U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

BUILDING TECHNOLOGIES OFFICE

U.S. DOE ZERO ENERGY READY HOME 2013 WINNER Housing Innovation Awards

DOE ZERO ENERGY READY HOME™ CASE STUDY

Ferguson Design & Construction, Inc.

Sagaponack, NY

BUILDER PROFILE

Ferguson Design & Construction, Inc.
Builders: Sarah Ferguson and
Kim Kakerbeck
324 Wainscott Harbor Road,
Sagaponack, NY 11962
917-374-5985, kakerbeck1@aol.com
www.FergusonDesignandConstruction.com

FEATURED HOME/DEVELOPMENT:

Project Data:

- Name: Eco-friendly home
- Location: Sagaponack, NY
- Layout: 6 bedrooms, 5 baths, 2 floors
- Conditioned Space: 5,088 ft^2 (with basement)
- Completion: Feb 2013
- Climate Zone: IECC 4A
- Category: Custom

Performance Data:

- HERS Index without solar PV: 43
- HERS Index with solar PV: NA
- Projected annual utility costs: without solar $5,465, with solar $3,168
- Projected annual energy cost savings (compared to a home built to 2009 IECC): without solar $2,581, with solar $4,878
- Projected annual energy savings: without solar 869 gallons propane; with solar, 869 gallons propane, 11,379 kWh

Sarah Ferguson and Kim Kakerbeck, the principles for Ferguson Design and Construction, Inc., have recently completed their first U.S. Department of Energy (DOE) Zero Energy Ready Home. The 6-bedroom home achieves a HERS score of 43 even before PV is installed and will cut utility bills dramatically for its owners. This marks a significant achievement for the builders, who came into construction from other careers.

Both were working in New York City, Ferguson in finance and Kakerbeck in telecommunications, when Ferguson, tired of Wall Street and especially troubled by the 9/11 attacks, left the city for the home she had recently constructed in Sagaponack, a village in "The Hamptons" at the east end of Long Island. An architect based in New York City, at a firm Kakerbeck had previously worked for, designed the house but he could not oversee the project, which left Kakerbeck and Ferguson the job of supervising many of the details for completing the home. The knowledge gained from this, as well as Ferguson's many summers of working on her father's construction crews during school, led Ferguson out of her former career and into the construction trade. Kakerbeck was to follow later. Both women come from a long family line of architects, engineers, and builders.

Kakerbeck joined Ferguson full time in the company in 2009. By this time Ferguson had become much more focused on green and energy efficient construction. "The house we built in 2000 wasn't very green. Our architect had tried to incorporate some sustainable practices but the trades didn't really understand it yet. No one around here really did," said Ferguson. "People had ideas but it was like pulling teeth to put it altogether."

Ferguson and Kakerbeck have figured out how to put it all together now. Their first DOE Zero Energy Ready Home has also received a LEED Gold certification and the home they constructed next door received LEED Platinum certification. The

ZERO ENERGY READY HOME
U.S. DEPARTMENT OF ENERGY

The U.S. Department of Energy invites home builders across the country to meet the extraordinary levels of excellence and quality specified in DOE's Zero Energy Ready Home program (formerly known as Challenge Home). Every DOE Zero Energy ReadyHome starts with ENERGY STAR for Homes Version 3 for an energy-efficient home built on a solid foundation of building science research. Advanced technologies are designed in to give you superior construction, durability, and comfort; healthy indoor air; high-performance HVAC, lighting, and appliances; and solar-ready components for low or no utility bills in a quality home that will last for generations to come.

Water-savings faucets, LED lighting, and ENERGY STAR appliances add to energy savings. All interior finishes are no- or low-VOC and cabinets and furniture were made from recycled barn boards and trees salvaged from the property.

DOE ZERO ENERGY READY HOME CERTIFIED:

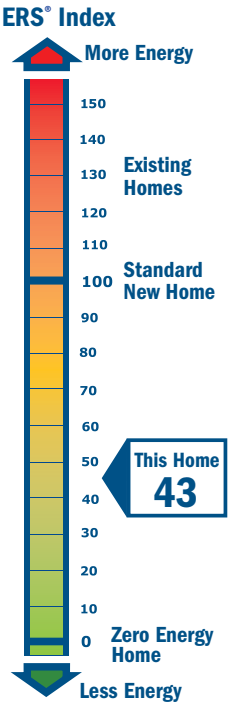
1 **BASELINE**
certified ENERGY STAR for Homes Version 3.0

