Decision Factors:
Options for new ENERGY STAR Criteria for Windows, Doors, and Skylights
February 11, 2003

The Department of Energy is circulating two alternative sets of criteria for stakeholder comment. Each achieves the Department's stated goals of:

- Increasing energy savings beyond those achievable with the current ENERGY STAR criteria;
- Setting the ENERGY STAR criteria at a level consistent with, but more stringent than code wherever practical; and
- Providing consumer-friendly guidance on selecting high-performance windows.

Comparing the Two Alternatives

The two alternatives differ in their approach in that one, the one offered in May 2002 (referred to hereafter as the "three-zone alternative") focuses on increasing national energy savings while maximizing potential peak load reductions, and the other, referred to hereafter as the "four-zone alternative," is intended to maximize total national energy savings. Following is a discussion of the advantages and disadvantages of each alternative.

- Three-zone alternative: The criteria proposed on May 8, 2002.
- Four-zone alternative: This proposed criteria splits the Central Region into two separate climate regions, with the North/Central focused more on achieving maximum heating savings and the South/Central on achieving maximum cooling savings.

The significant differentiating factor in the two proposals is the extent of the solar heat gain control required in the area of the country approximately within 3,500 – 5,999 Heating Degree Days. DOE is inclined to believe the benefits of added solar heat gain protection in this region of the country and the resulting reduction in energy demand for the three-zone alternative outweigh the greater overall energy savings achieved of the four-zone alternative.

Reference/ Proposals	<2000 HDD	2000–3499	3500–5999	6000+
2000 IECC	U≤0.75 SHGC≤0.4	U≤0.5 SHGC≤0.4	U<.4 (U≤0.5 3500 to 3999	U < .35 SHGC – Any
Current Energy Star	U≤0.75 SHGC≤0.4		U≤0.4 SHGC≤0.55	U≤0.35 SHGC- Any
Three-Zone Alternative	U≤0.65 SHGC≤0.4	U≤0.4 SHGC≤0.4		U≤0.35 SHGC - Any
	CDD > 6300	**6300- 4500 CDD**	**3600–5400 HDD**	**5400+ HDD**
Four-Zone Alternative	U≤0.65 SHGC≤0.4	U≤0.4 SHGC≤0.4	U≤0.4 SHGC≤0.55	U≤0.35 SHGC – Any

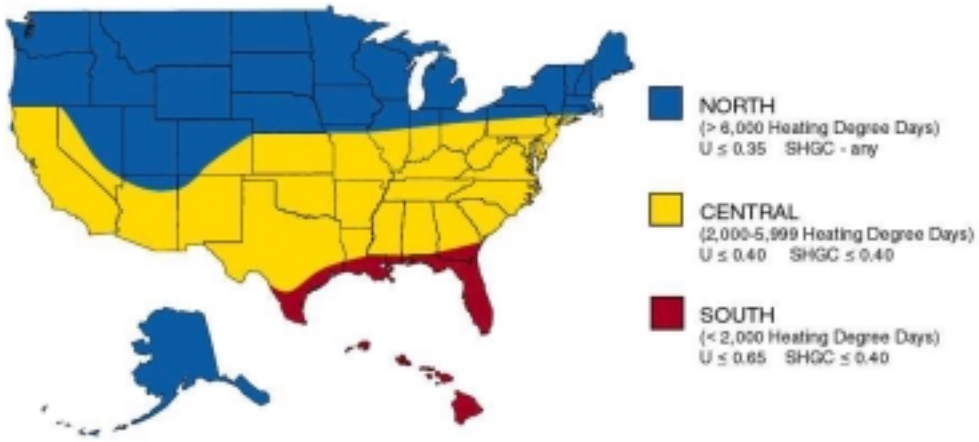
Northern Climate Region: Both alternatives set a U-factor maximum of less than or equal to 0.35, which is the level set by the IECC. Neither alternative is set more aggressively than the IECC because reducing the U-factor below 0.35 in this region would require triple glazing (at a price premium of 30 – 50%, and without a guaranteed payback for the consumer) and would eliminate metal-clad wood windows, which make up a significant percentage of the market. Under either each alternative, all glass manufacturers are expected to have products that would qualify for ENERGY STAR.

