

WindroseProject



LoE²
Glass
Products



Another
success
story:
LoE² saves
energy in
the South



Sweltering South

The most difficult regions to cool in the United States are the South and Gulf coast. These subtropical areas sport summer temperatures well into the 90's and a high relative humidity. This creates special requirements in thermal cooling of homes and buildings. If the building's air conditioner is oversized to compensate for excessive heat gain, it is difficult to get comfortable humidity control. Excessive peak loads from these oversized systems put extra strain on the power utilities during hot weather and waste precious fossil fuel.

Cardinal knows that its LoE²™ coated glass can slash summer heat gain through windows, but wanted to prove it through testing and analysis. Following the successful Roseville project in California, Cardinal initiated a new two-year test in Texas to prove the benefits of LoE² in the South.

Cardinal purchased three identical 1,800 ft² tract homes in the Windrose community just north of Houston. (see table)

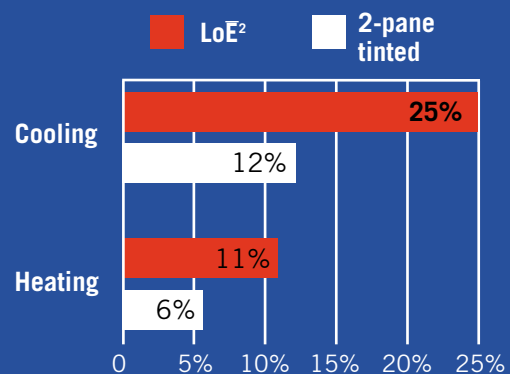
Windrose Housing Features

	Glass type	AC size in Tons	Visibility	IECC Code Compliant*
House 1	Single, tinted	4.0	Low	
House 2	2-pane, tinted	3.5	Low	
House 3	LoE ² , clear	2.5	High	X

*Based on the IECC Model Energy Code requirement of 0.40 SHGC. See www.energycodes.gov.

The houses had on-site monitoring equipment that recorded indoor and outdoor temperature and humidity, furnace and air conditioner energy consumption, and other important factors. What were the results? Our tests demonstrate that LoE² offers a marked improvement in energy savings when compared to single or 2-pane tinted glass products.

Energy Savings over Single Pane Tinted Glass



This brochure is designed to show what proven energy savings with LoE² glass can mean to you.

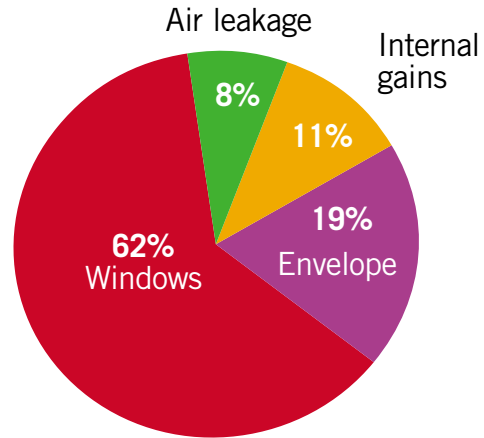
You can reduce your cooling energy usage by 25% or more.

Predictable Savings

Energy professionals often rely on predictive simulations to determine the thermal performance of buildings. Through its testing, Cardinal showed that the measured air-conditioning savings of the Windrose houses correlated well with computerized predictions. With confirmation that these simulations are accurate, the results can now be extended across the seven-state region.

