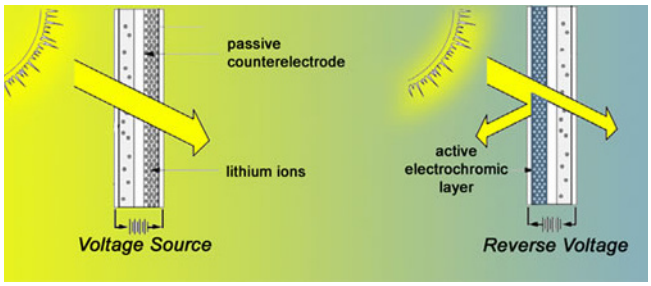
BERKELEY LAB

Why We Do Windows

Windows can let in too much sun and let out too much heat. They are responsible for 30 percent of the heating and cooling requirements in U.S. homes and businesses — adding up to $40 billion a year. Improved technologies and better design could slice this energy loss in half, and it is even possible today to turn windows from net energy losers into energy suppliers.

In 2003, Berkeley Lab opened the Advanced Window Systems Test Facility on a south-facing bluff overlooking San Francisco Bay. Ever since, it has been a focal point for energy-saving innovation. Inside are three realistic office rooms wired with instruments to measure heating, cooling, and lighting. The windows that illuminate these rooms are regularly switched out to compare new glass coatings or glazing technologies, such as panes that change from clear to a deep-blue tint when a small electric current is applied. Dynamic blinds and shading systems, mounted inside or outside, can be evaluated for their effects on temperature, glare, and comfort as they track the sun throughout the workday.

Berkeley Lab scientists know that the quickest and least expensive way to find new sources of energy is to stop wasting what we already produce. Because buildings account for 40 percent of U.S. energy consumption, the energy savings potential of more efficient buildings is enormous. The Advanced Window Systems Test Facility is a proving ground where Berkeley Lab scientists work closely with private industry to speed these new technologies to market, and take us all a step closer to a sustainable energy future.



Caption:

Making Windows Smart

Electrochromic "smart" windows have the ability to switch from transparent to dark-tinted in a matter of minutes through the application of a weak electric current. Clear windows bring in the sunlight when it is beneficial, such as in the early morning and on cold winter days. When there is too much sun, the dark-blue tint reduces heat and glare. With manual or computer control, this electric tinting can maintain pleasing light and temperature conditions throughout the day, saving energy the whole time.

These windows are made by depositing multiple layers of specialized materials on glass or plastic. Chemically, these thin sandwiched layers act much like those in a battery. The outside layer is tough, transparent, and electrically conductive. As voltage is applied to it, lithium ions stored in an interior layer begin migrating toward the front. When these ions reach the active electrochromic layer, it turns Prussian blue. Reversing the voltage causes electrons to flow into the tinted layer, making it once again transparent.

Measuring Progress

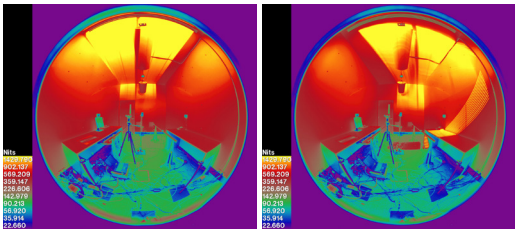
Each of the three rooms in the Advanced Windows System Test Facility contains more than 50 sensors used to measure factors such as interior light levels, surface brightness, temperature changes, and the status of window controllers. Along with data on exterior weather and light conditions, this information is sent to computers for analysis. The testing rooms are also monitored with digital cameras equipped with fish-eye lenses. Using a color gradient like those that display temperature changes on a weather map, the cameras log the progression of heat and light in the rooms as the sun sweeps past the test windows throughout the day.

A View to the Future

Berkeley Lab is planning to open in 2013 a new series of eight flexible double-room modules that can be outfitted by clients to test new windows, dynamic shading, roofing, and skylights. Heating, ventilation and air conditioning (HVAC) systems will be tried out as well. One module can rotate like a carousel to track the movement of the sun. Interior components such as computer-controlled energy systems, specialized ceilings, and lighting also can be evaluated. Located adjacent to Building 90, headquarters for the Environmental Energy Technology Division, these new, south-facing test beds will be available to researchers from industry, universities, and DOE National Laboratories.

Berkeley Lab's Advanced Window Systems Testing Facility is supported by funding from the U.S. Department of Energy's Office of Energy Efficiency & Renewable Energy (EERE) and the California Energy Commission's Public Interest Energy Research program (CEC PIER).

Caption:



Caption:

PIER PUBLIC INTEREST ENERGY RESEARCH "Research Powers the Future"

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

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Find out more at: **windows.lbl.gov.**
For more details and the latest news, visit **www.lbl.gov.**