

NREL Tests Dehumidifiers, Defines Simplified Simulation Model

Study of residential dehumidifiers results in practical performance curves for use in whole-building simulation tools.

Dehumidifiers remove moisture from a home's indoor environment, thereby increasing occupant comfort, improving air quality, and reducing the likelihood of mold, rot, and dust mites. To help energy professionals more easily evaluate this technology for the market, National Renewable Energy Laboratory (NREL) researchers tested the efficiency and capacity of a variety of dehumidifiers and developed a generalized approach to simulate any residential dehumidifier. The test results and modeling method are documented in a new report. Typically, dehumidifiers are only rated at a single temperature and humidity, so rating data alone cannot determine whether a product will meet the moisture removal needs of a particular home or situation. The rating also cannot determine the dehumidifier's energy use or performance under actual conditions in a home or basement.

In a controlled laboratory setting, NREL researchers subjected six ENERGY STAR®-labeled dehumidifiers to a wide range of temperature and humidity conditions to measure how the units dehumidify air and consume electric energy. The vapor compression dehumidifiers selected for this project ranged in capacity and efficiency to ensure reasonable representation of the available products. The report describes the measured performance results and gives a method for other researchers to estimate off-rating-point operation of other dehumidifiers. Sets of coefficients are included to enable each dehumidifier to be simulated in whole-building analysis tools.

NREL researchers also defined a new, generalized approach for modeling dehumidifiers that is suitable for nearly any residential dehumidifier on the market without much sacrifice in accuracy. In fact, this modeling method predicted each dehumidifier's performance with an average error of less than 6%. Researchers expect that the new approach will streamline modeling and simulation of dehumidifying appliances in homes, so the proper equipment can be selected and installed. This research delivers a key benefit to the efficiency industry: knowing only the rated efficiency and capacity, energy professionals can now estimate real-world residential dehumidifier performance with better certainty.

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Experimental test setup of the Ultra-Aire XT150H residential dehumidifier in NREL's Advanced HVAC lab in the Thermal Test Facility.
Photo by Dane Christensen, NREL/PIX 19601

Key Research Results

Achievement

Six residential dehumidifiers were tested over a wide range of temperatures and humidity levels to broadly determine moisture removal capacities and efficiencies. Whole-building simulation tool performance curves were derived for use in evaluating the energy, comfort, and cost impacts of dehumidifiers.

Key Result

Knowing only the rated efficiency and capacity, energy professionals can now simulate residential dehumidifiers with low error. This enables quicker and easier equipment evaluation, so better real-world performance and cost impacts can be determined.

Potential Impact

National objectives for cost-effective energy savings in the residential sector can be met more quickly and with greater consistency. Appropriate equipment selection will lead to improved health, safety, comfort, and building durability.