Building America
Efficient Solutions for Existing Homes

Short-Term Test Results: Transitional Housing Energy Efficiency Retrofit in the Hot-Humid Climate

St. Petersburg, Florida

PROJECT INFORMATION

Construction: Existing

Type: Multifamily

Partner: Matrix Construction, Inc.

Size: 5,800-ft^2

Location: St. Petersburg, FL

Climate Zone: Hot-humid

PERFORMANCE DATA

Projected annual energy cost savings: $5,375 (35%)

Estimated annual cost for post-retrofit efficiency package: $3,668

Estimated annual cash flow: $1,707

Estimated incremental savings investment ratio (SIR): 1.29

Building America U.S. Department of Energy

This project evaluates the renovation of Free Clinic Beacon House, a two-story, multiuse facility built in 1926 and located on the west coast of central Florida. This homeless shelter can accommodate and feed up to 30 people and provides community evening meals for approximately 200 people every day. An optimal package of retrofit measures was designed to deliver 30%–40% annual energy cost savings for this building, with annual utility bills exceeding $16,000 and high base load consumption. This study has more specific relevance to retrofits of shared-use facilities such as transitional housing, dormitories, and assisted living facilities, which are partially commercial given the services provided.

Building America researchers projected energy cost savings for potential retrofit measures based on pre-retrofit findings and disaggregated, weather-normalized utility data. A cost-benefit analysis was conducted for the seven retrofit measures implemented; 1) adding attic insulation and sealing soffits, 2) tinting windows, 3) improving whole-building airtightness, 4) upgrading heating and cooling systems and retrofitting the air distribution system, 5) replacing water heating systems, 6) retrofitting lighting, and 7) replacing laundry equipment.

Projections using full measure costs indicate that the lighting retrofit ($1,333/year savings, or 8.6% of total annual utility costs) and window film measures ($188/year savings, or 1.2% of total annual utility costs) yield the highest savings to investment ratios. However, when considering only incremental costs, the high-efficiency heating and air conditioning systems presented the strongest savings to investment ratio ($2,530/year, or 16.3% of total annual utility costs).

The building's architectural characteristics, vintage, and occupancy profile (high density with frequent movement of occupants in and out of the building) presented challenges from a simulation perspective and from an audit/data collection perspective to optimize a retrofit measure package and resulting economic projection. This research addresses these challenges in an effort to assist contractors and energy auditors implementing deep-energy retrofits in structures with characteristics that are similar to the subject building.

POST-RETROFIT PACKAGE OF IMPROVEMENTS

Systems and Equipment:

- Cooling System: 2 units (SEER 15)
- Heating System: Electric heat pump (HSPF = 8.7)
- Programmable thermostat
- Air distribution system: Replace for heating and cooling (R-6; Qn,out = 0.02)
- 2 tankless gas water heaters (EF = 0.82)
- Washer and dryer: 1 replaced (set to be replaced after lease expires)
- Lighting: T8, low-Watt T12, and CFLs
- Electrical rework

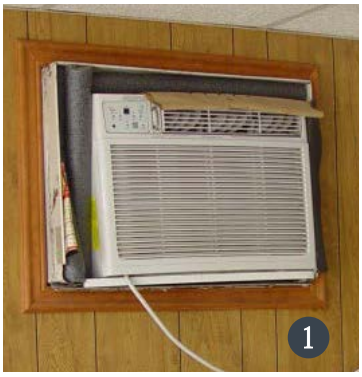
Envelope:

- R-34 ceiling insulation (R-1 for south 15 ft
- Film on first floor south, all east- and west-facing windows to SHGC ≤ 0.37
- Reduced envelope leakage ACH50 to 8.8 (based on ~5,300 ft^2)

Additional Partnering Organizations:

- Florida HERO
- Free Clinic Beacon House
- St. Petersburg Free Clinic, Inc.

For more Information, refer to:
http://www.fsec.ucf.edu/en/publications/pdf/FSEC-CR-1944-13.pdf



Figures 1-3. Window air conditioning units (1) throughout the building were replaced by 5-ton SEER 15 HSPF 8.7 forced air, central heat pumps (2) and a programmable thermostat for increased energy efficiency. Two externally mounted, natural gas water heaters (3) replaced the three existing electric tank units.

Lessons Learned

- Overall, this retrofit successfully addressed energy use, comfort, and durability and met the general goals of the residents, staff, and funding agency. In addition to improved mechanical efficiency, the building now has balanced airflow. Removing the window units also provided opportunities for restricting uncontrolled airflow into and out of the building (Figures 1-2).
- Simulation software indicated the priority of finding equipment with the highest available capacity to accommodate the facility's large water heating demands. The tankless gas water heaters installed (Figure 3) are projected to save $875 annually, a 5.6% reduction in total annual energy costs, and the simple payback is 10 years.
- Some age-related and architectural obstacles created unforeseen costs and effectively limited some measures. These realities impacted the mechanical system replacement, limited the attic insulation measure, and ruled out a potential window retrofit and a mechanical ventilation strategy.
- Overall, the projected energy cost savings expected from the full retrofit package are nearly 35%; annual savings are projected to be $5,375. A simple payback is eight years.

Looking Ahead

Researchers anticipate actual savings in this study to be greatly influenced by the fluctuation between pre- and post-retrofit occupancy behavior. Perhaps variation in resident behavior may average out given the large occupancy. However, in the post-retrofit condition, staff has greater control over operational settings. Observations show that even with greater staff control, post-retrofit energy consumption may be influenced by the take-back effect. Granted additional funding, further research to address these questions could include 1) analyzing utility bill data for energy cost savings confirmation and 2) monitoring indoor air temperature and relative humidity, recording set points, and surveying occupants for indoor air quality assessment.

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

www.buildingamerica.gov

LAB-XX-XXXX February 2013

The U.S. Department of Energy's Building America program is engineering the American home for energy performance, durability, quality, affordability, and comfort.