



Building America Case Study

Greenbelt Homes, Inc. Pilot Retrofit Project

Greenbelt, Maryland

PROJECT INFORMATION

Construction: Existing homes

Builder: Greenbelt Homes, Inc., ghi.coop

Type: Single-family, configured primarily in sets of 2, 4, or 6 attached homes

Pilot Retrofit Project: Envelope upgrade study based on 7 4-unit buildings

Size: 800–1,200 ft²

Price Range: About \$70,000–\$300,000

Study Period: 2010–2014

Climate Zone: Mixed-humid (IECC climate zone 4A)

PERFORMANCE DATA

Average per Pilot Home,
Normalized Season Estimate

Pre-Retrofit Heating Energy: 8,412 kWh

Post-Retrofit Heating Energy: 5,158 kWh

Average Heating Energy Cost
Savings: \$488/year

Cost of All Measures: \$15,744

Added Efficiency Measures: \$8,399

In fall 2010, Greenbelt Homes, Inc. (GHI) a 1,566-home cooperative of circa 1930–1940 homes in Greenbelt, Maryland, undertook a multiyear pilot energy-efficiency retrofit project. GHI established this pilot project as a basis for decision making for the rollout of a decade-long community-wide upgrade program that will incorporate energy-efficiency improvements to the building envelopes and mechanical equipment. The community upgrade is fully funded by the cooperative through its membership with no outside subsidies. This project thus presents a unique opportunity to evaluate and prioritize the wide range of benefits of high-performance retrofits based on member experience with—and acceptance of—the retrofit measures implemented during the pilot project. Addressing the complex interactions between benefits, tradeoffs, construction methods, project management implications, realistic upfront costs, financing, and other considerations provides a case study for energy retrofit projects to include high-performance technologies based on the long-term value to the homeowner.

The U.S. Department of Energy Building America team Partnership for Home Innovation wrote a report on Phase 1 of the project that summarized a condition assessment of the homes and evaluated retrofit options within the constraints of the cooperative provided by GHI. The pilot project focused on identifying the added costs and energy savings benefits of improvements. Phase 1: baseline evaluation for a representative set of 28 homes sited in seven buildings; Phase 2: installation of the building envelope improvements and continued monitoring of the energy consumption for the heating season and energy simulations supporting recommendations for upgrades to heating, ventilating, air conditioning, and water heating to be implemented in Phase 3.



The three predominant wall construction methods of townhomes in the GHI community used materials common to the area and climate zone including: (1) 8-in. concrete masonry unit (CMU) block; (2) wood frame with brick veneer; and (3) wood frame with vinyl siding.

Key Energy-Efficiency Measures

ENVELOPE: CONCRETE BLOCK

- Repair/add crawlspace wall insulation (12 homes).
- Replace crawlspace vapor retarder.
- Replace double pane clear windows with maximum 0.3 U/0.3 solar heat gain coefficient low-e windows and air seal (12 homes).
- Add 2-½-in. rigid insulation to the exterior with vinyl siding (4 homes).
- Add bath exhaust fans (12 homes).

ENVELOPE: FRAME/BRICK (WOOD FRAME WITH BRICK SIDING)

- Repair/add crawlspace wall insulation (8 homes).
- Replace crawlspace vapor retarder.
- Replace double-pane clear windows with maximum 0.3 U/0.3 solar heat gain coefficient low-e windows and air seal (8 homes).
- Add attic insulation; maintain storage area and air seal (8 homes).
- Add bath exhaust fans (8 homes).

ENVELOPE: FRAME/VINYL (WOOD FRAME WITH VINYL SIDING)

- Replace crawlspace floor insulation with spray polyurethane foam (8 homes).
- Replace crawlspace vapor retarder.
- Replace double-pane clear windows with maximum 0.3 U/0.3 solar heat gain coefficient low-e windows and air seal (8 homes).
- Add attic insulation; maintain storage area and air seal (8 homes).
- Add 1-in. rigid exterior insulation.
- Add bath exhaust fans (8 homes).

For more Information, see the Building America technical report *Greenbelt Homes Pilot Program: Summary of Building Envelope Retrofits, Planned HVAC Equipment Upgrades, and Energy Savings* at buildingamerica.gov

Image credit: All images were created by Home Innovation Research Labs.



Example of crawlspace improvement, exterior insulation, attic improvements, and finished homes

Lessons Learned

- Evaluate the cost of the concrete foundation upgrades, the scope of work, and the expected benefits to determine the priority of these upgrades.
- Evaluate the drainage issues encountered in the frame/vinyl crawlspaces to determine if additional remediation is necessary.
- Break out costs and savings for the frame/vinyl crawlspaces to determine if alternative approaches would provide similar benefits at a lower cost.
- Solicit the GHI members for their interest in maintaining the storage space, the area of storage needed, and any optional approaches such as a minimal level versus an enhanced level (whose cost would be borne independently by the member).
- Develop specific air sealing details for the attic including sequencing and material selections.
- Provide a detailed review of window installation options for each building type. This is required and is especially important for buildings that receive exterior insulation. Determine whether windows are installed as “innies” or “outies” and which commensurate trim details are required.