

Rosseville Project



LoĒ²
Glass
Products

Cardinal®

You can
reduce
your
cooling
energy
usage by
25% or
more.
Here is
the proof.



Hot-Button Issues

Residents of California, Arizona, and Nevada don't need a weather forecast to know how oppressively hot it can get. During the seemingly endless summers, air conditioners are strained to keep the house cool and comfortable. The right kind of glass can make a big difference.

Cardinal has long known that LoĒ²™, a highly efficient coated glass, can help slash summer heat gain through windows, which in turn means substantial energy savings. But Cardinal wanted to prove it.

Cardinal purchased two identical tract homes in Roseville, California, a bedroom community near Sacramento (seen above).

One house was outfitted with Cardinal LoĒ², while the other retained ordinary clear 2-pane glass. The houses were unoccupied, but equipped with electrical heaters that simulated normal occupancy. They also had on-site monitoring equipment that tested indoor and outdoor temperature and humidity, furnace and air conditioner energy consumption, and other important factors. Cardinal's results conclusively show that LoĒ² can cut energy costs, make homes more comfortable, and even reduce pollution in the environment. Clearly, LoĒ² is no ordinary glass.

HOUSING FEATURES

- Vinyl frame windows
- 17% window-to-floor area ratio
- A/C unit capacity:
 - 2-pane clear house, 3.5 tons
 - LoĒ² house, 2.5 tons
- Air/duct leakage and thermostat calibration tested and balanced

You can reduce your cooling energy load.

Noticeable Savings

Windows are the single largest factor in a home's cooling load. Cardinal has now gathered two years worth of data from Roseville, which offers unequivocal evidence of the energy savings offered by LoĒ². In contrast to the home with 2-pane clear glass, Cardinal LoĒ² cut solar heat gain by more than 50%. In the house with Cardinal LoĒ², Cardinal measured a remarkable 27% savings on cooling costs.

Energy savings extended to the winter time as well. The LoĒ² house saved 10% on the heating bill when compared to the house with regular clear glass.

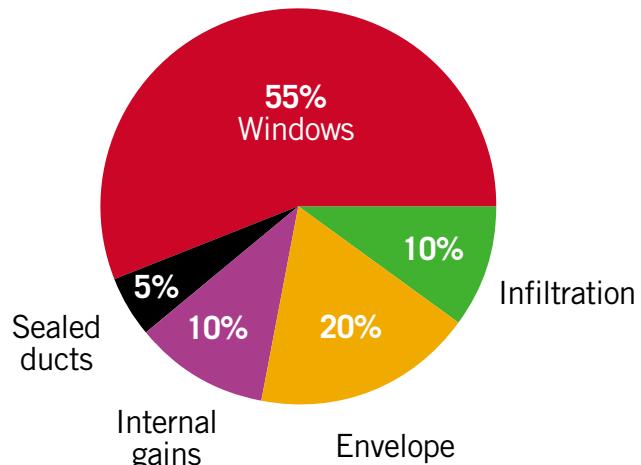
The stellar energy performance of Cardinal LoĒ² means that a smaller air conditioner can be used to cool the same space. Cardinal found that the combination of LoĒ² and a smaller air conditioning unit with an increased Seasonal Energy Efficiency Ratio (SEER) can save 35% annually on heating and cooling costs.

For the builder, this is the lowest cost, most highly efficient upgrade available.

For the homeowner, the combination of energy and equipment savings can add up to \$12,000 over thirty years.*

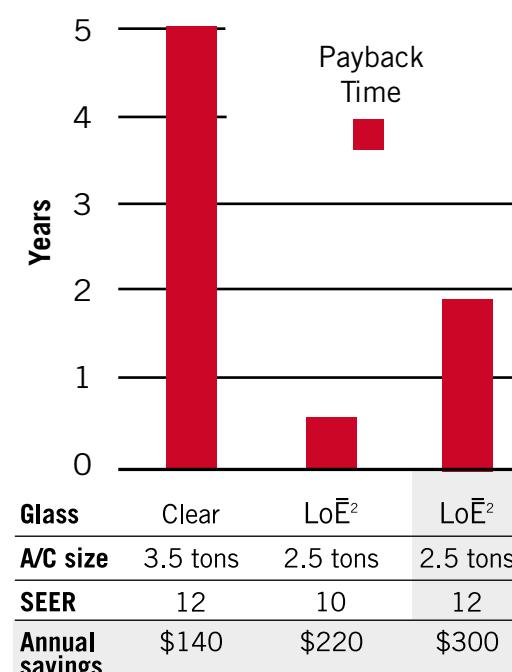
*Assumes a 2% year-over-year increase in energy rates.

Cooling loads for homes with clear glass windows



Roseville savings analysis

LoĒ² and a smaller-sized, high SEER A/C unit - the best energy and cost savings over the long term.



You can reduce your heating energy load.

Power Choices

Cardinal's extensive research with its test houses in Roseville has already demonstrated the energy savings that can be achieved by using LoĒ². But that's not the only benefit.

Currently, there are roughly a quarter of a million new homes built every year in California, Arizona, and Nevada. Based on the demonstrated savings produced by LoĒ² in Roseville, Cardinal projects that if all new windows in this region used low solar gain glass rather than clear, the energy savings would equal 1 billion kilowatt hours per year. The peak load savings equate to building one new 400 Megawatt power plant every year.*

What does this mean for the region in practical terms? Accumulated over 10 years of new home construction:

- Homeowners would save \$5 billion dollars on their electric bills.
- Peak load savings would have the same effect as adding more than 5% to the existing total electrical generation capacity.
- Air pollution savings would equate to shutting down all power plants for the next 3 months.

