

Integrated Ventilation System Increases Energy Efficiency and Ease of Installations

The newly developed ventilation-integrated comfort system (VICS) reduces space requirements and costly ductwork needed for separate heating, cooling, and ventilation systems—without compromising performance.

Researchers are helping homebuilders meet the growing demand for energy-efficient homes, and a key factor is improving the heating and cooling equipment. Heating and cooling a home is costly, typically consuming about 50% of the building's energy consumption.¹

With support from the U.S. Department of Energy Building Technologies Office, Steven Winter Associates, Inc. (SWA) and its partners designed and tested VICS prototypes to make balanced ventilation easier in homes, especially for newer, low-load homes.

¹ <https://www.eia.gov/todayinenergy/detail.php?id=36412>

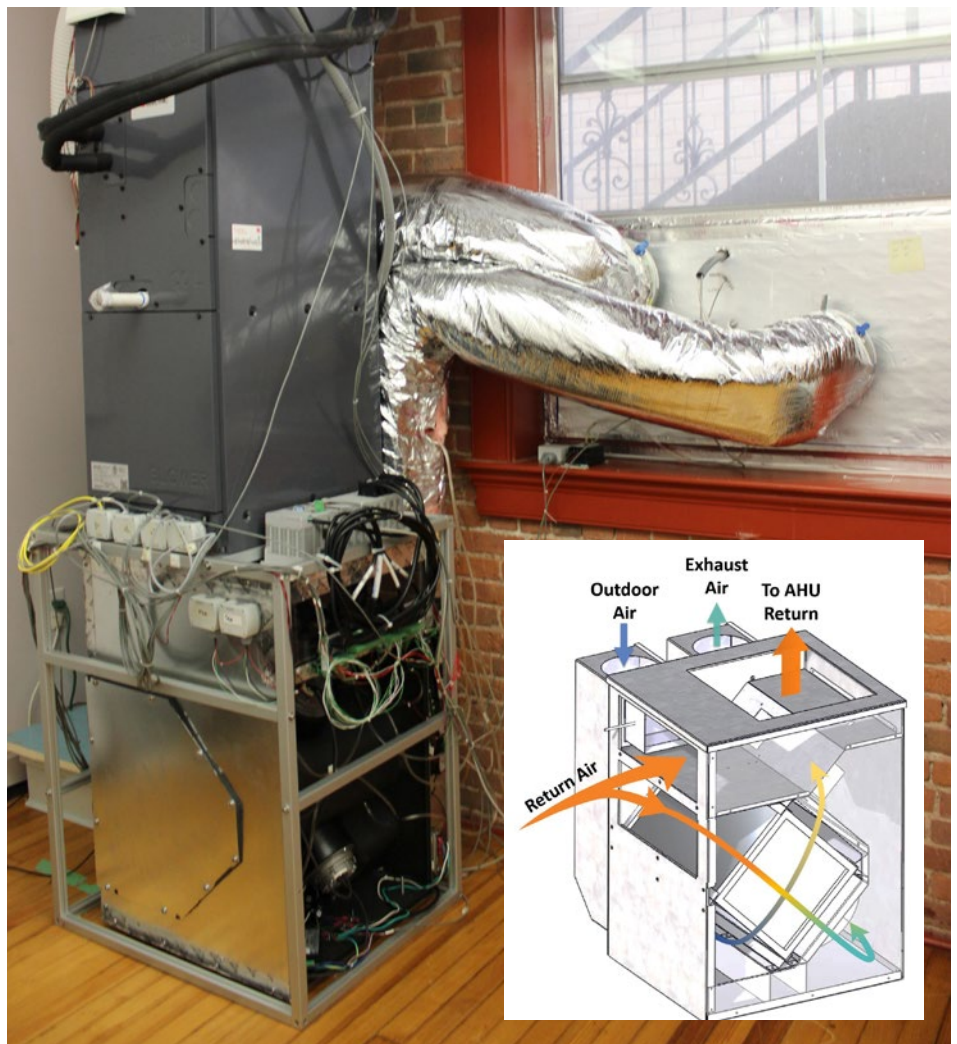
Project Information

Building Component: Ventilation

Team and Partners: Steven Winter Associates, Inc., Mitsubishi Electric Trane US LLC, CORE Energy Recovery Solutions, and Thermo-Stor LLC

Application: Residential

Years Tested: 2016–2019

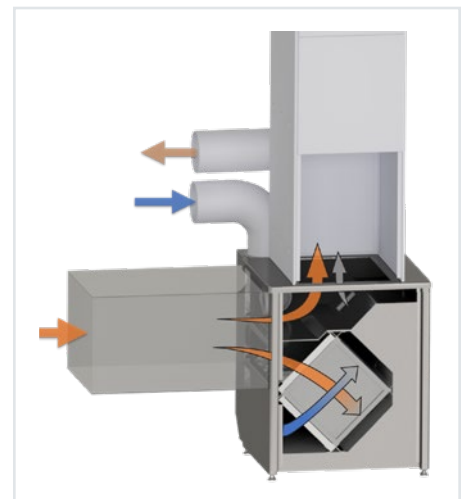


Conceptual diagram (bottom right) and beta version (background) of the ventilation-integrated comfort system researched and tested by Steven Winter Associates, Inc (SWA). Images from SWA

Designed to fit into mechanical closets, the integrated system will provide efficient, controllable, and balanced energy recovery ventilation that is integrated with heating and cooling systems. The VICS also reduce the risks of improper installation and additional commissioning with less required ductwork. The target installed cost of a commercial VICS product is \$2,500, which is comparable to current install costs provided by industry practitioners.

