TIP 340: Smart Ventilation Controls

Context

An essential part of a healthy, safe and durable home is good Indoor Air Quality (IAQ). As homes have become tighter in efforts to save energy for heating and cooling, mechanical ventilation is required to maintain or improve IAQ. The concept of smart ventilation is to reduce the energy costs of ventilation while maintaining IAQ. A smart ventilation control uses the principle of equivalent ventilation to allow the calculation of IAQ for mechanical ventilation systems whose air flows are not constant. It also allows real-time control of ventilation by calculating instantaneous exposure to pollutants and long-term dose relative to a constantly operating system. The control operates so as to lower the levels of pollutants relative to the non-smart, non-controlled ventilation system.

Initial research, funded by the US DOE to investigate the proof-of-concept for smart ventilation, has estimated typical ventilation energy savings of 40% or about 15% of total heating and cooling load.

Description

This project is designed to develop and optimize the technology and capabilities that would be used for the smart ventilation controller. In addition, the project specifically includes a key task: “Cost-effectiveness analysis for utility programs” that takes the experimental results and turns them into advice and analysis that can be used directly by utilities.

The following technical tasks will be performed:

- Field demonstration of the technology by monitoring ten homes for a year
- Simulation of ventilation system performance to expand to a wider range of homes than captured in the field demonstration
- Cost-effectiveness analysis for utility programs and adaption of existing SEEM software to include smart ventilation technology. The analysis will take approaches already used by BPA such that the results of the project can be directly assessed by BPA for suitability for inclusion in utility programs.

Why It Matters

The proposed work is intended to move beyond the simulated proof-of-concept and demonstrate effective operation through field studies and evaluate the potential for energy savings and peak demand reductions for the BPA.

This technology ensures that homes comply with IAQ standards and offers the opportunity to increase IAQ through real time control when outdoor pollutant levels are high. It reduces risks associated with poor IAQ by enabling low energy cost and low installed cost ventilation solutions. The estimated energy reduction for homes is about 1000 kWh/yr. Smart ventilation could also reduce resistance to envelope tightening that will add further energy savings.

Smart ventilation allows peak demand reductions for a home of 15% of its HVAC load. Smart ventilation can respond to utility peak demand signals in real time or use its own built in temperature or time based measurements.

Goals and Objectives

The objective is to remove barriers to the adoption of smart ventilation so that energy savings associated with tighter well ventilated homes can be realized at lower cost and energy use than current approaches. The key goals are to:

1. Demonstrate energy savings associated with smart ventilation technologies, and demonstrate the ability of smart ventilation to provide a cost-effective technology to reduce indoor air quality risks,
2. Evaluate the smart ventilation technology approach that will reduce the energy penalty and reduce the IAQ risks associated with tightening homes, and
3. Develop recommendations for utility programs, other energy efficiency programs and for codes/standards on how to calculate credits for smart ventilation systems.

Deliverables

A final report will be prepared that compiles all the field data, simulation results and cost-effectiveness calculations, together with the associated analyses.

The final report will include recommendations for smart ventilation applications in utility programs for both new construction and market retrofits.

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Project Start Date: October 1, 2015

Project End Date: September 30, 2017

Reports & References

Links

Funding

Total Project Cost:	$750,000
BPA Share:	$300,000
BPA FY2016 Budget:	$167,500

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