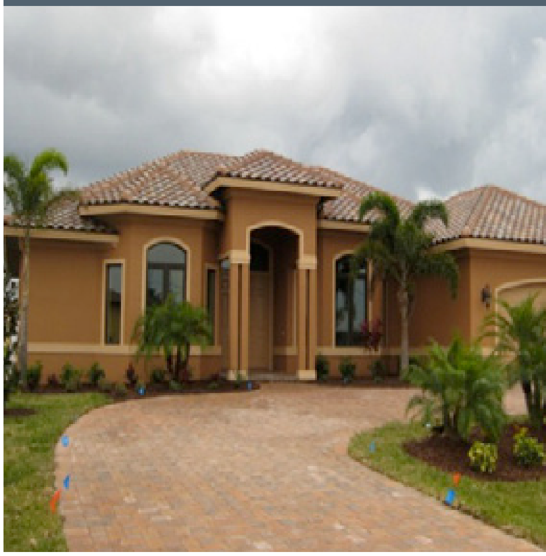
U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

BUILDING TECHNOLOGIES OFFICE



Building America
Efficient Solutions for New Homes

Case Study: Ravenwood Homes and Energy Smart Home Plans, Inc.

Cape Coral, Florida

PROJECT INFORMATION

Construction: New home

Type: Single-family

Partners:

Pacific Northwest National Laboratory
www.pnnl.gov

Energy Smart Home Plans
www.energysmarthomeplans.com

Florida H.E.R.O. www.floridahero.com

Builder: Ravenwood Homes

Size: 2,248 ft^2

Date Completed: March 2012

Climate Zone: Hot-Humid, IECC 2A

PERFORMANCE DATA

HERS index: 15 (with PV), 65 (without PV)

Projected annual energy cost savings: $1,690 (with PV), $483 (without PV)

Added first cost of energy-efficiency measures: $40,000 (with PV), $15,000 (without PV)

Annual mortgage increase: $2,000 (with PV), $750 (without PV)

Annual net cash flow to homeowner: -$310 (with PV), -$267 (without PV)

Building AMERICA
U.S. Department of Energy

Ravenwood Homes achieved a HERS score of 15 on its high-performance home with design assistance from a Building America research team including Pacific Northwest National Laboratory, Energy Smart Home Plans, LLC, and Florida HERO. The home which is located in southwestern Florida, was completed in 2011 and includes a 6 KW rooftop photovoltaic system; without the PV, the home achieves a HERS rating of 65.

Ceilings that provide a continuous air barrier can be a key energy-saving feature of a home. In this home the builder installed the ceiling drywall as one continuous layer then installed duct chases in dropped ceilings beneath this drywall so that ducts were installed in conditioned space with an unbroken air barrier above. Interior walls were also attached to the underside of this continuous ceiling plane.

Unfortunately a later design change significantly compromised the ceiling air barrier continuity. The builder installed 72 recessed can lights in the home rather than the 12 specified in the design. Although the can lights were sealed to the drywall, this change pushed the originally anticipated building infiltration rate of 2.0 ACH50 (air changes per hour at 50 pascals of pressure) to 4.39 ACH50, or more than twice what had been expected.

After the ceiling drywall was installed, the ducts were installed in chases beneath the ceiling providing a conditioned space for the HVAC ducts with a continuous air barrier above.

This builder's experience demonstrates how important installation details are in avoiding thermal bypasses and maintaining a fully aligned air barrier and thermal barrier. For example, the

KEY ENERGY-EFFICIENCY MEASURES

HVAC:

- SEER 16 AC with strip heat (little heating load in south Florida)
- All ductwork in conditioned space
- Positive pressure whole-house ventilation system (run-time only) all exhaust fans vented to outside

Envelope:

- Concrete block with 1-in. rigid foam insulation applied to the interior of the block wall with furring strips and drywall on top for some exterior walls. 16-in. on-center wood frame with R-19 fiberglass batt insulation on remaining exterior walls
- Vented attic with R-38 fiberglass batt insulation on the attic floor and radiant barrier on the roof deck
- Low-e, vinyl-framed, double-pane windows (U = 0.26-0.55, SHGC = 0.18-0.70)
- Moderately tight building envelope, ACH50 = 4.39

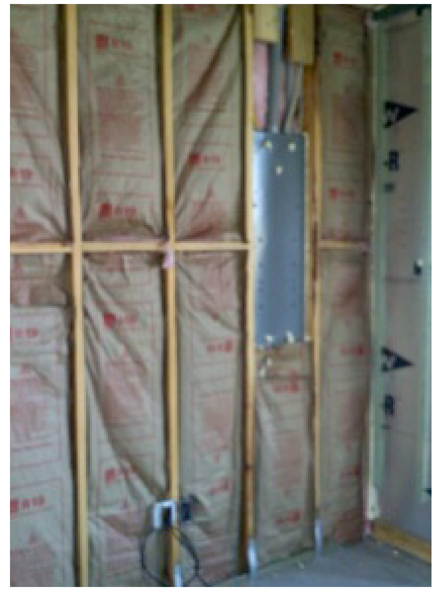
Lighting, Appliances, & Water Heating:

- 100% CFL
- ENERGY STAR® appliances
- Solar thermal open-loop direct system with two 4x8-ft rooftop panels and a 120-gal tank.
- 26-panel PV array, 5.98 kW

For more information, please visit: www.buildingamerica.gov

builder initially used inset stapling to secure kraft-faced insulation in the walls. Inset stapling creates creases in the face of the insulation that serve as potential pathways for air movement. This problem had to be corrected before drywall was installed.

This home, as Ravenwood's first, was more expensive than it needed to be and did not have a positive cash flow, despite the good energy performance. As the builder becomes more familiar with high-performance building practices and develops relationships with equipment suppliers, costs should come down and result in significant cost and energy savings in future high-performance Ravenwood homes.



Inset stapling was used to fasten the insulation to the sides of framing, which created a thermal bypass. The builder restapled the kraft tabs to the stud faces to remedy this problem.

Lessons Learned

- Ducts in conditioned space and the ceiling air barrier were instrumental in achieving moderate air leakage rates and scoring well on the HERS Index, although additional can lights penetrated the ceiling in many locations.
- Training was important for the installer to achieve best practices. Involving the builder, designer, and building science consultant in the training of all onsite workers helped to meet efficiency goals.
- Design decisions made in the field can dramatically influence energy performance. In addition to the recessed can lights, changes for this house included the addition of a swimming pool pump, downgrading the AC system, and installing a smaller PV array.

"I expected major changes to the building process but building my first high-performance home just required small adjustments in the timing of the trades. This has given new life to my business."

Dave Wishtichin, Head of Construction Ravenwood Homes

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