NREL
NATIONAL RENEWABLE ENERGY LABORATORY

NREL Improves Window Heat Transfer Calculations

Highlights in Research & Development

Analysis of algorithm discrepancies helps to promote market confidence in EnergyPlus and DOE-2.

Heat loss through windows represents a significant amount of the overall energy use in homes. To address discrepancies in building simulation software—and market barriers impeding building energy use analysis—researchers at the National Renewable Energy Laboratory (NREL) identified and resolved window-related energy predictions of EnergyPlus and DOE-2, thereby improving the accuracy of both simulation tools.

To explore changes to the calculation methods, a simple test case was analyzed, and discrepancies were noted relating to exterior and interior convection and interior radiation. The most significant errors were found in detailed window heat transfer algorithms due to implementation problems.

The results show a decrease in the difference between predictions of annual window heat transfer from over 18% to just over 3% by simple corrections to exterior (EnergyPlus and DOE-2) and interior (DOE-2 only) convection algorithms. If EnergyPlus and DOE-2 were to both use the same interior radiation algorithm, the difference in predicted heat loss is negligible (-0.3%).

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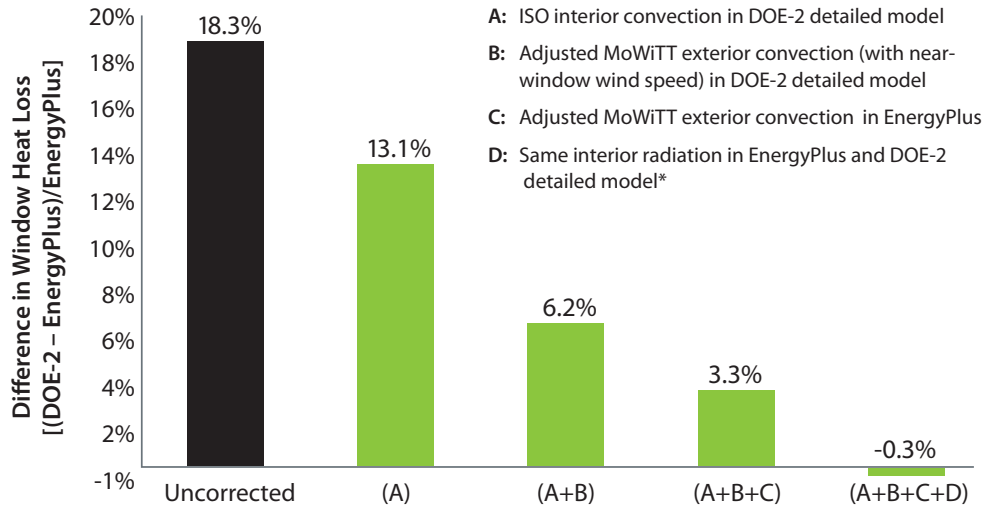
Reference: Booten, C.; Kruis, N.; Christensen, C. (2012). *Identifying and Resolving Issues in EnergyPlus and DOE-2 Window Heat Transfer Calculations*. NREL Report No. TP-5500-55787. *www.nrel.gov/docs/fy12osti/55787.pdf.*



Estimated cumulative impacts of the proposed changes (on single-pane window heat loss with Chicago TMY3 weather file).

*These results show the impact of using EnergyPlus-like zone radiation exchange in EnergyPlus and DOE-2 (modeled in EES). It is not deemed practical to add a radiative exchange algorithm to DOE-2.

Key Research Results

Achievement

Researchers in NREL's Residential Buildings group identified and resolved issues in detailed window heat transfer algorithms used by major building energy simulation tools. These solutions help to eliminate discrepancies and errors in simulations of building energy use.

Key Result

Using the BEopt™ test suite, NREL identified and resolved issues (in EnergyPlus and DOE-2) in exterior and interior convection calculations, making window heat loss estimates more accurate for both simulation tools.

Potential Impact

Software users will have greater confidence in model results, which will help promote greater acceptance of these software tools.

NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

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