U.S. DEPARTMENT OF
ENERGY

Office of
ENERGY EFFICIENCY &
RENEWABLE ENERGY

Interior Cellular Shades Boost Home Energy Performance

Windows are often a weak point in a home's energy efficiency. They tend to let heat escape during cooler months and allow solar heat gains during warmer months. Nearly 80%[1,2] of U.S. homes have inefficient single or double-pane windows, yet only 2%[3] of those homes are updated with more efficient windows each year—primarily due to high purchase and installation costs. Window attachments, particularly well-fitted cellular shades, offer an affordable option to high-efficiency replacement windows

Affordable Interior Window Insulation

At a fraction of the cost of window replacement, energy-efficient window attachments (e.g., interior and exterior shading, secondary glazing) offer a cost-effective and user-friendly way for consumers to save money year-round on their energy bills. Installing window attachments can save 15%[4] of a household's annual HVAC (heating, ventilating, and air cooling) energy use compared to vinyl blinds. High efficiency, insulating, and automated shades offer further savings potential.

Example of windows as weak points in a home's energy efficiency.

Project Partners

Oak Ridge National Laboratory (Lead)

Hunter Douglas

Lawrence Berkeley National Laboratory

Comfortex Window Fashions

Attachments Energy Rating Council (AERC)

A Cost-Effective Solution

Vinyl or metal blinds account for about 60% of all window coverings in U.S. homes, and curtains account for 19%.[5] Although blinds block some solar radiation, they do not provide much insulation. Simulations by the Lawrence Berkeley National Laboratory (LBNL) show that cellular shade coverings achieve higher energy savings than all other types of shading devices.[6]

Cellular shades are made of pleated fabric that is folded to create "cells" in a honeycomb design and can be raised and lowered. They trap air within each cell, as well as between the shade and the window, which is particularly beneficial in colder climates. Some shades have cells with low emissivity surfaces which reflect ultraviolet or infrared light to increase the insulating performance of the shade leading to increased energy efficiency. While cellular shades deliver all the benefits of conventional shades and blinds, e.g., controlling daylight, filtering glare, and offering privacy, they also reduce nighttime heat loss through windows, minimize cold drafts near windows, and reduce unwanted solar heat gain.

Cellular shades trap insulating air within the cells and between the shade and window.

Photo credit Hunter Douglas Duette® Architella® Honeycomb Shade courtesy of Hunter Douglas.

[1] Cort, K.A. 2013. "Low-E Storm Windows: Market Assessment and Pathways to Market Transformation." Pacific Northwest National Laboratory on behalf of the U.S. Department of Energy. PNNL-22565

[2] U.S. Energy Information Administration. 2009. Residential Energy Consumption Survey.

[3] Attachments Energy Rating Council. "Window Attachments: Energy Efficiency Program Brief." 2018. https://aercnet.org/wp-content/uploads/2018/03/AERC_Utility_Briefing_Doc_27FEB18.pdf

[4] Cort et al. Testing the Performance and Dynamic Control of Energy-Efficient Cellular Shades in the PNNL Lab Homes. August 2018. Pacific Northwest National Laboratory. PNNL-27663

[5] DRI, Residential Windows and Window Coverings: A Detailed View of the Installed Base and User Behavior, 2013.

[6] D.C. Curcija, M. Yazdanian, C. Kohler, R. Hart, R. Mitchell, S. Vidanovic, Energy Savings from Window Attachments, (2014)

Evaluating Savings

Oak Ridge National Laboratory (ORNL) worked with several companies and other partners to compare the energy impacts of five different cellular shades and vinyl blinds in a study performed in a residential home. A series of controlled experiments were conducted at the test home in Knoxville, Tennessee, from December 2019 to May 2020.

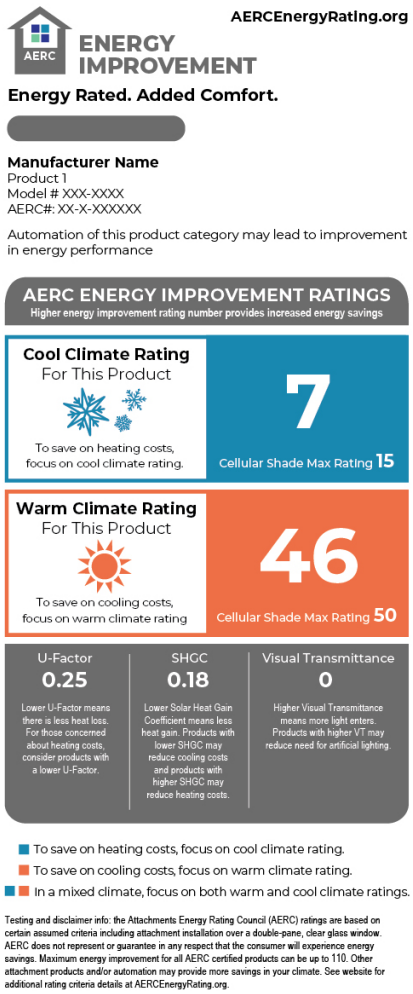
Data from these experiments helped create an energy model to simulate cellular shade performance in 15 climate zones for a modeled single-family home with 2,380 ft^2 of conditioned floor space. The potential energy impacts from each shade (or no shading device) were evaluated for each climate.

Findings

The experiments focused on the energy benefits of cellular shades during the heating season; research is needed to fully explore control strategies and benefits in the cooling season. General findings are as follows:

- Cellular shades provide higher heating energy savings than conventional vinyl venetian blinds.
- Cellular shades saved up to 20% on heating energy and up to 15% on total energy from heating and cooling compared to scenario without any shades.
- Cellular shades in homes with heat pumps and gas furnaces could save up to 2.1 and 3.0 kBtu/ft^2-year respectively

Cellular shade installed at ORNL's Yarnell Station house.



Right: The Attachments Energy Rating Council provides ratings like this for residential window attachment products so consumers can have independent and accurate information about the product's energy performance. All products with an AERC rating have been measured according to stringent standards and reviewed and accepted by AERC.

Where Can I Find Energy Efficient Cellular shades?

Highly efficient insulating cellular shades are currently available in the marketplace with a credible energy rating. The public interest organization, the Attachments Energy Rating Council (AERC), rigorously evaluates the energy savings of efficient window attachment products and provides energy performance information directly to the public. Look for the AERC energy improvement label on certified products to find information on the energy rating of a particular product in your climate zone or search AERC's qualified product list to check if your product is certified. Learn more at aercenergyrating.org.

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