North/Central Climate Region: The three-zone alternative retains a larger Central Climate Region (2,000 – 5,999 HDD), while the four-zone alternative splits the Central Climate Region into two separate zones, with the North/Central Region focused on capturing heating energy savings by increasing the allowed solar heat gains. The IECC does not require a SHGC in this zone. If a SHGC maximum of 0.40 were set, only products using soft-coat Low-E technology would likely be used to meet the ENERGY STAR criteria (pyrolitic products could meet the criteria with triple-glazing, which would not be cost-effective).

South/Central Climate Region: The three-zone alternative retains a larger Central Climate Region (2,000 – 5,999 HDD), while the four-zone alternative splits the Central Climate Region into two separate zones, with the South/Central Region sharing the same emphasis on cooling energy savings. Both alternatives share the same criteria for the southern part of this region (approximately 2,000 – 3,499 HDD).

Southern Climate Region: Both alternatives are almost identical, requiring a U-factor of 0.65 or lower and a SHGC of 0.40 or lower. The difference is how the dividing line is drawn, with the four-zone alternative based on CDDs vice HDDs. The emphasis of the criteria is to maximize cooling energy savings in the hotter regions of the country.

Overview: The Three-Zone Alternative



Advantages of Three-Zone Alternative

National Energy Savings: The three-zone alternative represents significant energy savings over both IECC 2000 and the current ENERGY STAR program. The emphasis of this criteria set is on saving cooling energy. It represents, however, a slight decline in heating energy savings compared to the current ENERGY STAR criteria. However, of all the alternatives the Department has considered, except for the one set of criteria for the entire nation, it saves the most cooling energy. This is a benefit to consumers, as the cost of electricity for cooling is often higher than the cost of other fuels (gas, oil) for heating energy. An emphasis on saving cooling energy also benefits the environment, since cooling energy tends to contribute more to air pollution (provided by electric power, often through carbon-and sulfur-intensive fossil fuels)

Peak Shaving: The emphasis on cooling energy savings with the three-zone alternative represents a significant opportunity for summer peak energy savings. Several parts of the central climate region, including cities such as New York, face energy infrastructure issues that include reliability and peak load cost increases during sudden increases in energy demand, typically during hot summer weather. A criteria designed to alleviate cooling demand in this portion of the country can help to mitigate these problems during a transition of the regional energy systems. Choosing the three-zone alternative over the four-zone alternative could reduce peak power in the 3,400 – 5,400 HDD region by 4,612 MW, representing the total potential reduction in peak load for existing homes using cooling in this climate zone. Assuming windows are replaced every 40 years, this would equal the equivalent of displacing one 115-MW power plant every year.

Comfort: Summertime comfort is a key benefit of ENERGY STAR qualified windows and many manufacturers and retailers have incorporated both Low-e and SHGC into their marketing messages for regions of the country with both heating and cooling needs. Requiring a minimum SHGC for ENERGY STAR qualification in this region would ensure that consumers would realize comfort benefits as well as energy benefits.

Concerns with Three-Zone Alternative

Solar Heat Gain in Northern Region - The criteria does not allow for solar heat gain in the Northern Region. The criteria for the Northern climate region have not changed from the original criteria, allowing products with any solar heat gain coefficient to qualify.

Solar Heat Gain in Central Region - The criteria for the Central region does not represent the most energy efficient option for the upper part of the Central region by retaining a 0.40 SHGC, eliminating the potential for heating energy reductions accrued from solar gain. Most areas of the Central climate region encounter the need for both seasonal heating and cooling energy use. In fact, the analysis shows the potential for cooling energy reductions is more significant than for heating energy reductions in every proposal. The criteria is designed to take advantage of the significant opportunity to achieve cooling energy savings as well as adjusting the U-factor according to climate region for appropriate heating energy savings. While a high solar-gain glass option for northern regions could help to increase heating energy savings, those gains are largely offset by increases in cooling energy demand during warmer seasons.

