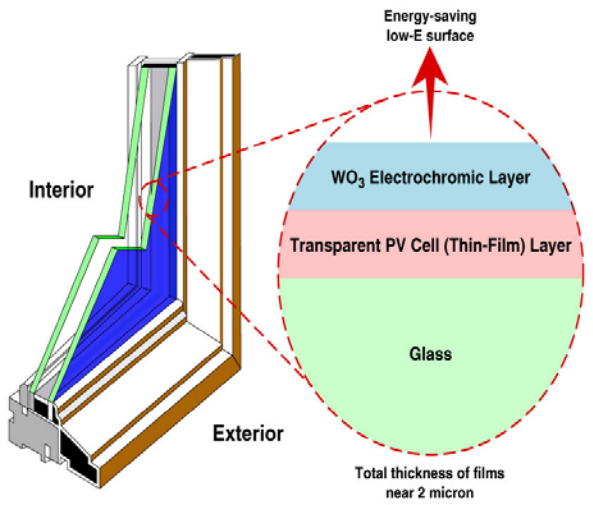
A national laboratory of the U.S. Department of Energy
Office of Energy Efficiency & Renewable Energy

NREL National Renewable Energy Laboratory

Innovation for Our Energy Future

PowerView Semi-Transparent Photovoltaic Module – "Smart Glass"

NREL is excited to introduce a breakthrough solar-powered technology with multiple market applications. This new technology, the PowerView Semi-Transparent Photovoltaic Module or "Smart Glass" is a self-dimming, self-powered glass that combines photovoltaic (PV) technology with electrochromic (EC) technology. The technology operates by coating the inside surface of the glass with a transparent, thin film PV cell followed by an EC layer. The PV cell provides power to activate the EC layer, darkening or lightening the window. The smart glass window can block up to 98% of transmitted light and 100% of UV light all the time. The user can also control the amount of light transmitted through the glass.



There are many energy efficiency and comfort benefits. The smart glass mitigates solar heat gain, including heat build-up, in buildings, homes, and vehicles resulting in reduced energy costs and a gain in user comfort. The PV and EC films can also be applied to thin polymer films that can be retrofitted onto existing windows in homes, buildings, and vehicles. The advantage the NREL smart glass has over similar products, such as suspended particle devices, is that it is *self-powering*. The NREL smart glass does not need to be connected to the electrical system of a building, house, or vehicle in order to operate, reducing the installation and operational costs. A safety and aesthetic feature of the smart glass is that should it fail, it will fail clear.

The smart glass can be used in commercial, residential, and vehicle windows, for both new and retrofit applications. Interior glass windows, day lighting applications, skylights, walls, floors, and partitions can use the smart glass technology. Indoor signage and displays can be made using smart glass. The smart glass technology can also be applied to dynamic or high performance eyewear such as sunglasses, prescription glasses, goggles, and motorcycle visors.

There are several market applications for this type of technology. Such as the window market, encompassing commercial, residential, and replacement windows, and is estimated to be $15Billion in the U.S., $30-$45Billion worldwide. Higher energy efficient building codes at the federal and state levels, rising energy costs, the focus on cost containment, increasing productivity, the bottom line, and the increasing amount of time spent indoors are a few of the market drivers that this technology meets. Other market applications include the worldwide automotive glass market, valued at approximately $4Billion, larger if other vehicles are included; and the sunglass and goggle worldwide market, valued at an estimated $9Billion.

The value proposition for this technology is that the NREL “smart glass” can increase revenue by reducing energy costs, increasing worker productivity, and increasing sales revenue. This is supported by demonstrated demand for this type of technology in studies that estimate energy efficient windows saving, in peak energy periods, 4-5 Quads ($40-$50Billion/year) of energy per year. Worker productivity has been shown to increase by 6-15% by employing energy efficient building designs. The Electric Power Research Institute has shown that the use of daylight in buildings can result in a 10-20% increase in rental income. A 1999 PG&E study comparing stores utilizing daylight versus artificially lighted stores showed that stores with natural daylight had 40% higher sales. Large box stores like COSTCO, Home Depot, ToysRUs, IKEA are using natural daylight to reduce energy costs and to boost sales revenue.

Licensing Our Technology

NREL is looking for a strategic alliance to develop and commercialize this platform technology. The alliance could be a license, a Cooperative Research and Development Agreement (CRADA), or a Work For Others (WFO) that leverages NREL’s unique capabilities, facilities, and personnel. For additional information on NREL’s electrochromic program please visit the following website http://www.nrel.gov/basic_sciences/basicframe.html If you want additional technical information on this technology please contact Roland Pitts at roalnd_pitts@nrel.gov. If you are interested in partnering with NREL through a license or CRADA or WFO, please contact Richard Bolin at richard_bolin@nrel.gov.

Contact Information

If you would like to explore collaborative opportunities with the National Renewable Energy Laboratory please contact Richard Bolin, 303-275-3028 or by email at Richard_bolin@nrel.gov.

Also for more technology transfer opportunities visit our Web site at www.nrel.gov/technologytransfer.