



CASE STUDY

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The net-zero home of Carl Benker and his wife in South Glastonbury, Connecticut

Award-winning net-zero energy home heats and cools with geothermal system

Objective: Reduce environmental impact of the single-family home by creating a net-zero environment. The WaterFurnace 7 Series helped make this possible.

Home Size: 2,755 Square Feet

Unit Type: WaterFurnace 7 Series

Number of Units: 1

Loop Type: Vertical loops in 300 ft. wells

When Carl Benker and his wife, Elizabeth Wegner, designed their first home, the couple never intended to win contests or awards. "As the parents of two young children, we just wanted to build something that was right for the world today and the

world we will leave behind for our children and for our grandchildren," said Benker. Together they selected a builder with a similar philosophy—Glastonbury Housesmith LLC in South Glastonbury, Connecticut. The builder's sustainability message

reads, "Each home reflects our desire to substantially reduce our impact on the world which will affect our children, grandchildren and all future generations." The Benker home is no exception.



WaterFurnace 7 Series System

The WaterFurnace 7 Series™ provides the ultimate in comfort and performance and represents our finest products. The 700A11 is the geothermal industry's first variable capacity unit available to homeowners and is one of the only systems to surpass both the 41.0 EER and 5.3 COP efficiency barriers. Visit us at waterfurnace.com/7series for more information.

Contracted and installed by:

[A&B Cooling & Heating Corporation | abcoolingandheating.com](http://abcoolingandheating.com)

That's why the 2,755-square-foot home has won three prestigious awards. Early this year the Benker home was named the winner of the 2014 Connecticut Zero Energy Challenge, a statewide design/build competition for single- and multi-family homes that challenges builders and homeowners to create homes that consume as little energy as possible. Residential Energy Services Network (RESNET) rating standards determine each home's Home Energy Rating System (HERS) Index, a nationally recognized scoring system that measures energy performance. The lower the number, the more energy efficient the home. A score of zero represents a net-zero energy home.

With a HERS Index of -23, the Benker residence also won the RESNET 2015 Cross Border Challenge, sponsored by RESNET and its Canadian counterpart, CRESNET. The challenge recognized the residence as the home reporting the lowest HERS Index with photovoltaics (PV) that was built in North America in 2014. Steven Winter Associates, Inc. (SWA), in their role as an ENERGY STAR®

rater, LEED® for Homes™ provider and rater and National Green Building Standard verifier, nominated the home for this award and guided the team through the Connecticut Zero Energy Challenge. Most recently, the home was named a 2015 Housing Innovation Award winner by the U.S. Department of Energy.

Solar array and geothermal make a good match

The Benker home produces more energy than it needs, thanks to a PV array on a steel pole that rotates and follows the sun throughout the day. The PV array generates enough electricity to power everything in the home, including all appliances, lights, hot water heater and the home's heating and cooling system—that makes it net-zero. The extra energy it produces will be used to power an electric car for approximately 12,000 miles per year.

Deciding to install a geothermal heating and cooling system was a big decision. Carl's family has been in the fuel oil business since 1923, so Benker briefly considered installing a fuel oil system.

"But I really wanted to build a home with as small a fossil-fuel base as possible," he said. "There are only so many ways to heat a house without using fuel oil, natural gas or propane. We could have selected an electric resistance heating system, but from an efficiency, performance and comfort standpoint, geothermal was a much better choice."

A geothermal system takes advantage of free energy stored just below the surface of the earth. Using a series of pipes (an earth loop) buried in the ground and a geothermal (sometimes referred to as a ground source) heat pump, the geothermal heating and cooling system extracts heat from the earth and carries it to a building in the winter. An indoor unit compresses the heat to a higher temperature and distributes it throughout the structure. In the summer, the process reverses, and the system extracts heat from the building and rejects it to the earth. In both cases, the geothermal system delivers consistent temperatures and efficiencies that exceed those of conventional heating, ventilation

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and air-conditioning (HVAC) systems, offering savings as high as 70% for heating, cooling and hot water.

Benker selected Guy Wanegar and his company, A&B Cooling & Heating Corporation, in South Windsor, Connecticut, to install the geothermal system. Wanegar first offered geothermal installations in 1995. Today they comprise 95% of his business.

Efficiency, cleanliness and comfort sell geothermal

“We sell geothermal on three advantages,” said Wanegar. “One is the efficiency geothermal offers. Nothing can touch it as far as efficiency goes. Second, we sell it on cleanliness. The carbon footprint of a house using a geothermal system is extremely small, because the system doesn’t burn any fossil fuels. Third, we sell the comfort a geothermal system provides. Our customers always remark that they are much more comfortable with geothermal than they ever were with a conventional heating and cooling system.”

