Glass of the Future

Burnham-Moores Center for Real Estate
University of San Diego
Master of Science in Real Estate Program

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Inefficient windows = wasted energy

- According to the U.S. Department of Energy, 25% to 35% of energy wasted in buildings is due to inefficient windows
- The California Energy Commission estimates that around 40% of a typical building’s cooling requirements are due to solar heat gain through windows
- **Windows are important factors in energy efficient buildings**
Smart Glass in Commercial Buildings

- Glass or glazing that varies light transmittance and/or thermal properties of windows

Types of Smart Glass

- Liquid Crystal
- Low-E
- Thermochromic
- Electrochromic
• Allows light flow with privacy
• Used for privacy control
• Changes on demand with an electric current
  • Advantages: Privacy at the flip of a switch, no window coverings needed
  • Disadvantages: Does not conserve energy
• Detailed description here: http://www.switchlite.com/home.html
- Traditionally used energy efficient glass
- Glass treated with invisible metallic coating to reflect or trap light and heat
- Reduces the amount of ultraviolet light that enters your home without blocking visible light

**Advantages:** Limits UV rays, reduces energy bill, prevents furniture from fading, reduces sound levels in home

**Disadvantages:** More costly than regular glass, slight haze to windows, no manual control, no control over visible light

- Detailed description here: http://www.efficientwindows.org/lowe.php
- Tint level based on temperature of the material
- Adapts directly to changing sunlight intensity
- Combined with low-e technology

**Advantages:** Continuously adapts tint to sunlight to manage heat and glare, installation the same as traditional windows, No power supply needed,

**Disadvantages:** Cannot be manually controlled, glass may not receive enough heat from direct sunlight to darken, added weight to insulated glass units

• Electrical current creates chemical reaction causing window to tint
• Depending on electrical current, selectable darkness allows more control over sun levels
• Current is not required to maintain tint level, only to change color states
• Very little current needed (power entire building of electrochromic windows equal to one light bulb)

- Detailed description here: http://www.commercialwindows.org/electrochromic.php
Case Study Comparison | Low-E vs. Dynamic Glass

**Low Rise Office**
4 stories, 80,000 sf
- $15.5M new construction
- 40% window to wall punched-opening windows
- Packaged rooftop unit VAV
- Dynamic glass on E+W+S facades

**Traditional Building**
- U Factor: 0.29 BTU/hr.ft².F
- SHGC: 0.38
- Tvis: 70%
- Manual shades on all sides
- Overhang on south façade

**Dynamic Building**
- U Factor: 0.29 BTU/hr.ft².F
- SHGC: 0.09 – 0.46
- Tvis: 3% – 58%
- Manual shades on north façade

Smart Glass | University of San Diego, MSRE

*Provided by View Dynamic Glass*
$1/sf premium for Dynamic Glass
0.5% premium of total building cost

11% lower OPEX

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<th>Annual Operating Costs Low Rise Office ($k)</th>
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14% HVAC and lighting electricity savings

8% lower peak cooling load
Example Project – Marine Corps Air Station Miramar, California

- Part of Department of Defense’s Environmental Security Technology Certification Program (ESTCP)
- Retrofit project – 1,700 square feet of low performing clear glass replaced

**Estimated Results**

- 23% reduction in HVAC peak cooling load
- 18% decrease in gas use
- 9% decrease in total energy use on annual basis
Tint change over 20 minutes…
Electrochromic Glass

**Challenges**
- New technology with technical glitches
- Higher upfront costs
- Installation more difficult
- Higher maintenance costs
- Without proven track record, hard to prove cost benefits
- Does not replace blinds or other window treatments
- Long transition times

**Benefits**
- Energy Savings and greater energy management
- Can include sensor to automatically tint windows
- Manual control of tint level of individual windows
- Greater management of heat and glare
- More natural light and uninterrupted views
- Increase occupant comfort and productivity
- Allows for greater window to wall ratios, while still meeting codes and energy efficiency objectives
- Applicable in new construction and retrofit buildings
- Earns points towards Leed
Dynamic Glass and LEED

LEED Certification Points (up to 28 pts)

- Energy and atmosphere 18
- Indoor environment quality
  - Thermal comfort 1
  - Daylight 3
  - Quality views 1
  - Interior lighting 2
- Sustainable sights 1
- Material and Resources 2

* View Dynamic Glass
Future of Smart Glass

- Increase cost efficiencies
- Integration of smart glass with other electrical systems within building such as the HVAC and lighting systems
- Photovoltaic smart glass – generating electricity while darkening windows with thin film of PV panel
- Wireless systems
- Other electronics in glass such as thermometer or display
Questions?
Links + Resources


Links + Resources continued


• Wasco, Mick. "View Windows at MCAS." Personal interview. 27 Feb. 2014.


Links + Resources continued