



## Building America Efficient Solutions for Existing Homes

# Case Study: Habitat for Humanity of Palm Beach County

Lake Worth, Florida

### PROJECT INFORMATION

Construction: Retrofit

Type: Single-family

Builder:

Habitat for Humanity of Palm  
Beach County

<http://www.habitatpbc.org/>

Size: 1,573 ft<sup>2</sup>

Date completed: October 2011  
(originally built in 1996)

Climate Zone: Hot-Humid

### PERFORMANCE DATA

HERS index:

Home as found = 120; case study  
after retrofit = 73

Projected annual energy cost  
savings: \$872

Total cost of energy-efficiency  
measures: \$ 5,401

Incremental annual mortgage:  
\$435

Payback period: 6 years

Billing data: Available in FY12

### Project Description

Habitat for Humanity of Palm Beach County, working with Building America researchers from Pacific Northwest National Laboratory and the Florida Solar Energy Center, upgraded this previously unoccupied 1996 home in Lake Worth, Florida to achieve an estimated 39% improvement in energy efficiency. The 1,573-ft<sup>2</sup> slab-on-grade, single-family home received extensive energy upgrades during its conversion to affordable and efficient housing for low-income families. By replacing the home's water heater, using compact fluorescent lamps (CFLs), reducing air infiltration, adding more ceiling insulation, and installing a central air conditioner, the home's annual energy bills are predicted to decrease by \$872.

Habitat installed a seasonal energy efficiency ratio (SEER) 14.5 central air conditioner with integral resistance heat and a 50-gal electric tank water heater with heat pump, placed CFLs in 80% of the fixtures, increased ceiling insulation to R-38, and significantly reduced whole-house infiltration scores from an ACH50 of 15.05 to 6.15. Together, these measures reduced energy bills by \$872 annually with a simple payback period of only 6 years and immediate positive cash flow for the homeowner.



The largest energy savings came from replacing this 30-gal tank electric water heater with a 50-gal electric/heat pump hybrid water heater. The new water heater will save an estimated \$182 annually in energy costs. Only relatively minor modifications were required to fit the new water heater in the old unit's space.

## KEY ENERGY-EFFICIENCY MEASURES

### HVAC:

- SEER 14.5 forced air, central air conditioner with integral electric resistance heater (little heating load in south Florida)
- Programmable thermostat
- Pre-retrofit duct leakage = 0.10 cfm flow to out (Qn out)  
Post-retrofit duct leakage = 0.065 cfm (Qn out)

### Envelope:

- R-38 blown fiberglass insulation in attic
- Pre-retrofit ACH50 = 15.05  
Post-retrofit ACH50 = 6.15

### Lighting, Appliances, and Water Heating:

- 80% CFL
- ENERGY STAR® refrigerator
- Coefficient of Performance (COP) 2.35, 50-gal hybrid heat pump/electric tanked water heater

For more Information, please visit:  
[www.buildings.energy.gov](http://www.buildings.energy.gov)



**Left:** This SEER 10 window unit was replaced with a SEER 14.5 central air conditioner, which will save an estimated \$109 each year. **Right:** The new air handler required additional effort to fit into the existing air handler closet space.

## Lessons Learned

- Air handlers and other ventilation equipment may be installed in confined spaces, making them difficult to replace or requiring that holes be created to accommodate the new equipment. Verify that any holes created during installation are properly sealed once the installation is complete.
- Most homes do not have central outside air ventilation systems, and the design or dimensions of existing air handler closets may eliminate the possibility of adding one. When the mechanical system is being replaced, consider modifying the closet to accommodate an outside air ventilation strategy.
- Certain efficiency measures may require unacceptable changes to the home's appearance. In this case, efforts to incorporate outside air were ultimately abandoned when it was determined that doing so would have an unacceptable impact on the aesthetics of the home.
- Insufficient quality assurance from the retrofit contractor can leave avoidable gaps and leakages in the duct system. In this instance workers failed to seal the plenum seams with mastic.

“The biggest change was upgrading to the heat pump water heaters. This had the largest bang for the buck of all the upgrades. The water heater was twice the cost but the energy savings will pay for itself within a five year period.”

– Don Kula, Director of Construction, Habitat for Humanity of Palm Beach County.

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