Building America Case Study

Whole-House Solutions for Existing Homes

Group Home Energy Efficiency Retrofit for 30% Energy Savings

Washington, D.C.

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 kilowatt-hours per square foot (kWh/ft^2)

Post-retrofit energy use: 10.6 kWh/ft^2

Percent energy savings: 44%

Incremental cost of energy efficiency measures: $22,678

Annual energy savings: 36,540 kWh

Monetized annual energy savings: $4,750

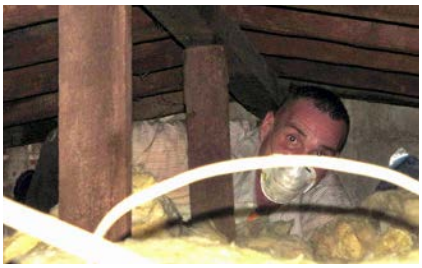
Simple payback: 4.8 years

Savings to Investment Ratio: 2.4

Significant energy savings are possible using cost-effective and readily available materials and systems implemented in a very brief timeframe—just two weeks in this case. This met the building owner's requirement that the retrofit be accomplished with the occupants in place. Beginning with an energy savings target of 30%, the U.S. Department of Energy Building America Partnership for Improved Residential Construction team was able to identify a set of minimally invasive retrofit measures. Once implemented, these measures achieved 44% energy savings for the Sasha Bruce Youthwork group home, based on post-retrofit utility bill data.

The project marks the first Building America group home retrofit. The home contains six bedrooms for eight resident youth and has three offices for five staff. The energy savings were achieved using cost-effective and readily available materials and systems.

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



Air sealing at the Sasha Bruce group home in Washington, DC (top), required accessing some tight spaces. The existing plenum (bottom) had 4 in. of standing water from an improperly plumbed condensate line! Replacing and replumbing saved energy and improved indoor air quality.

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Key Energy Efficiency Measures

HVAC

- ASHP: 17.55 seasonal energy efficiency ratio and 8.8 heating seasonal performance factor
- 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 cubic feet per minute at 50 Pascals)
- 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% compact fluorescent lighting (CFL) to 100% CFL
- Lighting controls: six occupancy sensors installed
- New ENERGY STAR® refrigerator, clothes washer, freezer, and dishwasher
- Water heater: replace 80 gal electric resistance heater (energy factor ([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, see the Building America report, *Occupant-in-Place Energy Efficiency Retrofit in a Group Home for 30% Energy Savings in Climate Zone 4,* at *www.buildingamerica.gov*

Image credit: All images were created by the BA-PIRC team.

Aerosolized duct sealing (left) helped reduce duct leakage to outside by up to 62%. Lighting controls, like this occupancy sensor (above), helped to automate control and reduce energy consumption.

Lessons Learned

- A typical group home energy efficiency retrofit with a 30% saving energy savings target can 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 heating, ventilating, and air conditioning equipment not only improved the building's energy performance, but also improved indoor air quality by identifying and addressing a risk factor that existed in the pre-retrofit home, where improper condensate drainage had resulted in more than 4 in. 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 ASHP 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 ASHP 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.

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

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www.buildingamerica.gov

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