Proposal to Investigate Energy Impact of Whole-House Dehumidifier Location

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Research Questions:

Where should a whole-house dehumidifier be located –stand alone, on return side of central system, on supply side of central system? If in cooling mode it would make more sense on the supply side but will that hurt the life of the unit? Should the code mandate rules or allow penalties/credits based on location in performance code while limiting options in prescriptive?

Code and Background Relevant to Florida:

The Florida Code accounts for energy impacts of ducts and air handler locations due to the high energy differences. As an example, Cummings et al. 2002 found that air handlers located in south Florida attics would have about 17% increase in cooling conditioning energy and 10% increase in heating energy compared to air handlers located in conditioned space. Air handlers located in north Florida would use about 15% more cooling energy and 19% more heating energy than air handlers in conditioned space.

A recently completed FBC project by Vieira and Beal, 2017, recommended code language to account for dehumidifier energy use in residences if a dehumidifier is included in the home. That research led to questions regarding the energy use of the dehumidifier as it relates to location. The location of the appliance can be a physical location such as an attic, garage or conditioned part of the home, but how the dehumidifier distributes its air must also be considered. Simple dehumidifier distribution pulls air from a room and supplies treated air back into a space. Other methods involve distribution to and from the central ducted heating and cooling system. This latter method can affect performance of the dehumidifier and central system depending upon how it is configured.

Locating a dehumidifier outside of conditioned space would tend to dump the heat released from the dehumidifier into that space. However one study, Rudd, et. al, 2005, monitored high dehumidifier use for a system located in the attic.

Scope of Work:

1. In a laboratory, alternate method of dehumidifier air distribution for a variety of cases. For all cases the dehumidistat shall be located in well mixed air location per the recommendation of the Vieira, Beal 2017 report: *[dehumidifier] Shall be controlled by a dehumidistat that is installed in a location where it is exposed to mixed house air and does not receive undue direct influence from mechanical ventilation air or supply air from the home's cooling or heating system(s).*

   The dehumidifier air distribution will be configured in the following ways:

    a. Air to and from return side of central system with a gravity damper to avoid short cycling of air
    b. Air to and from supply side of central system with a gravity damper to avoid short cycling of air
    c. Stand alone, air to and from central conditioned space
    d. Pretreating whole house mechanical ventilation air
2. Following lab results, simulate physical location of system in garage, conditioned space and attic accounting for any duct gain/loss effects.
3. Write a final report with results and recommendations.

Deliverable:

A final report will be prepared that explains the purpose, methods, and results of the research. The final report will provide a summary of test and simulation findings. Recommendations for Florida code changes will be provided if the authors feel it is warranted.

Budget:

Budget total is estimated at $40,000 and covers all costs for labor, materials, and overhead.

References

Cummings, J., C. Withers, Dr. L.Gu, J. McIlvaine, J. Sonne, P. Fairey, and M. Lombardi. 2002. "Field Testing and Computer Modeling to Characterize the Energy Impacts of Air Handler Leakage". FSEC-CR-1357-02. Cocoa, FL.: Florida Solar Energy Center. Submitted to Florida Department of Community Affairs September 23, 2002.

Rudd, Armin, Joseph Lstiburek, Kohta Ueno, "Residential Dehumidification Systems Research for Hot-Humid Climates," NREL/SR-550-36643, February 2005 http://www.nrel.gov/docs/fy05osti/36643.pdf

Vieira, R., and D. Beal, "Residential Performance Code Methodology for Crediting Dehumidification and Smart Vent Applications Final Report," FSEC-CR-2067-17, June 1, 2017.