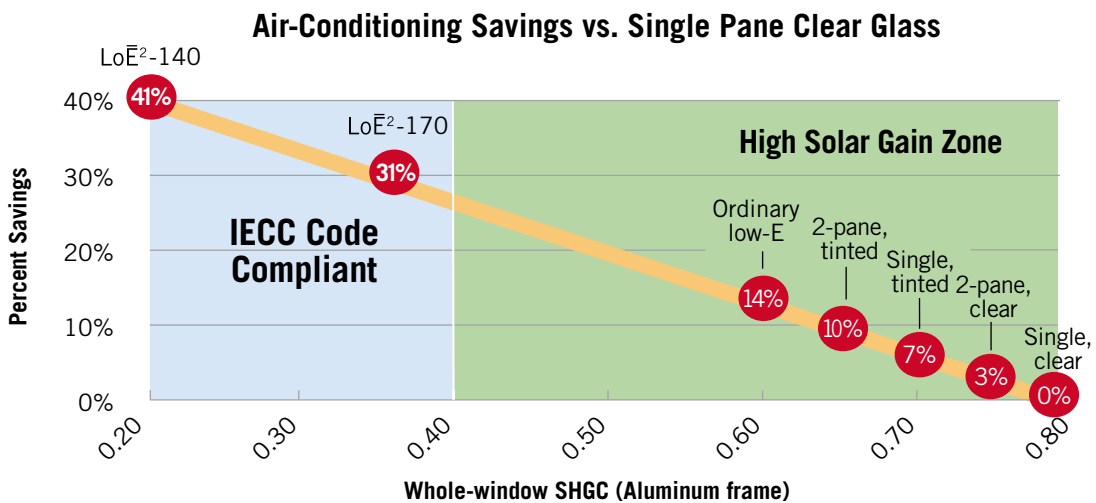
Windows are the largest component of the air-conditioning load - for the single pane tinted house the windows are nearly 2/3 of the peak demand. LoE² allows more daylight in, yet has half the solar gain of tinted windows. When the air conditioner is downsized to account for the reduction in solar gains, there is less variation in load. This reduces peak loads, saves cooling energy, and yields better dehumidification throughout the cooling season.

Cooling loads for homes with single pane tinted glass



The Solar Heat Gain Coefficient (SHGC) of LoE² makes it compliant with the stringent performance criteria of the International Energy Conservation Code (IECC).

The chart below shows how well the computer simulations compare with the Windrose testing process: the 26% predicted savings for LoE² versus single pane tinted glass matches precisely with the measured performance. Clearly, LoE² glass offers significant energy savings when compared to high solar gain glass products.



Emissions Control

The burning of fossil fuels to produce the electricity needed to cool homes also produces by-products that can affect air quality: nitrogen oxides (NOx) are a precursor to the formation of smog, sulfur dioxide (SO₂) is linked to acid rain and carbon dioxide (CO₂) is the dominant greenhouse gas believed to contribute to global climate change.

Energy-efficient LoE² windows not only save money on energy bills, but the reduction in power consumption will also reduce air pollution. There are over 300,000 new homes built in the South every year and an equal number that replace their old windows.¹ If all these homes used LoE² as opposed to regular clear or tinted glass, the air pollution savings would be over 400,000 tons per year. Accumulated over 30 years the avoided pollution by using LoE² would be close to 200 million tons!²

Certainly these are big numbers, but how can individual homeowners relate to this?

- These pollution savings equate to every one of the upgraded households driving their personal car 2,000 miles less per year.
- For the 7-state region the energy savings would eliminate the construction of a typical size power plant every year.
- The 30-year pollution savings from LoE² would be the equivalent to shutting off all of the power plants in the region for four months.

¹ From "Study of the U.S. Market for Windows, Doors and Skylights" by the Ducker Research Company, Inc.

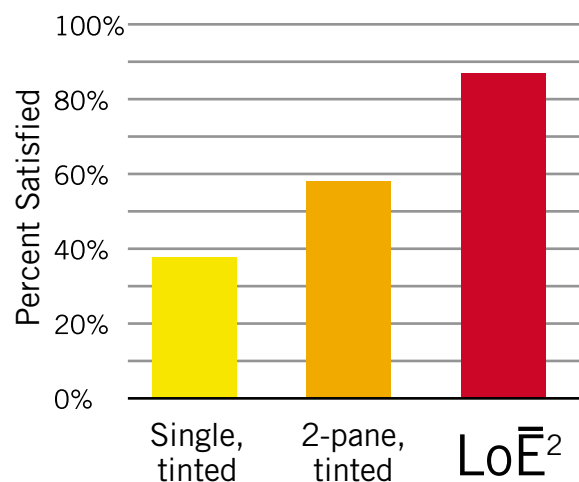
² From "Energy Savings and Pollution Prevention Benefits of Solar Heat Gain Standards in the International Energy Conservation Code" by Bill Prindle and Dariush Arasteh.