Wanegar came to the Benker project with 18 LEED certified homes under his belt, including the state’s first LEED Gold residential project, which he also completed with Glastonbury Housesmith. “As a company, we’re used to installing geothermal systems that meet LEED standards,” said Wanegar. “So that’s the way we approach every job today.” That approach appealed to Benker, who had decided to seek LEED certification for his home.

“It wasn’t a goal of ours, but the way we designed and built the house,

it seemed we could earn LEED certification without taking any special steps,” said Benker. “I wanted it more for some day in the future when we sell the house—something that might appeal to buyers.”

The geothermal system for the Benker residence uses two, 300-foot vertical wells for the geothermal loop and a WaterFurnace 7 Series variable capacity geothermal heat pump. The 7 Series is the first variable capacity geothermal unit available for homeowners and surpasses an Energy Efficiency Ratio (EER) of 41 in cooling and a 5.3 Coefficient of Performance (COP) in heating. That’s more than twice as efficient as today’s most efficient air conditioners or heat pumps and a third more efficient than standard geothermal units.

While other conditioning systems run at one or possibly two capacities (high and low), the 7 Series scales compressor output and airflow to exactly the level needed for any heating or cooling situation. The unit can ramp down to 20% of normal operation for the ultimate efficiency and comfort or scale up to 130% output for those brief periods when extra conditioning is required. And because the 7 Series operates over the industry’s largest range of capacities, it provides unmatched humidity control and can even eliminate the need for auxiliary heat in cold-weather climates.

“It’s easily the most efficient unit out there,” said Wanegar. “It operates with the WaterFurnace IntelliZone2 zoning system, which regulates the temperature in each of the home’s

three zones to provide maximum comfort and energy savings.”

Free hot water

The 7 Series is also equipped with a desuperheater, which provides all of the domestic hot water during the summer. In the winter, the WaterFurnace unit will pre-heat water and a hybrid hot water heater will finish heating it to the required temperature. The hot water system also uses insulated tubing to reduce heat loss and an on-demand hot water recirculation system that stops warm water from being wasted when waiting for hot water to arrive at the faucet.

“Using a desuperheater is really efficient,” said Wanegar. “It’s almost like free hot water, especially in the summer.”

Benker and his wife are happy with their decision to use a geothermal system to provide heating and cooling to their four-bedroom home. “It’s more efficient than anything else out there in terms of space conditioning, and during the summer, it does a better job managing humidity. We keep the house at 78 degrees, and it feels absolutely comfortable, because the humidity is only 50%. It also responds very quickly to the thermostat and gradually ramps up and down, so that we never feel blasts of hot or cold air. The temperature remains uniform and comfortable. And the 30% federal tax credit makes it affordable. I have to say that of all the mechanical systems in our house, my favorite is the geothermal system.”

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Sustainability defines house

The house is filled with a variety of other sustainable features, including:

- ENERGY STAR® appliances, including a heat pump clothes dryer and induction cooktop
- LED lighting fixtures
- Low VOC, GREENGUARD-certified components including insulation, drywall, joint compound and wood finishes
- Thermomass centrally insulated foundation with an R20 total insulating value
- Naturally cooled root/wine cellar maintained at 56 degrees year-round without using any power
- Aluminum roofing shingles with a 70-plus-year life span
- Fire sprinkler system that uses the existing cold water supply lines

- Framing designed to withstand higher than code-required hurricane wind loads
- Windows with orientation-specific solar heat gain to maximize winter solar heating and reduce summer cooling requirements
- Energy recovery ventilator that exhausts humid or stale indoor air and provides conditioned fresh air to the space

But Benker’s favorite feature is the wood flooring. “We needed to cut down a number of trees to build the house,” he explained. “I noticed that they were red oak, so I found a nearby sawmill to cut the trees into variable-width lumber, which was then milled and used as flooring. As a result, we were able to install the flooring throughout the house, with the only exception being the bathrooms.”

As pleased as Benker is with the flooring, he’s even more thrilled with the entire house. “The house came out just the way we had hoped it would, and I’m convinced that anyone can build a net-zero home. It takes some research, careful planning and assembling the right team, but in the end, the benefits are worth the extra effort, not only today, but for years to come. Given how much energy is used to heat and cool a house, a geothermal system is a ‘must’ to be energy efficient.”

The WaterFurnace name has been synonymous with geothermal since it was founded in 1983. Over the years WaterFurnace has worked to innovate new technologies, integrate key trends and grow its core business to represent clean and sustainable solutions. WaterFurnace units combine sound engineering with the highest levels of quality control to provide you with some of the most efficient heating, cooling and hot water systems on the planet. WaterFurnace—**Smarter from the Ground Up.** For additional information, please visit waterfurnace.com.



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