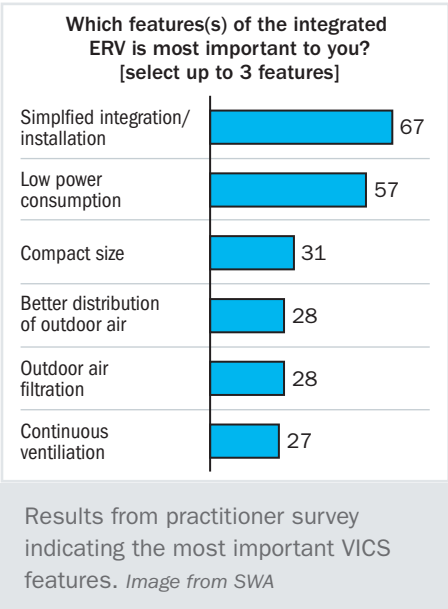
Objective and Market Opportunity

SWA designed, constructed, evaluated, and optimized a fully integrated space-conditioning and ventilation solution for low-load dwellings. The concept of combining outdoor air distribution with



An illustration of a VICS coupled with an AHU, demonstrating how the system can attach to many different air handling units (AHUs).

Image from SWA



heating and cooling distribution has been previously explored, but has yet to be implemented with great success, efficiency, or cost-effectiveness.

Large U.S. heating and cooling equipment manufacturers have been slow to adapt to the low capacities required for new low-load homes, despite the rise in demand. As a result, many overseas manufacturers of air-source heat pumps have experienced tremendous market growth in the United States, and many have made large investments in U.S. manufacturing. However, heat pump manufacturers generally do not

manufacture residential ventilation equipment.

This project sought to bridge the gap in U.S. manufacturing and consumer demand by developing and demonstrating an integrated solution that is efficient, provides superior comfort and indoor air quality, and is cost-effective.

Findings

A survey of builders, contractors, designers, raters, and other stakeholders who had vested interest in residential ventilation systems was performed later in the project period. Results confirm significant interest in the VICS concept and approach among the 95 respondents. The most appealing factor of the VICS concept was simplified installation and integration.

Four key developments made the VICS practical and timely:

- **Smaller design loads.** With evolving energy codes and above-code programs, heating and cooling loads in new single-family and multifamily buildings have dropped.
- **Smaller-capacity heating and cooling equipment.** Heating and cooling manufacturers, especially manufacturers of air-source heat

pumps, continue to introduce low-capacity systems.

- **Variable-speed fans.** Smaller, efficient, variable-speed blowers have become much more available and affordable.
- **Growing demand.** More above-code programs are requiring (or incentivizing) the use of balanced heat-recovery ventilation in new homes.

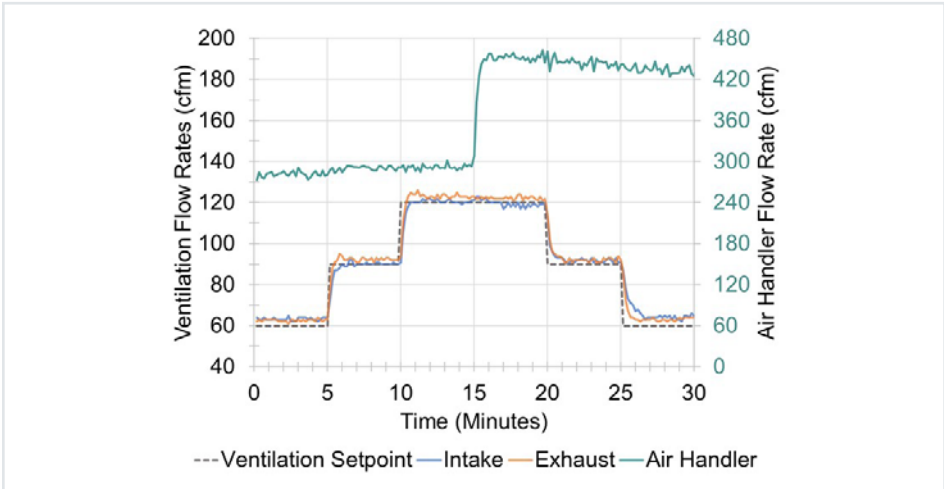
This system has the potential to offer very high-performance ventilation with much smoother and simpler installation than conventional systems. The latest VICS prototype consumed 40–75 watts, including the air handler power, to deliver 50–120 cubic feet per minute of whole-dwelling ventilation. The large, cross-flow energy recover ventilator core performance matched manufacturer values (73% winter sensible effectiveness, 64% summer total effectiveness), and further improvements are possible.

Prototypes were designed with manufacturing in mind, and discussions with manufacturers are ongoing. ■

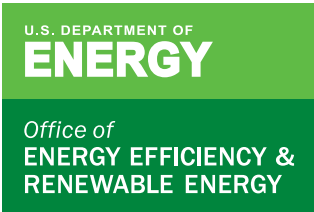
Learn More

Technical Report:

<http://www1.eere.energy.gov/buildings/pdfs/78352.pdf>



The above graph demonstrates a successful VICS operation as ventilation flow rates (intake and exhaust) are maintained at the setpoint, regardless of the air handler fan speed. The air handler accelerated to high speed to meet a big heating or cooling load, and the ventilation rates maintained its setpoint. *Image from SWA*



For more information, visit: energy.gov/eere/buildings/building-america

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