedicated to a specific heat pump, the entire exchange field is tied into one flow center with a switching relay. This allows either of the units to utilize the entire exchange capacity, maximizing the efficiency of that unit.”

“You could also say that ‘maximizing efficiency’ is the theme we used throughout this project,” concludes Youndt. “We had a big house with the need for a not-so-big carbon footprint.” ♻️



Tom and Denise Shaw wanted a comfortable house for their four children and two dogs.



The system uses a ClimateMaster Tranquility geothermal heat pump that uses a Trane air handler, along with three Bradford White tanks as buffer tanks and for domestic hot water.

VERTEX MECHANICAL WALKS THE WALK

Its historic facility receives the latest in energy efficient technology

Deep in the heart of Pennsylvania's rural Amish region is a 14,000-sq.ft., four-story brick building, originally built in 1903 as a tobacco warehouse. Today, the carefully repurposed brick structure is home to HVAC/mechanical contractor Vertex Mechanical Inc.

"Several years ago we took a risk when we bought it," admits company President Vince Youndt, "but we needed room to expand our operations, the location was good, timing was right and — just as importantly — we wanted to demonstrate our ability to overcome the biggest of obstacles in making older buildings energy efficient. Before we knew it, we were hip-deep in renovations, making our own 'home' as green as it could be."

Beginning in 2007, renovations to the building began. According to Youndt, no space — inside or out — was spared the scrutiny of the firm's exhaustive energy overhaul. Early in the work, and while the entire structure was being gutted, geothermal digging and trenching began to expose an area for the geo-exchange field under what is now parking space just 100-ft. from the loading dock.

"We installed 12,000-ft. of horizontal, slinky geothermal pipe buried at a depth of 5-ft.," says Youndt. "Although the exchange field has a 14-ton capacity, we're only drawing an 8-ton load from it."

Then, as the building looked skeletal inside, Vertex crews worked on piping, plumbing, ductwork and electric, completing all tasks according to plan.

"Ultimately, we wanted customers to see the very heart of Vertex's mission: to provide and maintain the highest quality and most efficient heating, cooling, and electrical systems, even — and especially — when the buildings or

homes are older, defying the best efforts to bring them into a much 'greener' state," adds Youndt.

Vertex crews installed three ClimateMaster split-system geothermal units to operate 13-tons of geo-exchange (one 3-ton and two 5-ton systems). One of the larger systems isn't used. It's more for backup or for extreme temperature swings.

The old system consisted of a gas-fired in-floor system and a 10-SEER central cooling unit. At the time, only the downstairs was heated and cooled.

"We doubled our office space areas and are now heating and cooling all four floors of the building," says Youndt. "With the ClimateMaster units, our energy costs have only gone up 15%, with nearly four times as much conditioned space."

To keep the traditional look inside and out, insulation wasn't added to the brick walls. The attic received an R-38 blanket, and new windows were installed all around.

"It's great having the whole building at a comfortable temperature year-round," says Youndt. "It keeps us in shape too." The fourth floor of the building is a spacious gym, where many Vertex employees grab a workout before or after work.

The old warehouse has a service elevator running from the basement to the fourth floor, which employees could (but rarely) ride to the top. In its former life, the tobacco warehouse acted as a staging area to which local farmers brought their harvest. The tobacco would be loaded onto boxcars and hauled out on rail.

While it's no longer a staging area, it's still a local hub for quality products and expertise.