



Products

ENTER A SEARCH CONCEPT OR KEYWORD:

welcome products library professional development projects what's new contact us about us site map

Winter 2000 Vol 5 No 1

article 11 of 13

[previous article](#) | [next article](#)

[Contents](#)

features

- [2020 focus](#)
- [Energy efficiency... and a lot more](#)
- [Getting the most out of energy](#)
- [Old McDonald had \(an energy efficient\) farm](#)

newsbriefs

- ['Check out' this energy efficiency program](#)
- [More stuff less energy](#)
- [Milwaukee carpenter recycles houses](#)
- [It's high noon for daylighting](#)

e² Science

- [Energy efficient residential windows](#)

notes & business

- [President's Note](#)

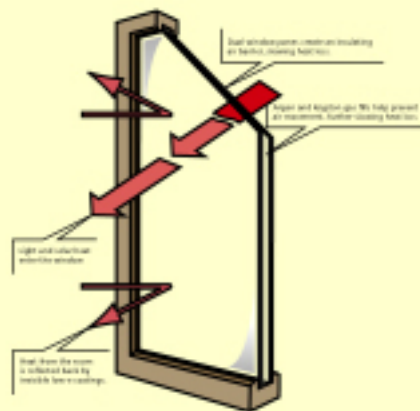
e² Newsletter

Energy efficient residential windows

Windows used to be simple: a single pane of glass and a frame. They kept out wind and gave people a view. The problem was energy—single paned windows had the same insulating power as a sheet of steel (about R-1). As people became more concerned about energy, various innovations were added to make windows more efficient.

The first innovation was storm windows, which kept out wind and created an insulating layer of air. Dual paned windows were based on this idea and they first became popular in the 1970's. Later, gas fills between the panes added still more insulation. Finally, special coatings were put on the glass to reflect heat back into the room. Thanks to these innovations, typical energy efficient windows are three times more efficient—and much more comfortable—than single paned windows of old.

See full window view of an energy efficient [window diagram](#)



Dual panes

Dual window panes help keep a house warm by creating a buffer between the cold air outside and the warm air inside, much the way a coat protects you from winter winds. For this buffer to work, it's important that the trapped air doesn't convect. Convection happens when warm air rises and cold air sinks, setting up a circulation that moves heat between the inner and outer panes. This transfers heat out of the house and impairs efficiency.

To prevent convection, it's essential to have the right size air gap. "A narrow air gap—around half an inch—is optimal," says Ross DePaola, owner of WESTLab in Madison, Wisconsin, which tests the energy performance of windows. "If the gap is narrower, you don't have enough of a buffer. If it's any wider, you get air movement."

Gas filled

Gas fills help prevent convection because they are heavier than air and therefore less likely to move. Gases such as argon and krypton also

- [From the Director](#)
- [Commentary](#)
- [FY 1999 financial summary](#)



[home](#)

conduct heat less quickly than air, further slowing down heat loss.

Low-emittance

Low-emittance, or low-e, coatings save energy by reflecting infrared heat back into the room. "Imagine putting aluminum foil on a window," says DePaola. "Only you make it so thin you can't see it." These coatings, which are invisible, are often made of silver.

By contrast, windows without a reflective coating allow heat from the room and people to stream outside, making the area near the window feel cold. This can cause people to turn up the thermostat to compensate—something low-e windows help prevent.

The future

Researchers are already working on advanced window technologies to make windows still more efficient. One idea is to use a vacuum, instead of a gas fill, between the window panes (like a thermos bottle). This would prevent heat loss by air convection and conduction altogether.

Another innovation is so-called "smart windows," which can change their characteristics based on the environment. For example, if there was too much solar heat coming through the windows in the summer, the window would automatically become more reflective. In the winter, the window would let in the maximum amount of heat.

In the future windows may be more efficient than a highly insulated wall. This is because windows can let heat in, not just prevent it from leaking out. Someday we may really be able to live in glass houses. At least it won't be high energy bills that prevent it! [Understanding window labels -- next page >>](#)

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