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

BUILDING TECHNOLOGIES PROGRAM

Building America
Efficient Solutions for Existing Homes

Case Study:

Group Home Energy Efficiency Retrofit for 30% Energy Savings

Washington, DC

PROJECT INFORMATION

Construction: Existing

Type: Group Home: Sasha Bruce Youthwork, Washington, DC
www.sashabruce.org

Size: 4,392 ft^2

Year of construction: 1900

Date completed: 2011

Climate Zone: Mixed-humid

PERFORMANCE DATA

Pre-retrofit energy use: 18.9 kWh/sqft

Post-retrofit energy use: 10.6 kWh/sqft

Percent energy savings:

Incremental cost of energy-efficiency measures: $22,678

Annual energy savings: 36,540 kWh

Monetized annual energy savings: $4,750

Simple payback: 4.8 years

Savings to Investment Ratio: 2.4

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Project Description

This Sasha Bruce Youthwork home marks the first group home retrofit project to be featured by Building America. The home contains 6 bedrooms for 8 resident youth and has 3 offices for five staff. Beginning with a savings target of 30%, the BA-PIRC team was able to identify a set of minimally invasive retrofit measures that, once implemented, achieved 44% energy savings for the group home, based on post-retrofit utility bill data. This level of energy savings was achieved using cost-effective and readily available materials and systems that were implemented in a very brief timeframe (just two weeks) and met with the building owner's requirement that the retrofit be accomplished with occupants-in-place.

Retrofit measures included high efficiency air source heat pumps, duct sealing, building envelope air sealing, selective window replacement, increasing ceiling insulation, high efficacy lighting, lighting controls, and ENERGY STAR appliances. Funding for the retrofit measures was generously provided by Walmart and the Home Builder's Care Foundation. The incremental cost of the energy retrofit was $22,678, which yielded annual energy savings of $4,750, and a simple payback of just 4.8 years.

Air sealing at the Sasha Bruce group home in Washington DC required accessing some tight spaces.

The existing plenum had 4" of standing water from an improperly plumbed condensate line! Replacing and re-plumbing saved energy and improved indoor air quality.

KEY ENERGY-EFFICIENCY MEASURES

HVAC:

- ASHP: 17.55 SEER & 8.8 HSPF
- Aerosolized duct sealing for up to 62% reduction in leakage to outside
- Replumb condensate lines to eliminate standing water in return plenum

Envelope:

- Air sealing for 7% improvement (935 CFM 50)
- Ceiling insulation from R-19 to R-49
- Windows: from old, poorly functioning (U=0.5) to new, double pane vinyl (U=0.32)

Lighting, Appliances, and Water Heating:

- Lighting: 75% CFL to 100% CFL
- Lighting: 6 occupancy sensors installed
- New ENERGY STAR® refrigerator, clothes washer, freezer, & dishwasher
- Water heater: replace 80 gal electric resistance heater (EF~0.8) with 50 gal electric resistance (EF~0.92)
- Water savings: shower heads from 2.5 gpm to 2.2 gpm; faucets from 2.2 gpm to 2.0 gpm. ENERGY STAR® clothes washers

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

Aerosolized duct sealing helped reduce duct leakage to outside by up

Lighting controls, like this occupancy sensor, helped to automate control and reduce energy consumption.

Lessons Learned

- A typical group home energy efficiency retrofit with a 30% saving energy savings target may expect to have a savings to investment ratio (SIR) between 1 and 2. This specific project had a simple payback of 4.8 years and a SIR of 2.4.
- Replacement of HVAC equipment not only improved the building's energy performance, but also improved indoor air quailty by identifying and addressing a risk factor that existed in the pre-retrofit home, where improper condensate drainage had resulted in over 4" of standing water in a return plenum.
- Occupant operation of windows was found to increase the minimum equivalent leakage area of the building by up to 19% while the air source heat pump was cycling (i.e., residents and staff tended to leave windows open, especially during heating). This points to an opportunity to further reduce energy use through future adjustments to occupant behavior (i.e., through reducing window openings during air source heat pump operation).
- Air sealing measures were expected to garner a 30% reduction in infiltration rates, but post-retrofit data showed that a 10% reduction was more realistic for a building that did not have specific, accessible air-sealing measures identified and targeted prior to the retrofit. A lesson learned was that scheduling air sealing measures (and other measures expected to have a high return on investment) earlier in the project can help ensure that there are sufficient funds remaining to make changes to the scope when surprises do occur.

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