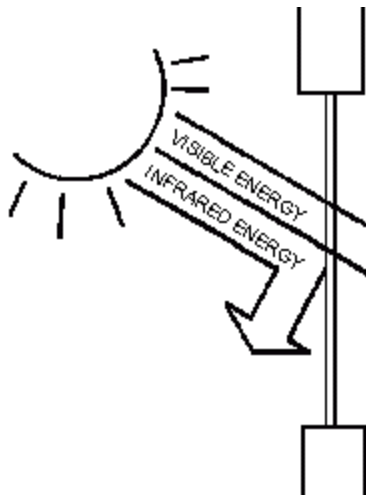


Energy-Efficient Window Glazing Systems

A Pacific Energy Center Factsheet

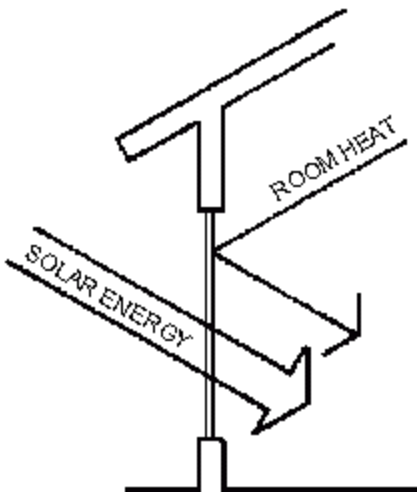


*Characteristics of the ideal window in a cooling load dominated building**

How This Technology Saves Energy

Proper window design and selection can reduce a building's energy use throughout the year. Electric lighting requirements can be reduced by designing windows to take advantage of natural daylight. For buildings with significant cooling loads, special glazings can reject excessive summer solar heat.

Where cooling loads are the major concern, as in most commercial buildings, the perfect window would provide light but no heat. About 45 percent of the sun's energy is at visible wavelengths; the rest is invisible. To minimize cooling loads, it is desirable to transmit as much visible energy as desired for the application, while rejecting the rest of the solar radiation. Such a window has high visible transmittance (the percentage of visible light that passes through) and a low shading coefficient (an indicator of heat gain due to solar radiation).



*Characteristics of the ideal window in a heating load dominated building**

Alternatively, for buildings with significant heating loads, low-emissivity (low-E) coatings can be applied to double-pane glass to minimize heat loss through the window. These glazings let solar heat in to offset winter heating system requirements and keep the warmth inside. Gases such as argon and krypton between the glass surfaces further improve thermal resistance.

Energy-Efficient Window Glazings

Commercial building windows can be optimized for particular applications with several different types of glazings, described below.

Tinted Glazings

Tinted glass, sometimes called absorbing glass, has energy-absorbing materials within it, lowering the shading coefficient and giving a tint—generally bronze, gray, blue, or green.

Reflective Glazings

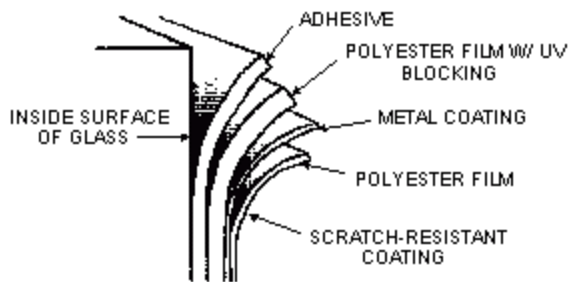
Reflective glazings have better shading coefficients than tinted glazings because they reflect rather than absorb most of the infrared heat. The reflective coating is made of thin layers of metals or metallic oxides on the surface of the glass.

Spectrally Selective Glazings

Tinted and reflective glazings achieve a low shading coefficient but make the window appear dark. Spectrally selective glazings allow the light to pass through without the heat. They are highly transmissive in the visible spectrum while blocking the infrared. They selectively transmit or reflect specific wavelengths, giving both an excellent shading coefficient and good visible transmittance.

Applied Films

Applied solar control films, also known as adhesive-backed films, are a common retrofit. They typically darken a window and give a mirror-like look to the glass, particularly the films that offer the highest degree of solar control. Window films are multilayer assemblies of coatings and polyester films. They are attached to the insides of existing windows by an adhesive backing. Current products are highly scratch-resistant and long lasting. Optical clarity is excellent and the films generally hold up 5-15 years.



Multi-Layer Film Assembly

Low-Emissivity (Low-E) Glazings

Where heat loss is more of a concern, as in smaller buildings in cooler climates, low-E glazings may be appropriate. These ultra-thin, transparent, metallic coatings reflect heat back to its source. Applied to at least one inside glass surface in a double-pane window or on a plastic layer suspended in

the air gap, low-E coatings increase the window's ability to reflect long wave infrared radiation, reducing energy loss from a warm room. Low-E glazings may also enclose gases such as argon or krypton between the panes to reduce conductive heat loss.

Benefits and Pitfalls

In most commercial buildings, energy-efficient window glazings result in significant energy savings and improvements in comfort. However, the different types of glazings have characteristics which may or may not be appropriate for a particular situation. Both the benefits and pitfalls of each glazing option should be considered before choosing a particular glazing.

Benefits

- Tinted, reflective, and spectrally selective glazings can all reduce solar heat gain significantly.
- Spectrally selective glazings let in the most visible light, providing the greatest daylighting opportunity.
- A gas-filled multi-layered low-E window with a good frame that has thermal breaks or is vinyl can out perform a standard insulated wall in terms of overall seasonal heating loads by allowing solar heat in and not allowing room heat out.
- Tints and reflective glazings can give a building a pleasing appearance.
- Applied films reduce solar heat, glare, and UV; increase shatter resistance; and provide some improvement in insulation value.

Pitfalls

- Tints alone only achieve a modest shading coefficient because some of the heat absorbed eventually transfers into the space as radiant heat. Reflective glazings can have similar problems if installed on the inside of the glass.
- Reflective glazings may cause increased lighting requirements and indirect cooling load attributable to the lighting because of their very low light transmittance.
- Tints have a color which may or may not be appealing. And, for consistent appearance they are applied to all faces of the building even though they may not be economic on all faces.
- Spectrally selective glazings can produce problems with glare, particularly in rooms with computer screens.

For More Information

Contact your PG&E representative or call 1-800-468-4743 for more information about PG&E's energy efficiency programs and other services.

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