While each homeowner will enjoy a measurable savings in their energy bill, the cumulative effects mean cleaner air for everyone and increased reliability of electrical supplies into the future.

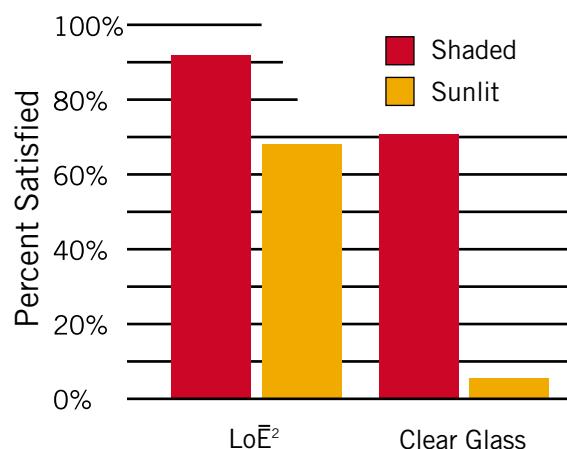
*Estimated peak load reduction of one kW per house. Assumes window replacement in existing homes at 80% of new home start rate. Estimated energy savings of 2,200 kWh per house per year. Regional electrical generation capacity and air emission analysis comes from E-GRID 2000 database.

Comfort Zone

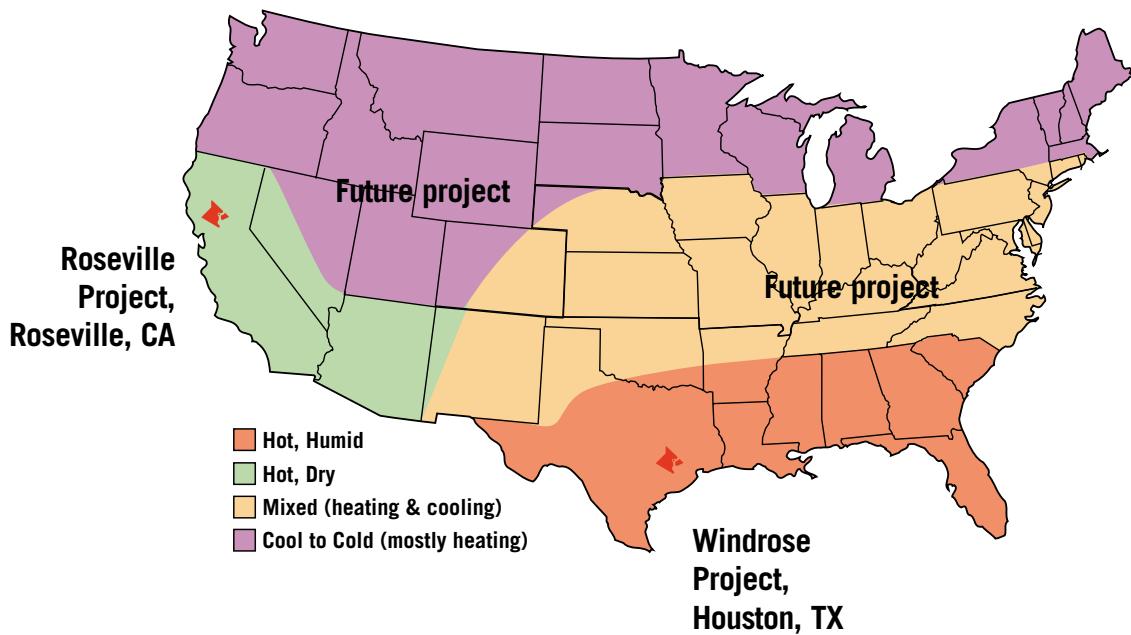
The American Society of Heating, Refrigeration and Air Conditioning Engineers has developed standards to rate the thermal comfort of an indoor environment. ASHRAE Standard 55 defines an environment as "acceptable" when 80% of the occupants are comfortable.

Using the measured temperatures from the Roseville test homes, the charts below show how dramatic the improvement in comfort is with LoĒ². Even with direct sunlight shining in, the home with LoĒ² will feel more pleasant than the clear glass house with the shades drawn. To develop a comparable comfort level in the clear glass house, the homeowner would have to lower the cooling thermostat setting by 4°F or more. Set for equal comfort, the energy analyses show that the measured savings of 25% for LoĒ² would now increase to nearly 40%!

Your choice of glass affects comfort



Cardinal LoĒ² offers energy savings, pollution reduction, and improved comfort when compared to ordinary clear 2-pane glass. Cardinal's Roseville project is the proof.



Looking Beyond Roseville

Cardinal's testing in Roseville, California, marked the beginning of an extensive, ongoing testing program to demonstrate the performance of Cardinal LoĒ².

Cardinal is currently performing similar tests in different areas around the country to measure the performance of Cardinal LoĒ² in different climates and varied conditions.

The Roseville project depicts results in the southwestern region, which typifies a hot, dry climate. Further testing is or will be conducted in these regions:

- South and Gulf coast (Hot, Humid)
 - Windrose Project - ongoing
- Middle corridor (Mixed)
- North (Cool to Cold)

Cardinal will periodically publish the results of its findings for the benefit of its customers and the glass industry at large.

For more information about LoĒ² please talk to your builder, architect, contractor, or window manufacturer. Or visit our web site at: www.cardinalcorp.com.

 **Cardinal**[®]

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