

NREL Provides Guidance to Improve Air Mixing and Thermal Comfort in Homes

NREL research determines optimal HVAC system design for proper air mixing and thermal comfort in homes.

As U.S. homes become more energy efficient, heating, ventilation, and cooling (HVAC) systems will be downsized, and the air flow volumes required to meet heating and cooling loads may be too small to maintain uniform room air mixing—which can affect thermal comfort. Researchers at the National Renewable Energy Laboratory (NREL) evaluated the performance of high sidewall air supply inlets and confirmed that these systems can achieve good air mixing and provide suitable comfort levels for occupants.

Using computational fluid dynamics modeling, NREL scientists tested the performance of high sidewall supply air jets over a wide range of parameters including supply air temperature, air velocity, and inlet size. This technique uses the model output to determine how well the supply air mixes with the room air. Thermal comfort is evaluated by monitoring air temperature and velocity in more than 600,000 control volumes that make up the occupied zone of a single room. The room has an acceptable comfort level when more than 70% of the control volumes meet the comfort criteria on both air temperature and velocity.

Technical Contact: Ren Anderson, ren.anderson@nrel.gov

Reference: Ridouane, E.H. (2011). *Evaluation of Air Mixing and Thermal Comfort from High Sidewall Supply Air Jets*. NREL Report No. TP-5500-48664. www.nrel.gov/docs/fy11osti/48664.pdf.

Key Research Results

Achievement

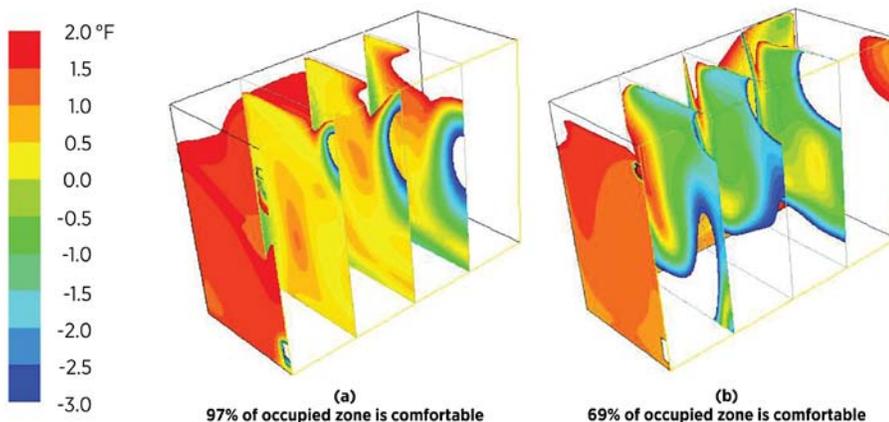
NREL's Residential Buildings Group has provided recommendations on air handler system design and operating conditions to achieve optimal thermal comfort in high-performance homes.

Key Result

The study shows that high sidewall supply air jets achieve uniform mixing in a room, which is essential for providing acceptable comfort levels. The study also provides information required to optimize overall space conditioning system design in both heating and cooling modes.

Potential Impact

Thermal stratification and non-uniform comfort can be a problem if air handlers are not sized to provide sufficient airflow to mix room air, particularly during heating conditions. This report provides operating guidelines to ensure adequate air mixing in high-performance homes.



Plots of acceptable draft temperature in cooling mode when the room is supplied by 55°F air. The plots show the distribution at selected cross-sections along the room. Colored regions on each cross-section are considered comfortable (blue regions are on the cold side and red regions are on the warm side).