The climate appropriate U-factors for each region of the country continue to offer significant heating energy savings in the central and northern regions. Passive heating energy savings are dependent on many factors outside the scope of the window itself, including consumer behavior patterns (such as use of window coverings), daylight, orientation of the house, shading, and percentage of sunny days in winter.

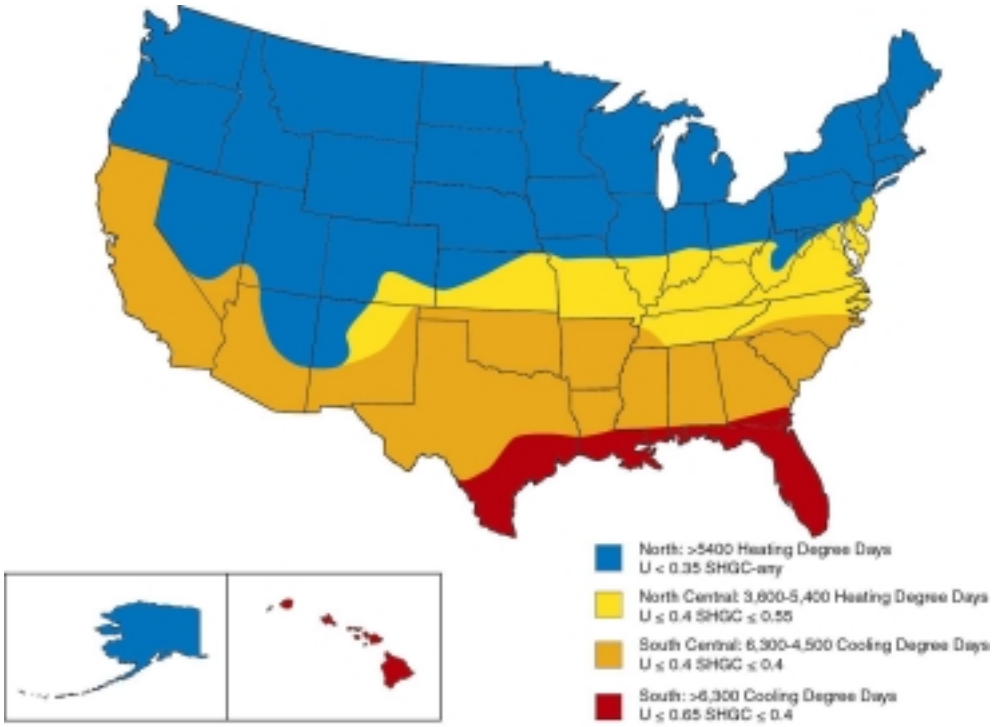
Impacts on Glass Industry - The criteria could be harmful to the pyrolitic glass industry. The Northern climate region is a significant portion of the country and remains a viable market for manufacturers of pyrolitic glass to sell their products for ENERGY STAR qualified windows. In addition, the remaining parts of the country remain potential markets for pyrolitic glass manufacturers, although not necessarily as products that qualify for the ENERGY STAR label.

While the market share for pyrolitic products is decreasing, market factors such as window manufacturer and retailer emphasis on the cooling energy savings of their products, changes in distribution patterns, and shifting market share among retailers has affected the share of pyrolitic coatings.

Non-thermally Broken Windows - Dropping the U-Factor in the Southern Zone from 0.75 or below to 0.65 or below will preclude operable non-thermally broken windows from qualifying as ENERGY STAR. This conflicts with the requirements of hurricane codes. The Department determined, using the NFRC database, that fewer than five percent of operable,

non-thermally broken products which would qualify for ENERGY STAR at a 0.75 U-Factor/0.40 SHGC would drop out at a criteria of 0.65 U-Factor. Therefore, there would not be a major trade off between ENERGY STAR product availability and code-compliant products, as there would be operable, non-thermally broken windows available meeting the three-zone alternative. In addition, the new NFRC modeling procedures to be implemented in April 2003 will result in slightly lower (by up to 0.08) U-factors for aluminum windows; making the 0.65 an easier target for the industry to meet with current products.

