Smart Glass for Commercial Buildings

Installing “dynamic glass" in large buildings saves energy

Center for Natural Sciences, Mathematics, and Nursing at Bowie State University, Md. (Photo courtesy of SageGlass)

The Impact

Windows are often the most inefficient part of a building envelope. Installing smart glass (also called dynamic or electrochromic glass) or special sheet coatings greatly improves energy efficiency. Smart Glass has the potential to cut heating, ventilation and air-conditioning (HVAC) costs by up to 30% and lighting costs by as much as 60%.

Description

Smart glass products typically consist of layers of glass panes in a sealed, insulated glass unit (IGU) with a thin layer of metal oxides placed between two glass panes or applied to one or more panes. Bursts of voltage can stimulate color changes in the glass, causing it to change its tint. Another method is to physically and chemically treat the glass during manufacturing so that it automatically transitions during the day from clear to tinted, translucent or even opaque glass without electricity. For retrofits of existing windows, some manufacturers provide sheet coverings that are either electrically charged or treated with chemicals.

Smart glass can be incredibly useful for reducing heat gain (an increase in interior temperature) from sun-exposed windows, thus reducing energy costs for cooling. As the day goes on, the electrically charged glass can be programmed to automatically change its tint to allow in more light and heat. This regimen can be optimized for energy efficiency. Project Drawdown estimates that smart glass could result in 0.34 to 0.54 gigatons of emissions reductions between 2020 and 2050 in the U.S.

Where It's Been Implemented

Smart glass is found most often in Europe and Canada. Examples are also found in the United States at Bowie State University in Maryland (shown above) and yogurt company Chobani's office building in Twin Falls, Idaho. Other examples include the U.S. General Services Administration headquarters building in Washington, D.C., the McKinnon Center at the University of New Mexico and the Luminary Office Building in Dallas, Texas.

Key Drivers

Buildings for residential and commercial use constitute the most significant energy-consuming segment in the U.S. economy. They account for around 40% of America's total energy usage, use up 74% of its electricity, and are responsible for 35% of the nation's overall carbon emissions. About 35% of an average building's energy is lost through its windows. Therefore, solutions that significantly reduce electricity usage, especially in large buildings, can have a great and lasting impact on carbon emissions. Additionally, reducing energy use will drastically decrease long-term costs. While smart glass is more expensive than traditional glass, the energy cost savings can, over time, more than make up for the initial expense.

With the onset of more drastic weather due to global warming, heat waves and hot summers will become progressively more common, causing an increase in energy bills. Smart glass could become a cost-competitive option to decrease the overall expenses of a building. Furthermore, power grids can become overstressed during intense periods of heat. Buildings that require less electricity to stay cool can help ease the strain on power grids.

Key Factors for Success

Local climate, weather, building location and builder adoption are all important factors for the success and impact of this solution. Buildings with high sun exposure will benefit much more from smart glass applications, both in new construction and in retrofits. During summer and warmer times of years, the energy requirement for cooling interior air can be reduced through the utilization of smart glass. Programmable smart glass can reduce heating loads in the winter, too.

The successful adoption of smart glass technology depends, among other factors, on making smart glass more affordable through economies of scale and technological advancements. In addition, subsidies, tax credits, or rebates from governments or energy companies to offset the initial installation costs will aid this process.

Key Obstacles

The main obstacle is price. While prices vary, smart glass is roughly three times more expensive than traditional glass. However, energy savings will accumulate over time, and smart glass has the potential to pay for itself within five to seven years.

Timeline to Implementation

The best time to install smart or dynamic glass is at the time of new construction, although retrofit films do show promise. While additional care must be taken by the builder when installing smart glass, the time it takes to install it is similar to ordinary glass. Smart glass is not widely used in the United States, but, as knowledge of the benefits of smart glass increases, its application will likely accelerate.

Background

Historically, windows have consisted of only one pane of clear glass, which is a very poor insulator, quickly causing heat or cooling loss. In order to retain heat in the winter and keep heat out in the summer, double-paned and even triple-paned windows became popular beginning in the 1970s. Today, single-pane windows are almost never installed in new construction or retrofits. In the early 2000s, improvements in production saw low emissivity or “Low-E” glass, a thin coating on the glass panes to keep heat in or out, depending on the season. Smart glass takes that technology one step further. As awareness of the climate crisis increases, and as energy costs mount, installing smart glass in new construction will be an increasingly attractive option.

First developed in 1984, smart window technology has significantly extended beyond research laboratories. It is projected that the smart glass market will attain a value of $7.5 billion by 2028. Various forms of smart windows are already being utilized in boats, vehicles, and aircraft, and are increasingly being incorporated into structures like office buildings and airport terminals.

References and Resources

- Architect Magazine, October 11, 2019. “How to Specify Smart Glass”
- Dynamic Glass, Project Drawdown
- Helpful Descriptive Brochures from SageGlass.com
- Sage Builds a Brighter Future for Smart Glass, GreenBiz
- Chobani Headquarters Example
- Bowie State University Example

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