

# Measured Impacts of Whole House Mechanical Ventilation on Comfort, Energy Use and Pollutants

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## Rationale:

As codes wrestle with the level of air tightness that should be allowed before mechanical ventilation systems are needed, the effectiveness of ventilation fans to reduce pollutants is a key piece of information. This study would expand the knowledge by comparing long-term measurements of CO<sub>2</sub> and overall VOC levels in ten homes operated during periods with and without code levels of ventilation. Temperature and relative humidity will be measured also. Results may help inform future Florida code changes.

## Overview:

Currently ASHRAE 62.2 standards, the IMC and Florida Statutes all vary on minimum flow rate of residential whole-house mechanical ventilation systems. There is also variance in allowable limitations in operation schedules. A delayed provision of the 2014 Florida Building Code, set to take effect on July 1, 2016, requires natural air change be supplemented through whole house mechanical ventilation for homes with tested air leakage of 3 ACH<sub>50</sub> or less. However, there is concern among Florida builders and contractors about the implications associated with mechanically introducing humid outside air on a consistent basis (Vieira, et. al. 2016). These implications include the potential impact on comfort, moisture issues, and both first cost and operating costs of the home. Research data on the impact of ventilation on pollutants in Florida homes is very limited, although there is some available in homes with and without code mandated levels of ventilation (Martin, et. al. 2016). Inspections of homes with installed whole-house mechanical ventilation systems found some people shut off their systems or they delivered less than the design air volume (Sonne, et. al. 2015).

This research will help FBC make decisions regarding whole house mechanical ventilation by showing the difference between ventilating and not ventilating to required code levels. Homes selected for the study will typically be ENERGY STAR certified homes. These homes tend to have above-code envelopes and high efficiency equipment. These factors, combined with the ventilation may in some cases increase the likelihood of high humidity levels. Measurements will compare indoor to outdoor levels of overall VOCs, CO<sub>2</sub>, humidity and temperature with and without the ventilation.

## Scope of Work

The work will include seeking and finding 10 recently built, occupied, tight houses with working whole-house mechanical ventilation systems. The rating database of ENERGYSTAR homes will be used to find these homes. All study homes will have house and duct air tightness tests to verify as-found conditions. The flow of the mechanical ventilation systems will be measured and adjusted if necessary and may even include minor repair during the experiment. Long-term measurements of indoor and outdoor VOC level, CO2 level, temperature and humidity will be monitored every minute and stored in 15 minute averages or sums.

Approximately every two weeks the whole-house mechanical system will be turned on or off. This will allow house conditions with and without ventilation during heating, air conditioning and non-conditioning data to be collected. Due to limited heating season, the time period for mechanical system on and off may be altered from the normal schedule. A total monitoring period of about 5-6 months will be sought after in each home.

## Deliverables:

A final report will be prepared that explains the purpose, methods, and results of the research. The final report will include an analysis of the impact of whole house mechanical ventilation upon measured CO2, total VOC, and indoor temperature and humidity. The impact of the mechanical ventilation system upon space conditioning energy use will also be reported. If the authors feel it is warranted, recommendations for code changes will be provided.

## Expected Outcome and Impact on the Code:

This research may help overcome opposition to the requirement for requiring mechanical ventilation. It may help determine basis for maintaining levels in the current code or altering them.

## Estimated budget:

\$81,000

## References:

Martin, E., B. Amos, J. McIlvaine, D. Chasar, S. Widder, and K. Fonorow. Measured Cooling Season Results Relating the Impact of Mechanical Ventilation on Energy, Comfort, and Indoor Air Quality in Humid Climates. Proceedings of the 2014 ACEEE Summer Study on Energy Efficiency in Buildings, Washington, DC: ACEEE.

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Sonne, J.; Withers, C.; Vieira, R. (2015), "Investigation of the Effectiveness and Failure Rates of Whole-House Mechanical Ventilation Systems in Florida," FSEC-CR-2002-15, June 1, 2015.