BUILDING AMERICA TOP INNOVATIONS 2013 PROFILE

INNOVATIONS CATEGORY:
1. Advanced Technologies and Practices
1.2 Energy-Efficient Components

TOP INNOVATOR:
NREL

High-Efficiency Window Air Conditioners

NREL estimates its window air conditioner recommendations will result in 5% to 10% cooling energy savings—enough to pay for the air conditioner over its lifetime. If all window air conditioners were improved in this way, the nation's energy use could be reduced by 40 trillion Btu per year, saving consumers $400 million each year.

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 U.S. Department of Energy

Comprehensive performance tests lead to affordable methods for increasing the energy efficiency of window air conditioners.

Window air conditioners are an inexpensive, portable form of spot cooling, making them a good solution for supplemental cooling, for air conditioning in homes that lack ductwork, and for renters. As a result, 7.5 million window air conditioners are purchased each year in the United States—more than all other home cooling equipment combined. However, window air conditioners have low minimum efficiency standards, and their installation typically results in air leakage, which significantly reduces the equipment's performance.

To measure the impact these products have on home energy use, researchers at the National Renewable Energy Laboratory (NREL) studied the performance of one 10-year-old and three new window air conditioners in a range of climates and conditions at NREL's Advanced Heating, Ventilation, and Air-Conditioning (HVAC) Systems Laboratory. The testing provided unique performance data that allowed separate evaluations of the performance impacts of cooling operation, internal air leakage, and leakage resulting from installation in a window.

NREL showed the new air conditioners' measured performance was consistent with their ratings, while the 10-year-old unit was no longer operating as efficiently as it could. NREL's methods also permitted calculation of real-world impacts (energy use and comfort) of window air conditioners in different climates, which showed that cycling, installation, and infiltration effects can prevent window air conditioners from achieving their rated efficiency.

In addition to the performance testing, NREL developed recommendations for window air conditioner manufacturers on how to improve this real-world performance at very modest cost. NREL also published a homeowner's guide for providing tips for better window air conditioner installation.

(Top left) NREL tested new and older model window air conditioners under real-world conditions for several climate zones and identified several cost-effective opportunities for reducing energy consumption and improving user comfort.

In its *Homeowner's Guide to Window Air Conditioner Installation for Efficiency and Comfort*, NREL provided homeowners with several low-cost practical tips for improving the operating efficiency of their window-unit air conditioners.

- Remove the accordion panels that come with the unit and replace with pieces of rigid foam insulation cut to fit between each side of the unit and the window frame. Use duct tape to secure the foam panels and prevent air leaks.
- Install foam backer rod between the sashes.
- Make a diverter of rigid foam (as shown in lower figure to the right) and install it to prevent conditioned supply air from being drawn back into the stale air return.
- Periodically clean the intake and exhaust grills on the inside and outside of the unit.
- Remove the unit from the window when the cooling season is over.

Lessons Learned

- Installation, infiltration, and cycling losses may prevent window air conditioners from achieving their rated performance.
- There is significant potential for degradation of the window units with time, because proper maintenance is difficult.
- A poorly installed window air conditioner can increase whole-house air leakage by 10%. Air sealing around the air conditioner is critical for best performance.
- Air recirculation can reduce the overall efficiency of the air conditioner by 10%.
- Homeowners can follow NREL-recommended installation procedures to reduce energy consumption by up to 10%, which can save up to $30 a year in utility bills. This can be done with a one-time cost of around $15 using materials from home improvement stores. This saves enough energy to pay for most air conditioners over their lifetime.

One problem with window air conditioners is that a significant portion of the conditioned air gets recirculated back into the air conditioner.

Installing a diverter helps to maximize cool air flow from the air conditioner.

REFERENCES

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