

# The Greening of OakHill

## GREEN RECOVERY SEMINAR SERIES SPRING, 2009

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We started to build this disability accessible renewable energy home in 2001. Major additions in 2006 include the 3.15 kilowatt solar panel array on the south roof and the bank of batteries that carry us through interruptions of the commercial power grid..

Previously installed renewable energy and conservation resources include a geothermal heating/cooling system, an outdoor wood or pellet burning furnace, passive solarium, an insulated concrete form foundation, energy efficient windows and polyurethane foam in the upper walls and silo

### OakHill Renewable Energy Investment

HeatMor Woodburning Furnace	\$4,669
HeatMor transfer pipe installation	\$2,822
Carrier Geothermal 3-ton Heat Pump	\$4,926
Geothermal Ground Loops installed	\$2,195
Inverters and Power Center	\$7,448
install (16) L-16 deep cycle 6v Batteries	\$4,210
(18) Kyocera 175 watt PV Panel System	\$19,645
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	\$45,915

Green-built Near-Zero-Energy-Homes (NZEH) like this require significant up-front investment, but they have small carbon footprints and low operating costs. We cut our own wood, only buy supplemental heating gas, and spend about \$1,400 per year for electricity purchased off the grid.

### Builders and Suppliers:

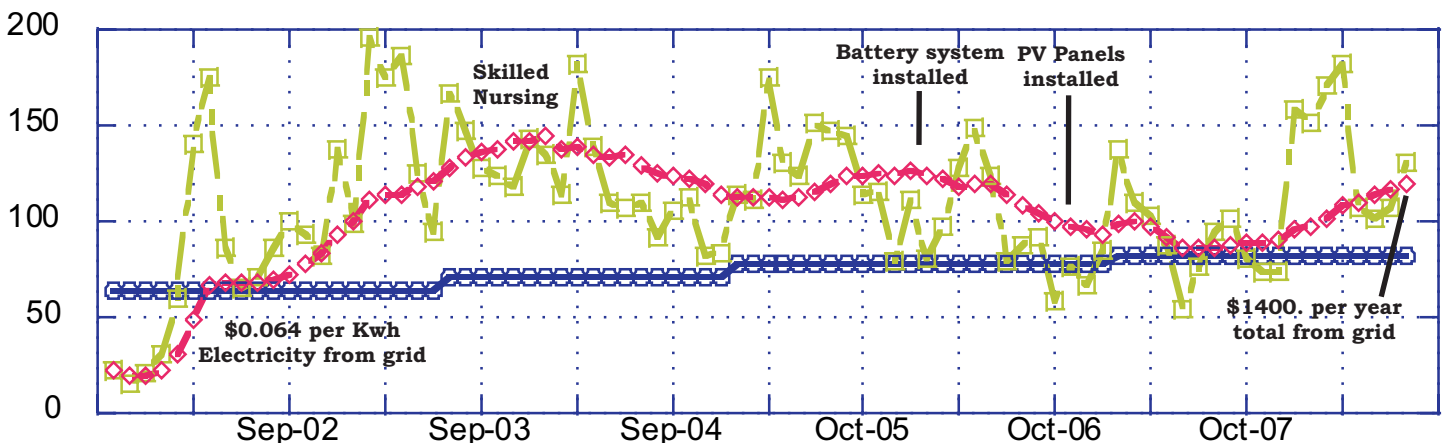
Ferguson Custom Homes, Janesville (design/build)  
 H&H Solar Electric Systems, Madison/Janesville  
 Zimmermans [www.wisconsininsulatedforms.com](http://www.wisconsininsulatedforms.com)  
[www.dwyersspecialty.com](http://www.dwyersspecialty.com) - Foam insulation



The silo houses the power system inverters, battery cabinet, and an elevator, which allows wheelchair or “freedom walker” access to all parts of the house and garage. The building design made it possible for the Browns to provide in-home skilled nursing care for both of their fathers before they died in 2003. “We’re also planning for ourselves,” says Dave. “Too often, retirees find themselves trapped in older split level homes. We designed our OakHill to be economical and supportive for the rest of our lives

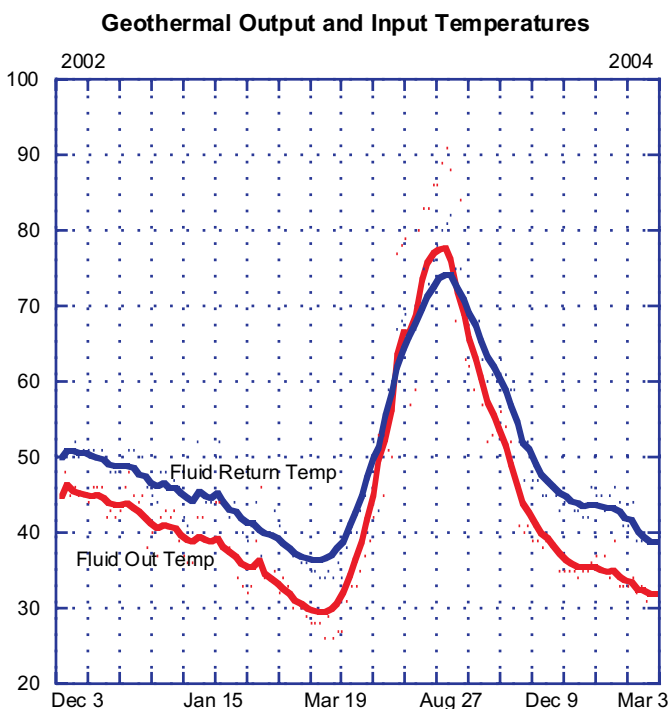
The photovoltaic panel array on the south-facing roof is rated at 3.15 kilowatts. The passive solarium below the roof has low-E windows all around. It requires no heat from the house air handler.

