NREL Highlights RESEARCH & DEVELOPMENT

NREL Evaluates Thermal Performance of Uninsulated Walls to Improve Accuracy of Building Energy Simulation Tools

NREL researchers discover ways to increase accuracy in building energy simulations tools to improve predictions of potential energy savings in homes.

Uninsulated walls are typical in older U.S. homes where the wall cavities were not insulated during construction or where the insulating material has settled. Researchers at the National Renewable Energy Laboratory (NREL) are investigating ways to more accurately calculate heat transfer through building enclosures to verify the benefit of energy efficiency upgrades that reduce energy use in older homes.

In this study, scientists used computational fluid dynamics (CFD) analysis to calculate the energy loss/gain through building walls and visualize different heat transfer regimes within the uninsulated cavities. The effects of ambient outdoor temperature, the radiative properties of building materials, insulation levels, and the temperature dependence of conduction through framing members were considered. The research showed that the temperature dependence of conduction through framing members dominated the differences between this study and previous results—an effect not accounted for in existing building energy simulation tools.

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Key Research Results

Achievement

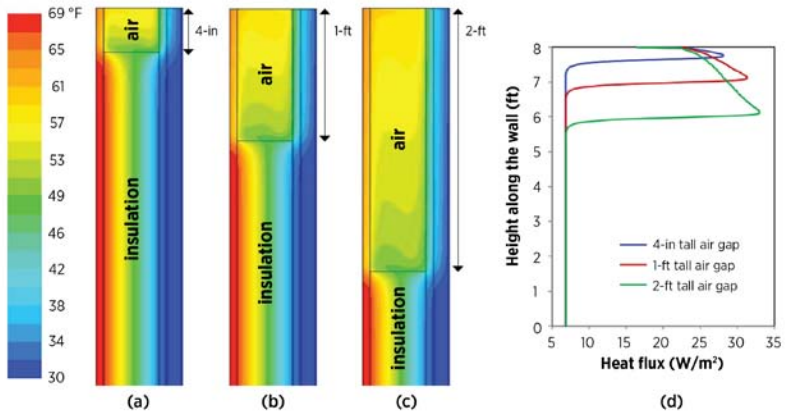
NREL developed CFD models of uninsulated wall assemblies that help to improve the accuracy of building energy simulation tools when modeling potential energy savings in older homes.

Key Result

The study provides correlations for the resistance of the uninsulated assemblies that can be implemented into building simulation tools to increase the accuracy of energy use estimates in older homes, which are currently over-predicted.

Potential Impact

Accurate estimates of the thermal characteristics of uninsulated assemblies will reduce pre-retrofit performance errors and help predict retrofit energy savings.



(a), (b), (c): Temperature distribution in the upper section of a partially insulated wall cavity. (d): Heat flux along the inner surface of the wall exchanging heat with the room air. These results are for 70°F indoor temperature and 30°F ambient temperature.

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