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

Building America Case Study
Technology Solutions for Existing Homes

Pilot Demonstration of Phased Energy Efficiency Retrofits: Deep Retrofits

Central and South Florida

PROJECT INFORMATION

Building America Partnership for Improved Residential Construction (BA-PIRC) *www.ba-pirc.org*

Partners: Florida Power & Light (FPL)

Location: Brevard County Florida

Application: Retrofit, Single-family

Number of Homes: 10 (The deep retrofits are a subset of the 60-home study)

Age Range: 1976 – 2003

Average Living Area: 1,972

Applicable Climate Zone: Hot-humid

Year Tested: 2012-2013

www.infomonitors.com/pdr/

PERFORMANCE DATA

Incremental Cost of Energy-Efficiency Measure (including labor): $7,074

Preliminary Average Energy Savings: 7,081 kWh/yr (38%)

Preliminary Average Energy Cost Savings: $852/yr

Simple Payback: 8.3

Building America® U.S. Department of Energy

The Florida Solar Energy Center (FSEC), in collaboration with Florida Power & Light (FPL), is pursuing a phased residential energy-efficiency retrofit program in Florida. Researchers are looking to establish the impacts of technologies of two retrofit packages—shallow and deep—on annual energy and peak energy reductions. Sixty homes have been instrumented to record total house power and detailed energy end-use data on all appliances as well as household interior temperature and relative humidity conditions. The deep retrofits, implemented in a subset of 10 homes, are targeted to reduce whole-house energy use by 40% or more. Measures for this retrofit phase, applied where existing conditions were deficient, included:

- Replacing air conditioning and heating systems with air source heat pumps, repairing ducts, and installing learning thermostats (HVAC retrofit)
- Replacing electric resistance water heaters with heat pump versions
- Replacing clothes washers, dryers, refrigerators, and dishwashers with ENERGY STAR® appliances
- Replacing standard pool pumps with variable-speed pumps
- Enhancing ceiling insulation.

While more time is required before a comprehensive analysis on pre- to post-retrofit, per site savings evaluation can be done, a preliminary assessment was conducted comparing October 2012–January 2013 data to October 2013–January 2014 data for six homes. Total savings for the post-retrofit period averaged 38% (19.4 kWh/day). Greater savings are expected once all measures are complete and the energy-intensive summer can be evaluated.

Measures with prominent, reliable savings include replacing electric resistance water heaters with heat pump appliances, which achieved 66% water heating energy savings; and installing variable-speed pool pumps, which showed average savings of 85% with a rapid repayment. The pool pump measure has the potential for enormous savings in Florida alone as there are approximately two million homes with pools, each using about 4,000 kWh/year.

The NEST, learning thermostat was installed in nine homes.

At nine sites, heat pump water heaters replaced electric resistance tanks.

Eight homes received ENERGY STAR® appliances.

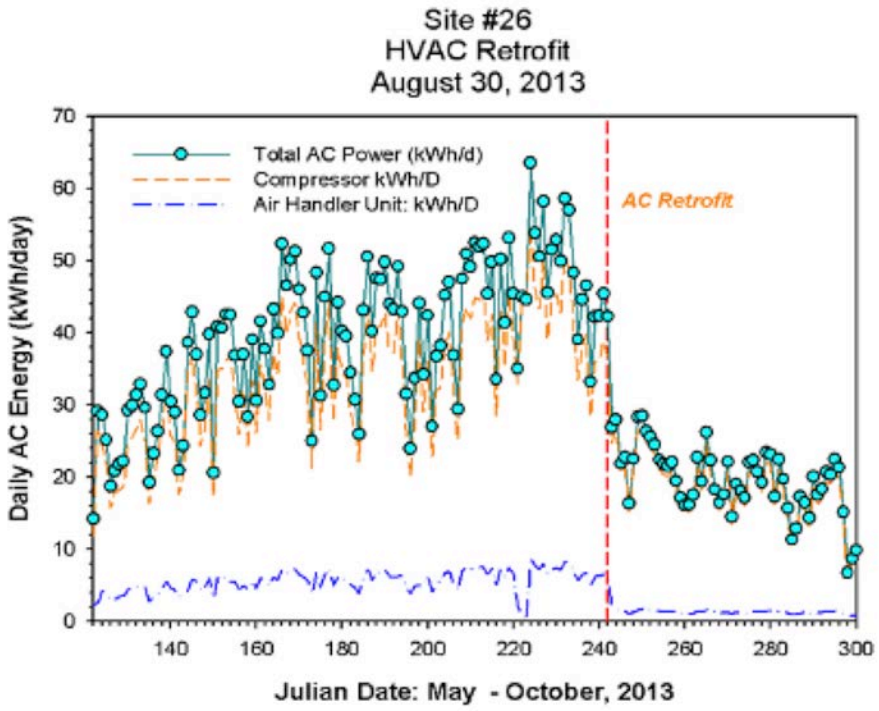
For more information, go to: *www.ba-pirc.org*, or access the report: *https://www1.eere.energy.gov/buildings/publications/pdfs/building_america/65327.pdf*.

To access the monitored data, visit the project at: *www.infomonitors.com/pdr/*.

Photos credits: BA-PIRC

Lessons Learned

- Results from HVAC retrofit showed heat pump replacements and duct repairs saved an average of 40% of pre-retrofit consumption; however, lower interior temperatures were generally chosen even with the learning thermostat, reducing the retrofit savings to 37% (15.4 kWh/day). The plot graph below displays the HVAC retrofit savings at one site, where 47% savings were achieved post-retrofit.



- Heat pump water heaters saw consistently large energy use reductions, yielding weather-normalized average savings of 69% (5.3 kWh/day).
- Refrigerator replacements in three homes showed average savings of 42% (1.3 kWh/day).
- The ENERGY STAR clothes dryer produced average pre- to post-retrofit savings of 44% (1.0 kWh/day); however, savings were highly variable.
- Post-retrofit energy savings for the single dishwater change-out were 32% (0.5 kWh/day), excluding any hot water demand reductions.
- Savings from variable speed pumps were up to 80%–90% (12.6 kWh/day); however, improper programming can cut savings in half.

Looking Ahead

The savings analysis for the deep retrofits is significantly limited at this time given the short comparison period, as well as some partially incomplete retrofits. A cost-effectiveness analysis will be possible once the deep retrofit savings evaluation is finalized.

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