U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

BUILDING AMERICA TOP INNOVATIONS 2014 PROFILE

INNOVATIONS CATEGORY:
Assured Health and Safety

INNOVATOR:
LBNL, multiple teams and labs

ASHRAE Standard 62.2. Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings

DOE goals call for zero energy ready homes that are 50% more efficient than the 2009 IECC and whole-house retrofits that reduce energy use 25% in existing homes by 2025. By specifying minimum ventilation rates, ASHRAE 62.2 is a critical enabling innovation that will contribute to DOE's long-term goal of saving the nation $2.2 trillion in energy-related costs through a 50% reduction in building energy consumption.

BUILDING AMERICA TOP INNOVATIONS

Recognizing Top Innovations in Building Science – The U.S. Department of Energy's Building America program was started in 1995 to provide research and development to the residential new construction and remodeling industry. As a national center for world-class research, Building America funds integrated research in market-ready technology solutions through collaborative partnerships between building and remodeling industry leaders, nationally recognized building scientists, and the national laboratories. Building America Top Innovation Awards recognize those projects that have had a profound or transforming impact on the new and retrofit housing industries on the road to high-performance homes.

Building America SM U.S. Department of Energy

Building America research and support were instrumental in developing and gaining adoption of ASHRAE 62.2, a residential ventilation standard that is critical to transforming the U.S. housing industry to high-performance homes.

High-performance homes provide more affordable, comfortable, healthy, durable, and safe homes for all Americans. That's a good thing. Tight construction is one of the most important cornerstones of high-performance homes, but is only possible with ensured dilution of indoor contaminants. And this ensured dilution is dependent on an effective base standard for whole-house and spot ventilation. This is why the ASHRAE 62.2 residential ventilation standard is critical to transforming the residential sector to high-performance homes. Building America research and support was instrumental in developing and gaining adoption of this vitally important standard.

To understand the importance of good indoor air quality, consider that people spend, on average, nearly 90% of their time indoors, with the majority of that time in their homes. And since concentrations of many pollutants indoors can be two to five times greater than in the outdoor air, ventilation is essential to maintaining good indoor air quality (Sherman 2004). However, historically residential ventilation was not considered a major concern by builders and home owners because it was believed operable windows and envelope leakage provided enough outside air in their homes. But building envelopes have gotten progressively tighter as research conducted after the first oil crisis in the 1970s quantified the relationship between building air leakage and heat loss (and therefore energy loss). Today, more rigorous building codes and voluntary labeling programs are requiring builders to test for and meet stricter air leakage limits. For example, the 2009 International Energy Conservation Code, the first IECC code to specify a whole house airtightness limit, required homes to have air leakage of 7 or less air changes per hour at 50 Pascals pressure (ACH 50) while the 2012 IECC requires homes to meet an airtightness limit of 3 ACH 50 or less in most climates (CZ3 and higher) and the Passive House program sets the limit at 0.6 ACH 50. ASHRAE 62.2 serves as a critical enabling technology as builders and codes approach zero energy homes with ever-tighter building enclosures.

These code changes would not have been possible without a recognized way to determine acceptable ventilation rates. Good indoor air quality is fundamental to

(top left) Building America-supported research and activities that were instrumental in getting the ASHRAE residential ventilation standard 62.2 written and adopted.

high-performance homes. Yet before ASHRAE 62.2, there was no generally accepted method for determining the ventilation rate a home needed to have for acceptable indoor air quality. As a result, there were fears that making homes too tight could result in significant indoor air quality problems which became a barrier to achieving airtight homes. In particular, builders were highly resistant to constructing tight homes and public programs often set weak air-tightening limits leaving too much energy efficiency on the table.

The establishment of ASHRAE Standard 62.2 resolved these issues by providing a minimum standard of care for the industry. The original standard, 62.2-2003 "Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings," was published by ASHRAE in late 2003. Since that time, there have continued to be revisions to the standard with new publications issued in 2004, 2007, 2010, and 2013.

ASHRAE 62.2 is of great benefit to the entire housing supply chain. Design and construction professionals now have a resource and guidance for specifying and integrating adequate ventilation in their projects. HVAC professionals and builders can reduce their business risk by employing an accepted set of criteria for whole-house and spot ventilation. The home sales process increasingly has a level playing field where the standard is enforced because it is no longer possible to gain a competitive first-cost advantage by leaving out adequate ventilation. And lastly, occupants have assurance that their homes are designed to provide adequate fresh air. (Sherman 2004).

Research and development sponsored by the U.S. Department of Energy (DOE) through its national laboratories and building research teams were instrumental in bringing about the creation and development of this nationally recognized standard for residential ventilation. In 1996, staff from Lawrence Berkeley National Laboratory (LBNL) urged ASHRAE to create a separate standard for residential ventilation for acceptable indoor air quality. ASHRAE had put forth Standard 62 in 1981, but it addressed ventilation in both commercial and residential buildings and was not specific to homes. From the committee's founding, Building America supported involvement from the national laboratories and research teams including staff from DOE, LBNL, Building Science Corporation, Florida Solar Energy Center, Washington State University Energy Office, and the Building Research Council at the University of Illinois.

Work by Building America-supported researchers from LBNL, Southface, the University of Illinois, FSEC, WSU, Davis Energy Group, and others was vital to getting the standard adopted by building organizations, including the Building Performance Institute (BPI), RESNET, the Air Conditioning Contractors of America (ACCA), California's Title 24 Energy Code, the U.S. Environmental Protection Agency's ENERGY STAR Certified Homes Version 3.0, EPA Indoor AirPLUS, and Healthy Indoor Environment Protocols for Home Energy Upgrades, the DOE Weatherization Assistance Program (WAP), DOE's Workforce Guidelines for Home Energy Upgrades, and many "green" building programs. These efforts have resulted in the standard's use in hundreds of thousands of U.S. homes.

Building America continues to support ventilation research necessary to resolve issues of concern to the stakeholders, for example, LBNL's studies in range hood performance, diagnostics development, filtration, and smart ventilation; Building Science Corporation's field testing of ventilation strategies; and investigations on ventilation system performance by Pacific Northwest National Laboratory and others. As new construction methods and codes continue to push builders to construct tighter building enclosures, Building America research will further clarify issues regarding best practices for ventilation methods and rates in different climate zones. This research will shape future iterations of the standard.

ASHRAE 62.2 Core Elements

"Source Control" Exhaust Ventilation

KITCHEN

On-demand: 100 cfm -OR- Continuous: 5 ACH

12′ x 12′ x 8′ → 100 cfm

FULL BATH

On-demand: 50 cfm -OR- Continuous: 20 cfm

"Whole Building" Mechanical Ventilation

$$Q_{fan} = 0.03A_{floor} + 7.5\,(BR + 1)$$

Floor area is surrogate for material sources
Bedrooms is surrogate for people, activities

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CREDIT FOR INFILTRATION

Allowances for intermittent ventilation, existing homes, and multi-family buildings

REFERENCES

ASHRAE Standard 62.2-2013. Ventilation for Acceptable Indoor Air Quality, https://www.ashrae.org/resources--publications/bookstore/standards-62-1--62-2

Sherman, M. 2004. ASHRAE's New Residential Ventilation Standard, ASHRAE Journal, Jan 2004, https://www.ashrae.org/File%20Library/docLib/Public/20031231103644_266.pdf.

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