Overview: The Four-Zone Alternative



Advantages of Four-Zone Alternative

Consistency with other Department Programs: In addition to offering a consistent approach to the Department's recommendations on fenestration codes, the four-zone alternative also builds on the work of its other energy efficiency programs such as Building America and Energy Smart Schools that rely on climate classifications. These programs take into consideration not only temperature, but humidity and other climate factors affecting consumer comfort and the impact of windows criteria on energy consumption.

National Energy Savings: Of the proposals under consideration by the Department, the four-zone alternative offers the highest potential total national energy savings. It significantly increases energy saved from heating, and represents improved cooling energy savings over the current ENERGY STAR criteria.

Impact on Glass Industry: By allowing for a higher SHGC in the North/Central climate region, windows manufactured with pyrolitic (or hard coat) low emissivity glass will be more likely to meet ENERGY STAR qualifications in both the Northern and North/Central climate zones, expanding the potential market for these products.

Concerns with Four-Zone Alternative

Non-thermally Broken Windows - Dropping the U-Factor in the Southern Zone from 0.75 or below to 0.65 or below will preclude operable non-thermally broken windows from qualifying as ENERGY STAR. This is inconsistent with requirements of hurricane codes with ENERGY STAR qualifying windows. Repeating from above, the Department determined, using the NFRC database, that fewer than five percent of operable, non-thermally broken products which would qualify for ENERGY STAR at a 0.75 U-Factor/0.40 SHGC would drop out at a criteria of 0.65 U-Factor. Therefore, there would not be a major trade off between ENERGY STAR product availability and code compliant products, as there would be operable, non-thermally broken windows available meeting the four-zone alternative. In addition, the new NFRC modeling procedures to be implemented in April 2003 will result in slightly lower (by up to 0.08) U-factors for aluminum windows; making the 0.65 an easier target for the industry to meet with current products.

Ease of Use - The four-zone map is more complex for consumers to interpret. By designing climate zone divisions adhering to state borders where climatically possible, this approach attempts to make it as simple as possible for consumers to identify their specific regions. The Department recognizes that the extra climate region makes it more challenging to have the windows program borders coincide with state borders to the same extent as with a three-zone program. However, ENERGY STAR will work with partners and with consumers to provide as much clarity as possible when there are several climate zones within a specific state.

Manufacturer Complexity The four-zone map will be more complex for manufacturers to use in product labeling, and will result in greater labeling costs to manufacturers. Manufacturers who design windows to meet each of the four climate regions will be required to print and use four or more distinct sets of labels to indicate exactly where their products are qualified. However, the Department anticipates most manufacturers will offer products qualifying in two or more regions, and therefore will not be required to print more styles of labels than has been the case with the current criteria.

Cooling Energy Savings - The four-zone alternative reduces cooling energy savings and reduces opportunities for peak shaving. The focus of the four-zone alternative is on realizing all possible solar heat gain benefits for the Northern and North/Central climate zones, thereby achieving the highest potential national energy savings. It does not exclude the possibility of promoting the sale of low SHGC products that meet the criteria in areas with specific concerns about summer cooling needs and peak load spikes due to cooling demand.

Comfort - The four-zone alternative may reduce some summertime comfort benefits for the north/central region of the country. Given that the four-zone alternative allows for higher

solar heat gain in part of the country with both heating and cooling demand, consumers would be able to choose ENERGY STAR qualified windows while missing out on the summer cooling energy and comfort benefits. This alternative may also limit some efforts on the part of manufacturers and retailers to tout the warm weather comfort attributes of their qualified windows.