

# Near Zero Energy Home

## Lakeland, Florida



### *Experimenting with Efficiency*

In the spring of 1998, the Florida Solar Energy Center partnered with the U.S. Department of Energy's Building America program to construct a comprehensive home efficiency experiment in Lakeland, Fla. Two homes, a control and a variable, were constructed for this experiment. Built with the same orientation to the sun, same floor plan, and same square-footage, the objective of this experiment was to compare the energy usage and savings between a single-family residence built to standard construction codes and a home engineered to reduce energy use to an absolute minimum.

*Solar-Control windows and larger overhangs contributed to 1/5 of the energy savings for cooling*

### *Cool Results*

In a typical Florida home, 35 percent of all electricity is used for cooling. The near zero energy home was built with a dozen extra energy-efficient features, from extra insulation to compact fluorescent light bulbs (CFLs), to help combat wasting energy while trying to keep the house cool during Florida's hot summers. Installing a high-efficiency refrigerator and CFLs – both appliances release less heat while operating – throughout the home helped lower electrical usage for cooling. The near zero energy home's windows are spectrally selective, which means they transmit about 70 percent of the visible light into a room while capturing about 98 percent of the infrared and ultraviolet portions that can overheat a room and fade furniture. Paired with extra-long overhangs from the roof, these windows contributed to one-fifth of the energy savings for cooling the home. The home also utilizes a programmable



*Solar Thermal and PV Panels, Lakeland House, Lakeland, Florida*



*Installation of PV Panels, Lakeland House*

thermostat, which increases the indoor temperature overnight while no one is occupying the house.

The Florida Solar Energy Center (FSEC), a research institute of the University of Central Florida, is the largest and most active state-supported renewable energy and efficiency institute in the United States. Working in alternative fuels, hydrogen fuel cells, photovoltaics, solar thermal technologies, high performance buildings, and education areas, FSEC's 140-member staff helps provide Florida with a future of energy independence and environmental sustainability.



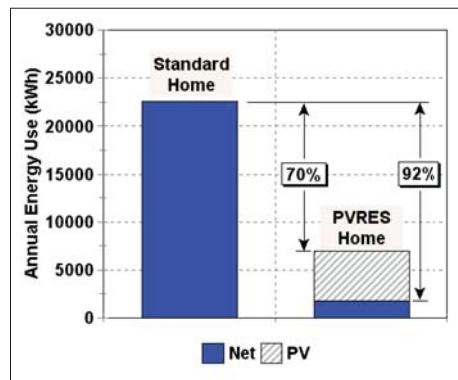
Research that Works

Building America is a private/public partnership that develops energy solutions for new and existing homes. The Building America project combines the knowledge and resources of industry leaders with the U.S. Department of Energy's technical capabilities. Together, they act as a catalyst for change in the home-build industry.



## Hot Days in Florida

On June 18, 1998, the hottest day of that summer, the control home's air conditioner consumed an average of 2,980 watts of power, while the near zero energy home's A/C consumed a mere 833 watts. When power from the PV system was factored in, cooling the near zero energy home required only 199 watts of utility-supplied power on that day. This is an astonishing 93% reduction compared to the control home.



## Solar + Efficiency = Big Savings

Not only is the home built to high efficiency standards, it also employs the use of clean power through solar water heating and photovoltaics (PV). The 80-gallon solar water heating system supplies most of the hot water for the occupants' needs using a two-kilowatt solar collector. The PV system is a four kilowatt utility-interactive system that allows the homeowners to sell back power produced by the PV system to the utility. One of the two PV arrays is located on the south-facing roof, which is generally the preferred location for PV systems in Florida. The other half of the array was placed on the west-facing roof to provide more PV power during the hot afternoons, when the utility experiences its peak demand period. In this case, the high efficiency of the



Photos by Steven C. Spencer

Rear view of the Lakeland House, Lakeland, Florida

near zero energy home paired with the two solar systems resulted in the offset of about 85 percent of all annual grid electricity needs.

*Pairing energy efficiency with solar energy reduced total energy use relative to an identical home by 90 percent.*

## Performance Features

### Control Home

- Gray/brown asphalt shingle roof with 1.5-foot overhangs
- R-30 attic insulation
- Single-glazed windows with aluminum frames
- R-4 wall insulation on interior of concrete block walls
- R-6 ducts located in attic
- Standard electric appliances (range, water heater, refrigerator, and dryer)
- Standard incandescent lighting (30 recessed-can lights)
- Standard-efficiency, 4-ton, SEER 10 (seasonal energy efficiency ratio) heat pump

### Near Zero Energy Home

- White-tile roof with 3-foot overhangs
- R-30 attic insulation
- Advanced solar-control double-glazed windows
- R-10 exterior insulation over concrete block system
- Oversized, interior-mounted ducts
- High-efficiency refrigerator
- High-efficiency compact fluorescent lighting
- Downsized SEER 15.0, variable speed, 2-ton air conditioner with field-verified cooling-coil air flow.
- Programmable thermostat
- 2-kW solar water heater
- 4-kW utility-interactive PV system attic insulation