The chart (below) plots OakHill’s monthly electric bills in green. Each plot on the red line is a rolling average of bill totals over the previous year. The blue line shows that the cost of purchased electricity rose 28% from 2002 through 2007. “Skilled nursing” identifies a period when in-home temperatures were maintained at 76 degrees year-round.



We have two Xantrex SW4048 inverters equipped with SWRC interfaces for remote computer monitoring. The Outback MX-60 charge controller has an MX-Mate interface. Each device is connected via Rs232 serial interface to a Windows PC running 24/7 using Winverter Monitor. We've enjoyed excellent results with this software suite obtained from:

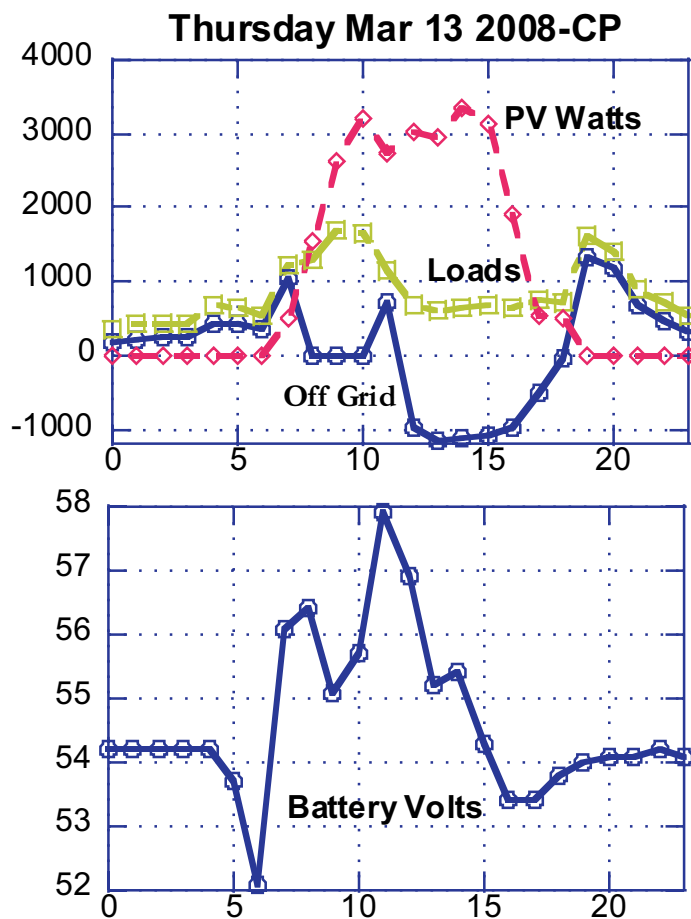
**RightHand Engineering LLC**  
**19310 226th Ave NE Woodinville, WA 98077**  
**Phone/Fax: (425) 844-1291**  
**www.righthandengineering.com**



Our Carrier 3-ton geothermal heat pump is like a refrigerator compressor that can run both ways. In wintertime, cool fluid from the outdoor buried pipe field is made even colder by the compressor. The resulting heat is transferred to a separate loop that pumps hot fluid through an exchanger in the home's air handler..

This is reversed when we cool the house during the summer. Hot fluid thrown off by the compressor is transferred to the outside field, and this warms the soil. So does the sun. Most of this stored heat is available in the fall. This is why geothermal systems are efficient and inexpensive to operate.

Geothermal systems need only a six-degree difference between output and return temperatures. The fluid is mixed with antifreeze, making it possible to get heat for the home out of "freezing" ground.



The Winverter programs read internal meters in the devices; then store minimum, maximum and average values every hour. At midnight, an Excel-compatible text file is stored for each device. We use Kaleidagraph software to convert extracts from the Excel spreadsheets and produce graphs (above)..

The graphs show a mostly sunny day in late summer. The panels, rated at 3.15 KW, were installed by H&H Solar Energy Systems. They produce a total of 14 KWh on a day like this. At mid-day, when the PV system produces more power than the house uses, the excess is first directed to "top off" the batteries. The remainder is sold back on the grid to our electric service cooperative rather than simply throwing it away..

Because our electric company is a cooperative, it does not participate in Wisconsin's Focus on Energy, and does not buy and sell electricity at the same rate. OakHill has to sell to the cooperative at about half the price it purchases.

The second graph (above) shows how the battery charge controller uses excess energy from the solar panels to cycle the batteries through an absorption phase; then hold them at float voltage.