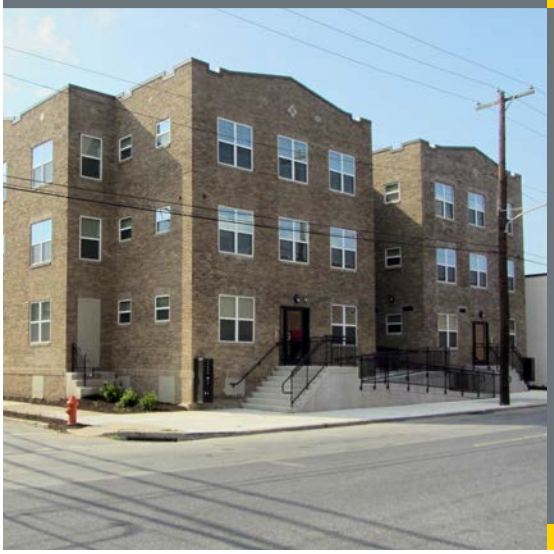


Building America Case Study

Whole-House Solutions for Existing Homes

56th and Walnut: A Philly Gut Rehab Development

Philadelphia, Pennsylvania

PROJECT INFORMATION

Construction: Deep energy retrofit of 32 apartments

Type: Multifamily, affordable

Partners:

Columbus Property Management and Development, Inc.
www.columbuspm.org

Consortium for Advanced Residential Buildings
www.carb-swa.com

Size: 461 to 999 ft^2

Date completed: 2012

Climate Zone: Mixed-humid

PERFORMANCE DATA

HERS index post-retrofit: 67–76

Projected annual energy cost savings per unit: $707

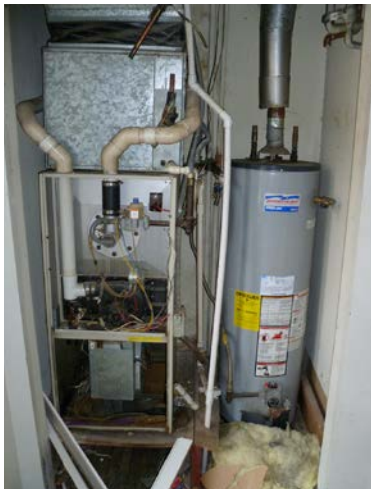
Projected annual energy savings per unit: 47%

Incremental cost of energy efficiency measures: $17,473

Incremental annual mortgage increase: $520

Brick masonry multifamily buildings are prevalent in urban areas across much of the U.S. Northeast and mid-Atlantic regions. Typically, these buildings were constructed in the early 1900s with stone foundations and solid brick-masonry walls, are often uninsulated, and have moisture control concerns and other challenges. Columbus Property Management and Development, Inc. (CPM) works closely with the local community of Philadelphia to provide housing for those most in need. To this end, CPM partnered with U.S. Department of Energy Building America research team Consortium for Advanced Residential Buildings (CARB) on a gut rehabilitation project consisting of 32 units in 11 three-story buildings. Affordable housing capital budgets are limited, and energy improvements often take a back seat to basic capital improvements such as interior finish upgrades and basic repairs. In this project, CPM sought a solutions package that would balance goals for significant energy efficiency and indoor air quality improvements versus concerns for increased first costs in these urban buildings.

With the improvement target set at a 50% source energy savings over the existing conditions, the CARB team identified, quantified, and addressed all energy uses, with the exception of miscellaneous electric loads. Using BEopt energy modeling software, CARB explored various optimization scenarios for energy performance and cost; and recommended improvements to the thermal enclosure, moisture management, HVAC, hot-water, and lighting.



With a high amount of air leakage around the return plenum platform, there was the potential for the return to cause the mechanical closet to be depressurized and lead to back-drafting of the water heater due to return side duct leakage. All equipment was replaced with sealed combustion or direct vented units.

