Building America Case Study
Efficient Solutions for Existing Homes

Bay Ridge Gardens – Mixed Humid Affordable Multifamily Housing Deep Energy Retrofit

Annapolis, Maryland

PROJECT INFORMATION

Construction: Existing

Type: Apartment Building: Bay Ridge Gardens,

Annapolis, MD

www.bayridgegardens.com

Size: 12 apartment units - 713sf and 909 sf each

Year of construction: 1970's

Date completed: 2013

Climate Zone: Mixed-humid

PERFORMANCE DATA

Pre-retrofit annual energy use (normalized): 28.4 kWh/sqft

Post-retrofit annual energy use (normalized): 16.3 kWh/sqft

Percent energy savings: 43%

Incremental cost of energy-efficiency measures: $85,996

Monetized annual energy savings: $6900

Savings to Investment Ratio: 1.1

Project Description

The Bay Ridge Gardens Apartments are comprised of multiple three-story buildings typically containing twelve apartments each. The apartments are between 700 sf and 925 sf and contain two or three bedrooms. In total, the complex consists of 198 units. While all of the units underwent a base scope energy retrofit, the BA-PIRC team concentrated on a deep energy retrofit (DER) of one building (twelve units).

The building as well as the nature of the DER project itself is typical of many that currently exist throughout the U.S. – a 1970's era three-story walk up, concrete masonry unit structure with a partial brick façade and sheetrock interior, and a tenant-in-place retrofit. The latter precludes significantly invasive retrofit measures that would render the apartments either unsafe or uninhabitable during construction. The project also investigated "risk factors" and regulatory issues, and their roles in determining what efficiency measures may not be viable because they would jeopardize building performance, occupant health, or trigger cascading regulatory requirements.

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 43% energy savings for the 12-unit DER apartment building, based on monitoring and post-retrofit utility bill data.

Building Exterior

Building America U.S. Department of Energy

KEY ENERGY-EFFICIENCY MEASURES

HVAC:

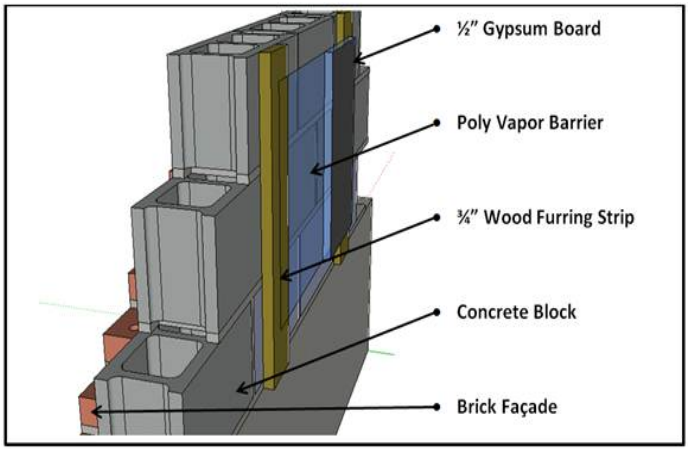
- Hybrid Heat Pump: 8.50 HSPF, 92.5 AFUE 2-stage furnace backup; 15 SEER, 1.5 ton air conditioning; resident pays for electricity and has incentive for reducing heating energy
- Aerosolized duct sealing for up to 63% reduction in total leakage
- Air sealing and insulating duct bulkhead which was exposed to the adjacent attic space above.
- Energy Recovery Ventilator for balanced, continuous ventilation and minimizing ventilation-induced airflow between apartments

Envelope:

- Air sealing for 63% improvement (average post-retrofit air leakage was 6.4 ACH50)
- Ceiling insulation: from R-19 to R-49
- Windows: from old, poorly functioning (U=0.5) to new, low-e vinyl replacement windows (U-0.35)

Lighting, Appliances, and Water Heating:

- Lighting: 100% incandescent to 100% CFL
- New ENERGY STAR® refrigerator
- Water heater: replace central 100 gallon gas-fired WH (0.54 EF) with 100-gallon, 95% thermal efficiency
- Solar thermal rooftop system; flat panel collector
- Energy Dashboard for homeowner education regarding energy use



Exterior Wall Assembly

Application of membrane and sprayfoam to seal ductwork and air leakage pathway

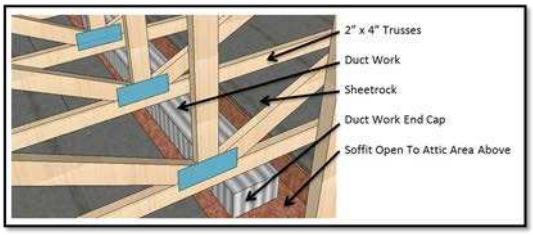


Diagram of bulkhead and duct trunk line open to attic

Lessons Learned

- Approximately 43% energy savings can be achieved in a 1970's multi-family building through standard, non-invasive retrofit measures, representing enormous opportunity for savings nation-wide due the number of buildings of similar character.
- Measure selection may depend on factors other than installation cost and energy savings alone. These include: occupant health and safety, unintended building performance consequences, regulatory requirements, and age of component or equipment.
- Contractors may have limited experience and/or motivation to implement energy retrofit measures carefully and thoroughly. One solution may be a performance-based approach for measures such as air sealing in addition to a detailed specification.

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

www.buildingamerica.gov

June 2013

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