2 **ENVELOPE**
meets or exceeds 2012 IECC levels

3 **DUCT SYSTEM**
located with the home's thermal boundary

4 **WATER EFFICIENCY**
meets or exceeds the EPA WaterSense Section 3.3 specs

5 **LIGHTING AND APPLIANCES**
ENERGY STAR qualified



6 **INDOOR AIR QUALITY**
meets or exceeds the EPA Indoor airPLUS Verification Checklist

7 **RENEWABLE READY**
meets EPA Renewable Energy-Ready Home.

company has committed to DOE Zero Energy Ready Home certification on all of its new homes. The company builds about two new homes per year, which are either custom homes built for a buyer or built and sold on speculation. The company also does two or three home renovations each year, incorporating as much energy efficiency as is possible given the parameters of the job. "Whatever we do, we try to do as efficiently as we can," said Kakerbeck.

"Overall it's just the right thing to do and we think we've hit it at the right time," said Ferguson. "People are finally paying attention to this sort of thing—for political reasons, if not from personal conviction. We have friends who are builders who used to make fun of us. Our website says 'build better, build green.' Now we're seeing them put green features in their homes."

Ferguson notes that the town of Southampton now encourages energy-efficient construction with a very progressive building code. "They are hard core about achieving low HERS ratings, although LEED still goes further," said Ferguson.

Fortunately, the company gained experience achieving low Home Energy Rating System (HERS) scores when they built their first ENERGY STAR home in Vermont. Kakerbeck said they achieved a HERS of 55 without added photovoltaics (although the house is prepared for this in the future when incentives are re-instated in Vermont). The project gave them the knowledge base for their current DOE Zero Energy Ready Home. On the DOE Zero Energy Ready Home they achieved a much lower HERS score of 43, still without photovoltaics, although the house has been made solar-ready for an 8.6-kW PV system once a buyer moves in.

The 5,088 ft^2 two-story home, which is considered modest for a new home by Hamptons standards, features six bedrooms, including two in the finished basement, and five bathrooms. Although it's not small, the home's highly insulated building shell and advanced heating system ensure that utility bills will be modest.

The home is constructed of double walls consisting of two sets of 2x4s with the studs at 16 inches on center. The studs are staggered so that heat cannot transfer directly through the studs. Together the two walls form a 7-inch wall cavity that is filled with blown-in fiberglass insulation for an R value of R-25. The exterior wall is covered with OSB that has a proprietary coating on it. When taped at the seams with the sheathing manufacturer's specified tape, the coated sheathing forms an air-tight, weather-resistant barrier and drainage plane that does not need housewrap. The walls are covered with clapboard and cedar shake siding.

Above-grade walls consist of double-wall construction with two 2x4 16-inch on-center framed walls set next to each other to provide a 7-inch-thick wall cavity for R-25 of blown-in fiberglass insulation. The stud walls are staggered to prevent thermal bridging through the wall. A coated OSB sheathing product provides air sealing and a drainage plane behind the clapboard and cedar shingle walls.

The roof has a 2x12 vaulted ceiling with 11.25 inches of blown cellulose filling the ceiling cavities for an R-40 insulation value. The roof decking consists of the same coated sheathing with proprietary taped seams. A 3-foot border of ice and water shield protects the edges and valleys of the roof. Over the sheathing is laid a "cedar breather" product consisting of thick mesh that allows ventilation under the cedar shakes. Some builders prefer it for more even ventilation than installing horizontal lathes under the shakes.

The poured-in-place concrete basement walls are insulated on the interior and under the slab with two inches (R-10) of XPS rigid insulation. Because the basement is occupied space, the foam must be covered with drywall as an ignition barrier, or in this case with framed 2x4 walls and drywall. In addition, all interior walls and floors are insulated with R-13 batts to provide sound proofing.

The windows are double-pane, low-e, argon-filled, fiberglass-framed, high-performance windows with an insulation U factor of 0.29 and a solar heat gain coefficient (SHGC) of 0.28. The south- and west-facing windows have a lower SHGC than the east- and north-facing windows to minimize summer heat gain.

The heating system is an air handler hydronic system that uses hot water coils as the heat source. The hot water for these coils comes from a 91% AFUE propane tankless boiler that also provides hot water for the radiant floor heat in the basement as well as domestic hot water.

