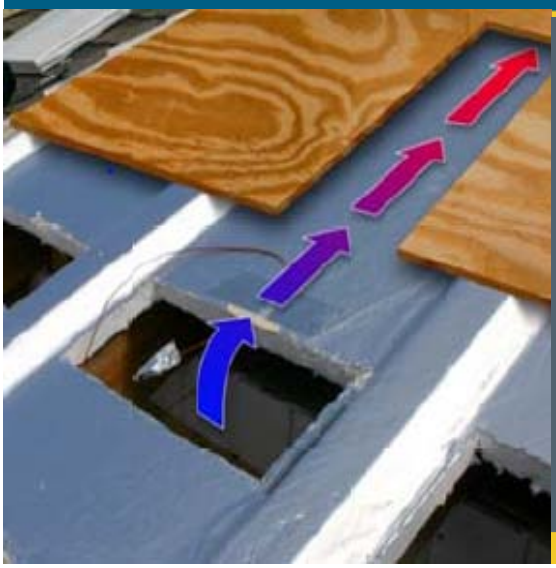


Building America Case Study
Technology Solutions for New and Existing Homes

Insulated and Ventilated Roof Deck

Oak Ridge, Tennessee

PROJECT INFORMATION

Project Name: ORNL Research Home

Location: Oak Ridge, TN

Partners:
Billy Ellis Roofing
www.billyellisroofing.com
Schaad Companies
www.schaadcompanies.com
Oak Ridge National Laboratory
www.ornl.gov/sci/ees/est/btric

Building Component: roof and attic

Application: New and retrofit, single- and multi-family homes

Year Tested: 2010

Applicable Climate Zone(s): Hot-Dry, Hot-Humid, Mixed-Dry, Mixed-Humid

PERFORMANCE DATA

Cost of Energy-Efficiency Measure (including labor): $4,000

Projected Energy Savings: 20% cooling savings

Projected Energy Cost Savings: $22/month; $260/year

In hot summer conditions, attic temperatures can exceed 140°F, representing the most extreme boundary condition for a home's thermal enclosure. Researchers at Oak Ridge National Laboratory are working with roofing and building contractors to test the insulated and ventilated roof (IVR), a roof deck system designed to minimize this heat gain. This new technology employs an innovative radiant barrier assembly that will substantially reduce attic temperatures for lower energy bills and greater comfort while also reducing temperatures and condensation potential at the roof deck for greater durability.

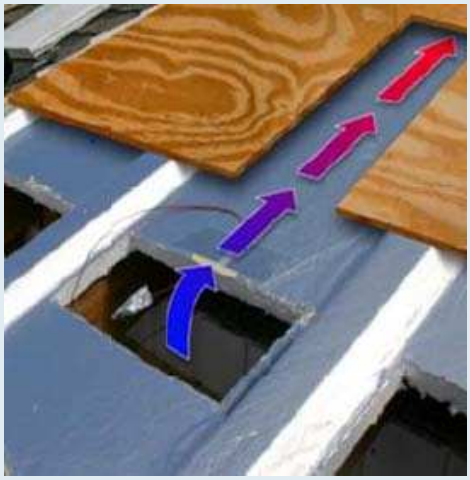
The IVR technology consists of a 1-inch-thick layer of expanded polystyrene (EPS) insulation that fits over and between rafters in new construction. The EPS insulation is profiled to form a 1-inch air space that runs vertically between rafters and the roof deck from the eaves to the ridge vent. It is also foil-faced on both sides - the top side is a radiant shield in the inclined space, while the bottom side serves as a radiant barrier in the attic. At each rafter bay, a slot is cut in the EPS just above the soffit. Heated air from the attic escapes through these slots, pulling ventilating air through the soffits as well, as it is carried by thermally induced convective flows up the roof deck and out of the roof assembly through the ridge vent.

This design can also be installed on top of an existing roof in retrofit applications. In this case, the EPS is mounted on furring strips attached to the existing shingles. The EPS layer is covered with new roof decking, a weather resistant covering of building paper or membrane, sheathing, and new shingles. Because the existing roof remains in place, homeowners can save the costs associated with debris removal if the roof can handle the additional structural load.

"You can include a quote from the builder specific to this measure if there is room."

Joe Q Builder, Construction Supervisor, Habitat for Humanity of Palm Beach

DESCRIPTION [Arial bold 11 pt]



Foil-face EPS is laid over the rafters and contoured to provide a 1-inch air gap beneath the roof decking from the eaves to the ridge vent. At each rafter bay, a slot is cut in the EPS just above the soffit allowing heated air from the attic and ventilating air from the soffits to be carried up and out through the ridge vent.

LOOKING AHEAD [Arial bold 11 pt]

[Times Roman 11 pt] Include a few sentences describing future plans for this technology, future research needs, or anticipated changes, either in production, implementation, or costs. For example, will costs decrease due to economies of scale as the technology goes into production mode? Is the builder planning to implement this in all future projects? Wil this soon be required by code? This paragraph can go here or at the bottom of the main text if it fits better there.

For more Information, see the Building America measure guideline report, www._____

Roofers installed the insulated and ventilated roof deck over an existing roof in this retrofit application in Oak Ridge, Tennessee. The EPS is installed on furring strips attached to the existing shingles.

New roof decking, membrane, and shingles are installed over the IRV for a roof that is insulated and ventilated to minimize attic heat build up.

Lessons Learned

- The ventilated and insulated roof assembly can be used with almost all types of roof products.
- In hot climates, this design reduced attic air temperature approximately 30°F to about 10°F above the outdoor temperature. Conventional roof and attic systems result in attic temperatures in excess of 135 °F.
- When the IVR is installed, a home can achieve the Building America Benchmark with R-38 attic insulation instead of R_{us}-50 (R_{si}-8.8) levels.
- The IVR system enhances attic ventilation, which helps keep moisture levels below thresholds for condensation on wood surfaces in the attic.
- Because the ventilated air comes from the attic space and not outside of the building, the IVR design complies with fire codes by not allowing burning embers access into the ventilation cavity.
- The underside of the roof deck was about 50°F cooler than the conventional roof system and approximatley 30°F cooler than a roof system with a radiant barrier. This increases the durability and lifetime of the roof deck and shingles.

Annual energy savings on a 1,539 ft^2 home built in Atlanta, GA, are estimated at $260; assuming the home was built to IECC 2006 standards and that HVAC ducts are in the conditioned space. With installation costs on a new home of approximately $4,000, there is immediate positive cash flow or a simple payback on cash invesmtent of approximately 15 years.