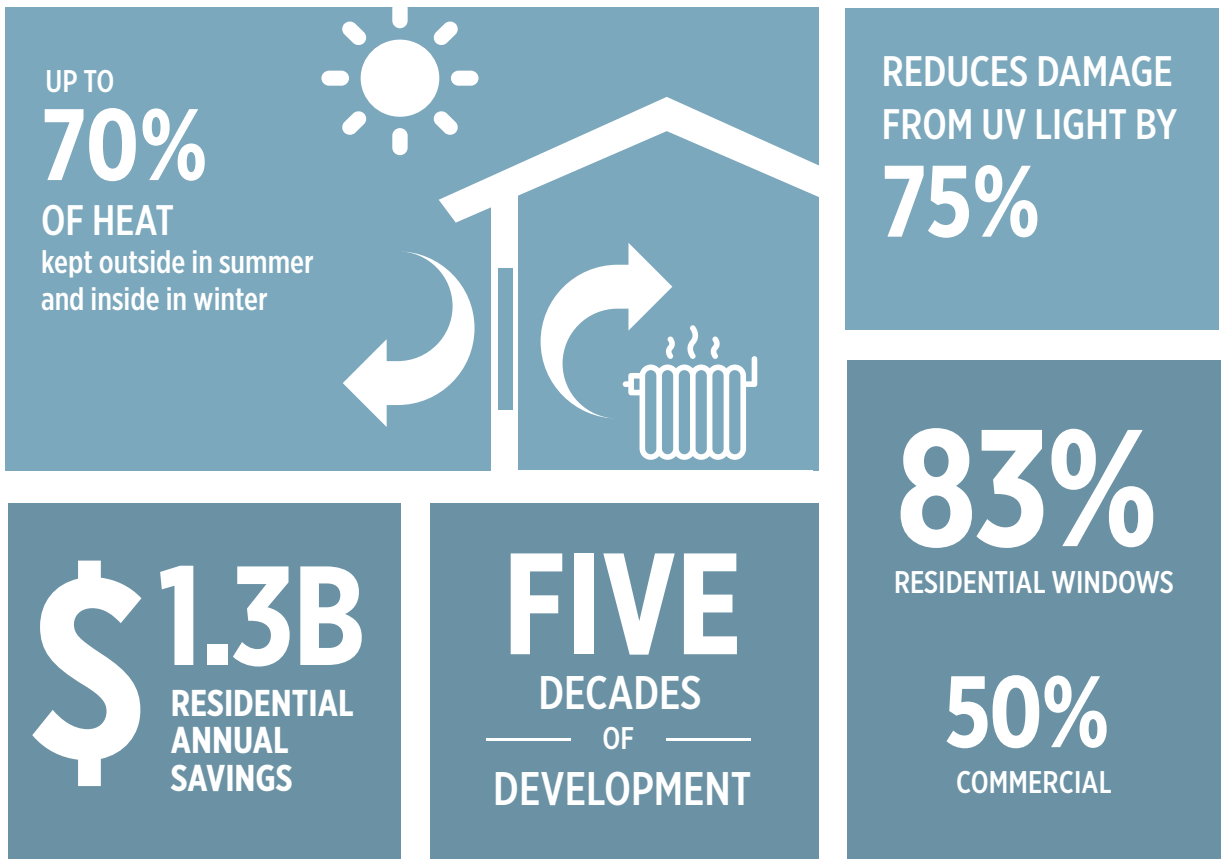


Low-e Windows

Saving Consumers Billions in Energy Costs

Increasing Efficiency in the Built Environment

Every year, Americans reduce energy bills by billions thanks to a low-emissivity (low-e) window coating that Berkeley Lab developed with industry. The coating prevents heat from entering buildings during summer months and escaping from them during winter. An invisible ultra-thin metallic coating, thinner than a human hair, filters out the infrared or heat portion of the light spectrum while allowing the full spectrum of visible light to pass through. Low-e coatings reduce the energy loss associated with windows by as much as 40%, improve occupant comfort, and reduce damage to interior surfaces from UV light. Once a novelty, low-e technology is now a market standard on which generations of innovative window designs have been based.



Five Decades of Development

From identifying a need to establishing an industry standard

1970s



EMPLOYING MATERIAL SCIENCE TO MEET AN R&D NEED

After the global energy crisis of the early 1970s, the U.S. government began funding research on higher-performance glass to curtail the energy—and money—escaping from windows. Low-e coatings had been around since World War II, in specialty applications like oven windows, and Berkeley Lab was funded by the US Department of Energy to collaborate with industry and investigate how this technology could be used to make building windows more efficient.

1980s



CATALYZING INDUSTRY THROUGH BASIC RESEARCH AND SEED INVESTMENTS

Berkeley Lab collaborated with the start-up Suntek on the development of a transparent film that was installed between the panes of a multi-pane window. This first commercial low-e product was introduced to the market in 1981. To demonstrate the window effectiveness in different climates, Berkeley Lab created the Mobile Window Thermal Test Facility (MoWITT). Berkeley Lab's successful demonstration of low-e spurred commercial companies to make major investments in the technology. By 1988, 20% of all windows sold in the U.S. had a low-e coating.

1990s



REFINING THE TECHNOLOGY AND SUPPORTING DEPLOYMENT

In the 1990s, Berkeley Lab helped create low-e coatings targeted at different climates: a soft coating that blocks nearly all infrared light, ideal for warmer climates, and a hard coating that allows some of the sun's shortwave infrared light to pass through and is ideal for cold climates. To educate the building industry and support low-e deployment, Berkeley Lab developed online training tools. Modeling tools developed by Berkeley Lab, such as WINDOW and THERM, supported labeling and certification of efficient windows.

2000s



DEVELOPING NEW CODES AND RATINGS

Window standards were added to the ENERGY STAR program in 1998. By 2005, the market share of windows with low-e coatings climbed to 41% of the residential market. Throughout the decade, Berkeley Lab continued to develop WINDOW, THERM, and the associated window component databases and to support National Fenestration Rating Council (NFRC) testing and calculation procedures and labeling, facilitating the development of window requirements in state energy codes.

2010s



BECOMING THE INDUSTRY STANDARD AND INCENTIVIZING INNOVATION

By 2015, 83% of residential windows used low-e technology, with cumulative savings of \$43 billion. By taking an active role in energy efficiency R&D, from project inception all the way through ongoing standard-setting, Berkeley Lab has catalyzed the private sector to further U.S. technological leadership and save energy. But energy loss from inefficient windows continues to cost U.S. consumers \$40 billion annually. To incentivize innovation, Berkeley Lab, in collaboration with industry, continues to develop new energy-saving window technologies.