The air conditioner consists of one 2.5-ton condenser that provides cooling for two zones—one upstairs and one downstairs. Cool air is directed to the two zones by dampers that are controlled by two thermostats. Because there are less penetrations, there is less air leakage and the home's high insulation levels have enabled the small tonnage system to provide adequate cooling for the house.

Ventilation is provided with a heat recovery ventilator (HRV) that is located in a basement utility room along with the air handler. The HRV brings in fresh air that is passed through a heat exchanger where it is warmed or cooled by outgoing air before it is directed through a filter and into the home's air handling unit for distribution through the HVAC ducts.

The home is equipped with remote controlled thermostats. The home has an in-ground swimming pool. The pool pump and filtration system are the highest efficiency equipment available, beyond what even the strict local code requires.

HOME CERTIFICATIONS:

DOE Zero Energy Ready Home

LEED for Homes – Gold

ENERGY STAR Version 3

EPA Indoor airPLUS

ENERGY STAR

Building America U.S. Department of Energy

Every DOE Zero Energy Ready Home combines building science specified by ENERGY STAR for Homes and advanced technologies and practices from DOE's Building America research program.

The builders also insulated all of the hot and cold plumbing pipes inside the home, another above-code measure.

All of the lighting in the home is LED lighting. The dishwasher, clothes washer, and refrigerator are all ENERGY STAR rated. All of the showers, faucets, and toilets are EPA WaterSense labeled. The landscaping includes 100% drought-tolerant plants and only 30% of the yard is covered with grass, which is also a drought-tolerant variety.

To improve the indoor air quality, the builders specified only low- and no-VOC interior finishes. They were careful to cover the ducts with plastic during construction and to replace the furnace filter once the home was completed. All of the cabinets are made with recycled barn wood. Some furniture in the home is made with trees salvaged during construction and scraps of the posts that were used for interior supports.

The home is in a coastal environment prone to hurricanes so every stud was tied to the foundation and every roof rafter was tied to a stud using hurricane strapping and clips. Firestopping caulk was used to caulk throughout the house. Fireblocking was installed in the basement, and all walls were sheetrocked, including the utility room.

Building to these higher levels of energy efficiency and environmental sensibility has been a natural progression for Ferguson and Kakerbeck. They have learned to take a systems approach, which has paid off in terms of higher quality. With the DOE Zero Energy Ready Home, they organized weekly project team meetings and met prior to construction to address issues regarding the building enclosure and durability. The home also underwent regular and thorough inspections by their HERS rater, Karla Donnelly of Steven Winter Associates. As a result, the project experienced minimal defects and 82% of construction waste was diverted.

A high-efficiency propane boiler provides hot water for the hydro coil central air heating system, radiant floor heat in the basement, and domestic hot water.

The challenging part has been educating the trades, real estate agents, and home buyers on the value of what they are doing. They have spent a lot of time working to educate them on the technical aspects of the energy-efficiency measures they've installed.

But for Ferguson and Kakerbeck, being able to build environmentally responsible and beautiful homes in their adopted hometown has been worth the effort.

KEY FEATURES

- **Path:** performance
- **Walls:** clapboard and cedar shake siding over a mesh air spacer; above-grade walls have R-25 blown-in fiberglass in a double wall of two 2x4 16 in. o.c. walls. Coated sheathing with proprietary tape for air sealing
- **Roof:** 2x12 vaulted ceiling with 11.25 in. blown cellulose (R-40). Coated sheathing with proprietary tape for air sealing
- **Foundation:** below-grade walls are R-10 rigid foam insulated on interior; 2 inches (R-10) XPS under slab
- **Windows:** double-pane, low-e, argon-filled, fiberglass-framed, U=0.29, SHGC=0.28
- **Air Sealing:** 1.2 ACH 50
- **Ventilation:** HRV with MERV 16 filter
- **HVAC:** 91% efficient boiler for hydro air system, SEER 16 AC. Total duct leakage of 4 cfm/100 ft^2 of conditioned space. Radiant heating for basement in slab.
- **Hot Water:** 91% AFUE propane boiler
- **Lighting:** 100% LED
- **Appliances:** ENERGY STAR-rated dishwasher, clothes washer, refrigerator
- **Solar:** solar ready with brackets and wire connections installed for a future 8.6-kW solar PV system
- **Water Conservation:** EPA WaterSense low-flow showers, sinks, and toilets; drought-tolerant plants
- **eMonitor Management System:** remotely controlled thermostats
- **Other:** low- and no-VOC finishes; reclaimed wood cabinets and furniture; recycled-content counter tops