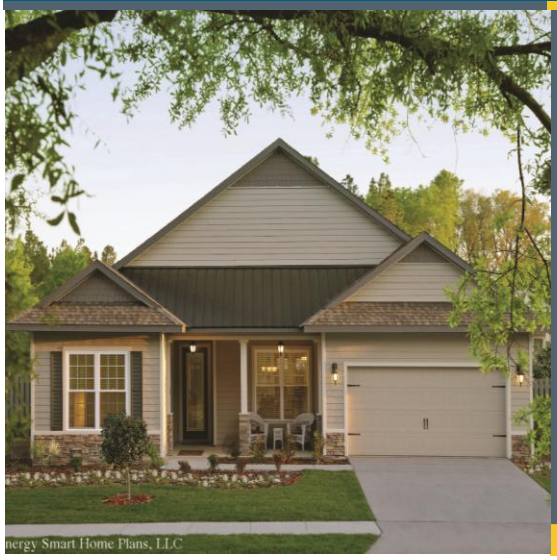

Building America
Efficient Solutions for New Homes

Case Study: Tommy Williams Homes Initial Performance of Two Zero Energy Homes

Gainesville, FL

PROJECT INFORMATION

Construction: New Home
Type: Single-family
Builder: Tommy Williams Homes
Sizes: 2,250 ft^2 and 1,546 ft^2 Price Range: $163 to $169/ft^2
Date sold: Feb 2010 and Oct 2010
Climate Zone: Hot-Humid, IECC 2A

PERFORMANCE DATA

HERS Indices	TW1	TW2
HERS Indices w/PV	-2	-1
HERS Indices w/ solar DHW but excluding Photovoltaics	49	50
Measured Data for 4/1/11-11/15/11	Average kWh/day	
House Total	**26.3**	**16.5**
Cooling	14.6	7.8
DHW	0.0	0.0
Other	11.6	8.7
PV gen	28.1	22.6
% Solar	**107%**	**137%**

Project Description

These high-performance homes in northern Florida are two that have achieved Home Energy Rating System (HERS) ratings of less than zero since Building America (BA) builders started building them in 2010. The homes (TW1 and TW2) were built in the Gainesville area by Tommy Williams Homes (TW), with technical assistance from Florida H.E.R.O. and energy-efficient home design input provided by Energy Smart Home Plans. The homes are being metered by the Florida Solar Energy Center (FSEC) as part of BA efforts to collect data that characterize the performance of the homes and verify that the solar photovoltaic (PV) system used in their design produces more energy than these all-electric homes require, as the HERS rating of <0 implies.

The table to the left shows measured home-performance data for a 7.5-month summer period in 2011. The whole-house, cooling, and "other" energy uses for these homes are substantially lower than typical homes in northern Florida. Energy usage in TW1 is about 30% to 45% lower than a typical home and in TW2 it is about 60% lower. The difference in energy usage between TW1 and TW2 is primarily due to occupancy patterns. Zero utility bills over the measurement period are possible because of this high level of efficiency.

(Left) South roof of TW1 showing the PV arrays and the solar domestic hot water (DHW) panels at roof peak. (Right) South roof of TW2. (*Photo Source: Energy Smart Home Plans*)

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KEY ENERGY-EFFICIENCY MEASURES

HVAC:

- SEER 16 HSPF 9.5 heat pump
- Interior ducts under vented attic. Duct leakage to outside = 0 to 2.5% of floor area @ 25 Pa
- Positive pressure whole-house ventilation system (run-time only).

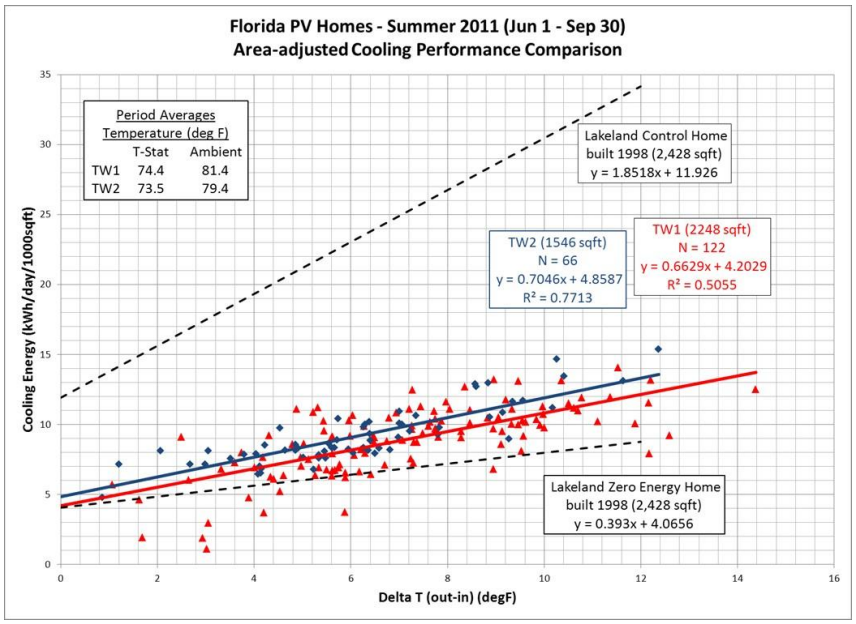
Envelope:

- R-30 blown ceiling insulation in vented attic
- R-15 spray-in fiberglass insulation in 2x4 frame wall
- Double-pane, low-e, vinyl windows. U = 0.35, SHGC = 0.25
- Tightly sealed house, ACH50 = 2.3 and 2.8

Lighting, Appliances, and Solar Systems:

- 100% CFL
- ENERGY STAR® ceiling fans
- ENERGY STAR® refrigerator and dishwasher
- Solar water heater (indirect system)
- PV array size (kWp DC): 6.8 (TW1); 5.4 (TW2)

For more Information, please visit:
www.buildings.energy.gov



The cooling performance of the two TW homes is compared to a typical and a very high-performance home in Lakeland, FL. This method of comparing the cooling performance of different homes in different locations and periods was developed at FSEC (Chasar et. al. 2006 http://www.ba-pirc.org/pubs/cooling/index.htm) and is useful for visualizing comparative performance.

Lessons Learned

- It is indeed possible to achieve a zero utility bill in a high-performance home with a modest number of solar PV arrays.
- Because of the low cost of PV systems and the low loads in these homes, it was not cost-effective to purchase HVAC equipment with a SEER rating greater than 16.
- Significant south roof areas are needed to get to HERS 0. In TW1 and TW2 it was possible to fit all the solar systems on the south roofs, but just barely (see photos on previous page).
- The interior RH in these low sensible-load homes was well controlled even without a supplemental dehumidification system. The mean monthly interior RH stayed below 60% all the time.
- Occupants in the two TW homes maintained a comfortable 73 to 74 °F interior temperatures in the summertime (see box in plot above). Still, the cooling energy use in the homes was low, attesting to the excellent performance of the envelope and equipment.

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PNNL-SA-84975, 2011

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