Building America Case Study

Demonstration House of Cold-Climate Solutions for Affordable Housing

Minneapolis, Minnesota

RETROFIT USING THREE ENERGY MEASURES

Excavationless, Overcoat, and Combi

Construction: Rehab, single-family, affordable

Builder: Urban Homeworks, *urbanhomeworks.org*

Partner: Northern*STAR*

Size: 1,754 ft^2 (plus basement)

Price Range: about $155,000

Date: 2015

Climate Zone: Zone 6

PERFORMANCE DATA

Air leakage reduction: 73%

Cubic feet per minute at 50 pascals: 5,404–1,483

Air changes per hour at 50 pascals: 17.51–4.81

Modeling predicted: $625 annual energy savings

Source energy savings: 95.4 MMBtu per year

Site energy savings: 81.7 MMBtu per year

Project cost (after subsidies): $13,662

Building AMERICA U.S. Department of Energy

Up to two million single-family homes in U.S. urban areas are available for renovation by nonprofit developers, but these homes are often in rough shape. Historically, budgeting has focused on improving homes to meet basic housing standards. But a growing interest in the long-term impact of home ownership has introduced the need to balance basic needs with home performance.

Northern*STAR* is a U.S. Department of Energy (DOE) Building America (BA) team that conducted a demonstration project to help nonprofit developers learn about pertinent issues in renovating these homes. This project aimed to help Urban Homeworks, which is a nonprofit developer, become familiar with three DOE BA performance measures, the installation processes, and the impacts and benefits of each. To maximize efficiency of application and address budget issues, the team worked with Urban Homeworks to identify ways to use volunteers and construction training programs to install the measures. An open invitation to visit the job site was extended to other nonprofit developers and industry partners to encourage dialog about the systems during live installation.

"Excavationless" describes a process for installing exterior foundation insulation. A trench 4" wide and extending down to the footings is dug with high-pressure water and a large vacuum truck called a "hydro-vac." The trenching can tunnel under concrete and other obstacles. The trench is then filled with liquid foam—or in this case—a combination of liquid foam and rigid-foam form. Above grade, the smooth rigid foam is coated with stucco and a metal cap with wood trim ties in under the siding and building paper.

Key Energy-Efficiency Measures

HVAC

The home has a "combi" space- and water-heating system, where water is heated and pumped to a coil in the air handler. Supply-side ducts sealed with Aeroseal provide warm air to all rooms. The new ventilation duct system has four ports.

- Polaris 100,000 Btu water/space heater
- Enerzone air handler and hydronic coil
- E15 Venmar heat-recovery ventilator
- MERV 13 deep-pleated filter
- Annual savings: 15%–20% per year.

ENVELOPE

- Foundation insulation: R-13 fully adhered, footing to rim top; continuous exterior
- Attic/roof: R-30 continuous rigid foam on roof planes. R-20 on three gable walls, closed-cell spray polyurethane foam (ccSPF). Continuous full-perimeter ccSPF from attic floor top down to top of plate.
- Original R-5 batt insulation in main floor 2×4 framed walls. Original walls intact.
- New custom-made double-pane, low-e, wood windows.

LIGHTING, APPLIANCES

- 100% compact fluorescent lighting
- ENERGY STAR® appliances
- Water heater is sealed-combustion combination "furnace" and water heater.

For more information see the Building America report *NorthernSTAR 1½ Story Demonstration House of Cold Climate Solutions for Affordable Housing* at *buildingamerica.gov*.

Image credit: All images were created by the Northern*STAR* team.

"Overcoat" describes a method of overlaying exterior insulation and an air/water barrier on the roof. Old shingles are removed and the roof deck is prepared for complete coverage of a 60-mil peel-and-stick membrane. The continuous membrane laps over all roof edges and ties into the siding for proper drainage. Two offset layers of poly iso insulation are then applied. Ten-inch screws are used to fasten through 2×4 furring strips and into the rafters below the deck. The furring strips provide air space for ventilation and a solid nail base for a new roof deck. Soffit vents and a ridge vent allow warm air to move continuously off of the roof. At this point, fascia and trim are added to complete the roof overcoat system.

Lessons Learned

The project goals were to 1) demonstrate three efficiency measures to the local affordable-housing industry and 2) encourage affordable-housing developers and builders to implement one or all of these measures when remodeling vacant or abandoned homes. To do this, we demonstrated how the installation was implemented, how it could be incorporated into their remodeling system (i.e., using volunteers or construction trainees), and what the cost impact was.

- Volunteer groups and a youth-contractor training program jumped on the opportunity to learn about these methods. The learning curve was significant and skilled supervision was needed; however, the second time will take much less supervision.
- Costs are a significant factor for excavationless and overcoat insulation and may be a deterent on some projects. However, these methods are robust and solve multiple problems that are common to other insulation approaches. As affordable-housing developers see the results, they will consider these methods more carefully. Much depends on the funding type and other remodeling needs in a given house.
- Ongoing training and encouragement will be required for developers of affordable housing to use these methods. We produced three "how to" videos that will be available to anyone on YouTube.
- The mission of affordable housing goes beyond simply remodeling homes. The socioeconomic well being and health of families are also addressed.

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

For more information visit
buildingamerica.gov

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

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