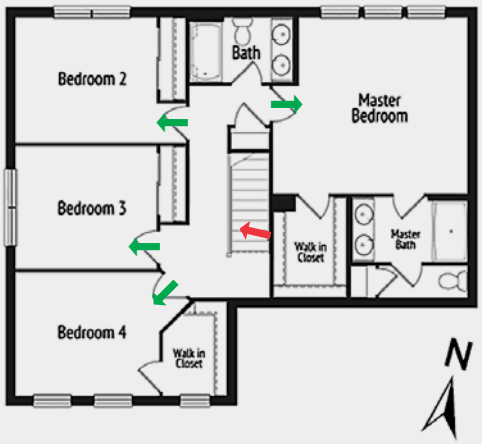

Building America Case Study

Evaluating Through-Wall Air Transfer Fans

Pittsburgh, Pennsylvania

PROJECT INFORMATION

Project Name: Evaluating Through-Wall Air Transfer Fans

Location: Pittsburgh, PA

Construction: New

Type: Single-family

Partners:
S&A Homes; *sahomebuilder.com*
IBACOS; *ibacos.com*

Size: 2,772 ft^2

Price Range: About $400,000

Date Completed: 2010

Applicable Climate Zone(s): Cold

PERFORMANCE DATA

HERS index: 27

Builder standard practice = 84

Case study house = 2,772 ft^2

With renewables = 81%

Without renewables = 67%

Projected annual energy cost savings: $559

Incremental cost of energy efficiency measures: $15,000

Cutting-edge builders are installing single-point space conditioning systems in low-load houses with no means of providing conditioned air to bedrooms except via open doors. In this project, U.S. Department of Energy Building America research team IBACOS assessed a strategy for providing conditioned air to those rooms when the bedroom doors are closed. IBACOS also measured—for the first time—data for the range and frequency of potential thermal discomfort that occupants may experience when using this strategy. Builders can use this information to discuss space conditioning options with their clients when designing their cost-optimized, energy-efficient house.

In a new construction unoccupied test house in Pittsburgh, Pennsylvania, IBACOS assessed the performance of market-available through-wall air transfer fans with respect to Air Conditioning Contractors of America (ACCA) Manual RS and ASHRAE Standard 55-2010 Section 5.2.5. The results showed that the system met the ASHRAE standard 100% of the time because no rapid shifts in temperature occurred in the areas of concern—the bedrooms. However, the system failed the ACCA requirements because a slow change in temperature did occur in the bedrooms, resulting in bedroom temperatures more than ±2°F different from the temperature at the thermostat 70% of the time in heating mode. According to the standard, occupants may be uncomfortable with temperatures outside of this range.

Through-wall fans move conditioned air from the hallway into the bedrooms of the Pittsburgh new construction unoccupied test house.

Building America SM U.S. Department of Energy

Key Energy Efficiency Measures

HVAC

- Whole-house loads of 18,526 Btu/h in heating and 11,236 Btu/h in cooling
- Four conditioned air distribution strategies for test purposes
- Whole-house energy recovery ventilator exhausting from the kitchen, laundry, and baths, and supplying into an air handler unit return plenum

ENVELOPE

- Reflective shingle roof
- R-60 blown ceiling insulation in a vented attic
- R-30 grade blown cellulose insulation in 2 × 8 wall thickness with 2 × 4 staggered studs, plus R-10 continuous exterior sheathing
- Triple-pane, low-E, vinyl windows; U = 0.24, SHGC = 0.22
- Tightly sealed house, ACH50 = 0.54

LIGHTING, APPLIANCES, AND WATER HEATING

Not applicable—unoccupied test facility

For more information, see the Building America report, *Simplified Space Conditioning in Low-Load Homes: Results from Pittsburgh, Pennsylvania, New Construction Unoccupied Test House,* at: *buildingamerica.gov*

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

The new construction two-story unoccupied test house faces south, has poorly shaded windows, and includes basement construction.

Lessons Learned

Pros:

- Using transfer fans to allow heating and cooling energy to reach the bedrooms in lieu of ductwork eliminates materials, labor, and associated bulkhead costs to bring the ductwork into conditioned space.
- The transfer fan assemblies were straightforward to install above the bedroom doors but require coordination between the electrician and HVAC installer to ensure electrical service is provided.
- Based on the results of this study, in the future, the predicted load conditions in each bedroom could be used to determine if a transfer fan might be applicable.

Cons:

- Placement of the conditioned air supply register relative to the transfer fan intake can result in some rooms receiving more conditioned air than others.
- The inability of the system to meet ACCA standards will prevent adoption of the system by builders or remodelers who are risk averse or who are required to meet those ACCA standards.
- Design-stage calculations need to properly account for solar loading. These unbalanced loads can cause discomfort when applying traditional HVAC design to low-load homes.

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

For more information, visit:
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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