Building America SM U.S. Department of Energy

Key Energy Efficiency Measures

HVAC:

- 95% annual fuel utilization efficiency condensing furnace
- 1.5 ton seasonal energy efficiency ratio 16 AC
- Well-sealed ducts located in conditioned space. Duct leakage to outside averaged 2.6 cfm25/100 ft^2
- Negative pressure whole-house ventilation system (continuous low-speed exhaust fan operation)
- Kitchen and bath fans vented to outside

ENVELOPE:

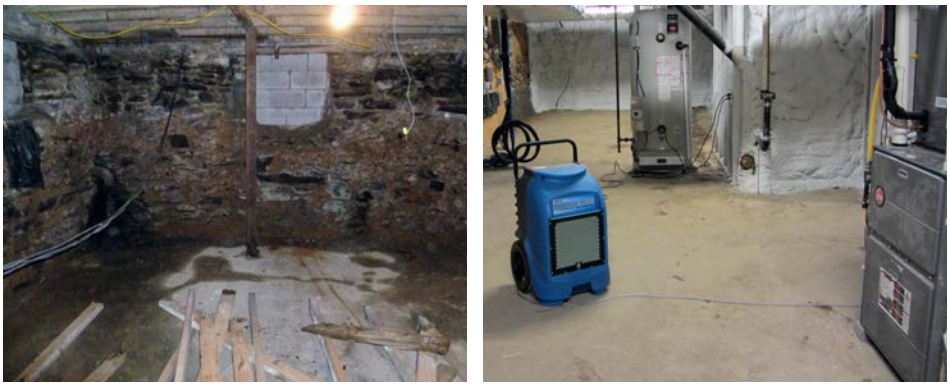
- 2 in. of closed cell spray polyurethane foam (ccSPF) applied against stone foundation.
- 3 in. of polyisocyanurate above roof deck covered with white TPO membrane. 3 in. of ccSPF on underside of roof deck.
- Reframed interior 2×4 steel stud wall at 16 in. o.c. spaced 1 in. from brick wall and filled w/3.5 in. of ccSPF.
- Double-pane, low-e, vinyl windows. U = 0.35, SHGC = 0.35
- Tightly sealed house. Building infiltration averaged 4.0 ACH50

LIGHTING, APPLIANCES, AND WATER HEATING:

- 62% compact fluorescent lights/13% linear fluorescent lamps
- ENERGY STAR® refrigerator
- Premium natural gas tank water heater (0.67 EF)

For more information, see the Building America report, *56th & Walnut—A Philly Gut Rehab Development* at *www.buildingamerica.gov*

Image credit: All images were created by the CARB team.



(Left) Pre-retrofit wet basement. (Right) Post-retrofit dry basement through the use of ccSPF against the stone foundation and a stand-alone dehumidifier. Ideally a sub-slab capillary break would be incorporated as well.

Numerous ancillary benefits were achieved but are not accounted for in cost/benefit figures. For example, upgrades to a sealed combustion furnace and direct vent water heater, along with sealing all distribution ductwork, resulted in the elimination of a potential carbon monoxide health hazard in apartment bedrooms.

> *"[CARB's] input had a lot to do with the final outcome. It is a pleasure working with you and your team, especially the way that they have integrated into our team and helped provide solutions to difficult issues instead of telling us there is a problem that we need to fix."*
>
> – David Hahn, Director of Construction and Operations, Columbus Property Management Housing Group

Lessons Learned

- With a non-damp-proofed stone foundation, no drainage layer or capillary break below the basement slab, and a high local water table, water entry and high relative humidity are systemic and chronic in these types of buildings. To button up a high-performance enclosure above a wet basement could lead to high interior moisture levels and all the associated problems. Therefore, it was imperative that the basement moisture problems be managed, if not eliminated, as part of the energy improvement package, and the costs of doing so were included in the overall cost of the retrofit.
- Post-implementation and test-out, energy modeling analysis for multiple sample dwellings yielded performance improvements ranging from 45% to 47%. The addition of whole-house ventilation after reducing the building infiltration resulted in a reduction of 3% to the source energy savings achieved, but ignoring potential indoor air quality issues to simply meet the 50% target savings goal could not be justified.

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

For more information, visit:
www.buildingamerica.gov

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

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