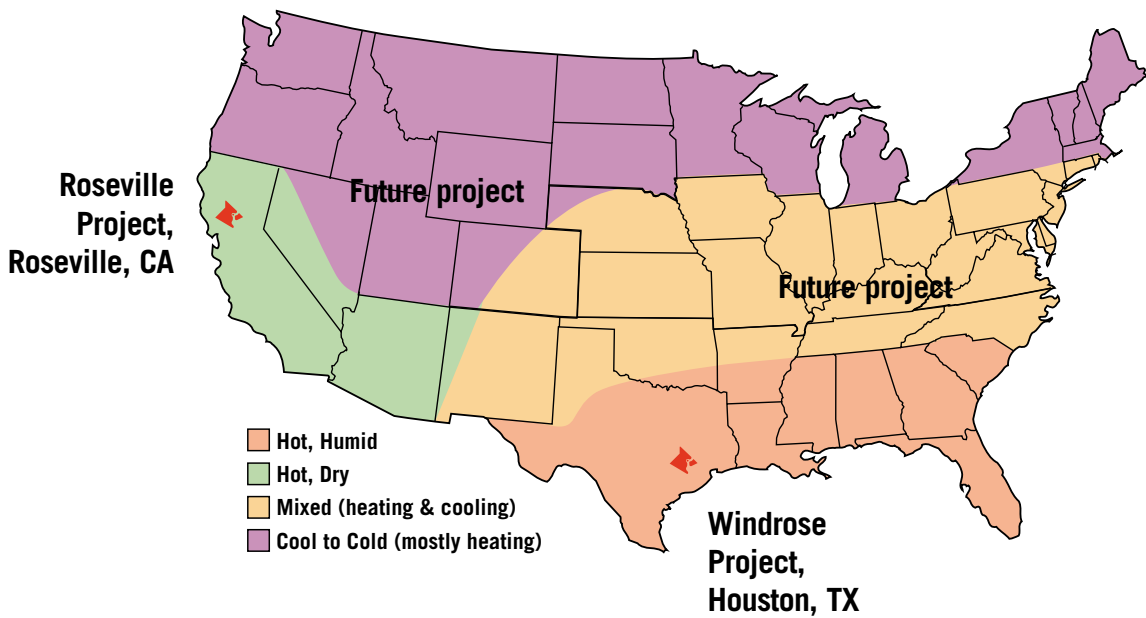
Comfort Zone

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.

Tinted glass products absorb solar energy and get hot in the sunlight. Glass surface temperatures can exceed 100°F even with relatively mild outdoor temperatures. The same thing happens with retrofit films that are installed to the inside of the house. The chart below shows that more than 60% of occupants will find the room with tinted single pane glass (or retrofit film) unacceptable. The double pane tint slightly improves comfort, but still fails against the criteria established by ASHRAE.

Acceptable comfort with LoE² windows is accomplished with a 78°F thermostat setting. The tinted windows would require a 74°F setting for double pane and a 72°F setting for single pane to achieve comfort equal to that with LoE².





Another Success Story

Windows with LoE² save energy, reduce fossil fuel emissions, and create a thermally comfortable home. Cardinal's Windrose project has proven this for the benefit of the South and Gulf coast regions, which typify a hot, humid climate. Previously, the Roseville project in California verified comparable energy savings for the Southwestern U.S.

In the future, Cardinal will be performing more tests in different areas around the country to measure LoE² performance in various climatic conditions. 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 LoE² please talk to your builder, architect, contractor, or window manufacturer. Or visit our website at www.cardinalcorp.com.

The Windrose project was managed by Bruce A. Wilcox, P.E. In addition to project management, Wilcox was responsible for the experimental design and analysis of the data collected. The Proctor Engineering Group verified the air-conditioning systems performance. Ed Hancock and Greg Barker of Mountain Energy Partners installed the data collection systems. Aeroseal sealed and tested the ductwork.

Energy Sense of Houston provided initial plan analysis, insulation inspection during construction, blower door testing multiple times during the test seasons, and acted as the local liaison. Gard Analytics performed DOE-2 energy modeling of the buildings. Ken Nittler of Westlab was responsible for NFRC ratings of the windows and assisted Gard with window performance data for the modeling programs.

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