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**Posted By: P. Marc LaFrance from US Department Of Energy**

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February 12,  
2004

12:44  
PM

LBNL's Macro Trade-Off Analysis - Comments Due  
March 19, 2004

Please see the link above or the "Tradeoff Analysis Results for Performance Based Ratings for the ENERGY STAR® Windows Programs" report under the "What's New" Header on the home page. DOE seeks comments on this latest analysis from LBNL. Since this subject will be discussed at the 8-11 March NFRC meeting, the deadline for comments is March 19, 2004. For historical perspectives, please look under "Get Materials" for the Windows Performance Based Ratings Topic. To get started to post comments, you just need to "login" (after you have signed up for the forum) from the home page then click on "view topic." You can then either post a comment, or initiate a new topic. You can read this topic and any responses without logging in, but you can only post your comment after you have logged in. If you have problems getting started, please call me at 202-586-9142. Thank you, Marc LaFrance, Technology Development Manager - Windows R&D

**Replied By: frank fisher from arcadia**

18 - Mar - 2004

9:16  
AM

**concerns on Energy Star Label**

I continue to read the D.O.E. proposal for commercial building energy ratings and the use of the Energy Star Label with some concerns. I would like to offer my comments in 3 sections: 1) Perception 2) Available products 3) Performance requirements of a commercial fenestration product. 1) Perception Each time I read reports or correspondence it always references windows. From my limited involvement with the D.O.E. and my current extensive involvement with the N.F.R.C. it is very evident to me that that neither of these organizations fully understand the commercial fenestration industry. It is my belief that these organizations consider the commercial window just a bigger brother of the residential product, and that they limit their understanding to just the portion of the fenestration that allows the building occupant to view the outside through use of non opaque glass. It is true that some commercial fenestration products are just a bigger version of their residential counterparts. But it is also true that a very large percentage of products do not resemble their residential counterparts. One of the biggest differences I see is in the use of opaque materials used within the commercial window. These opaque areas are often referred to as spandrel, and far too often assumed to be fabricated from glass. This is very wrong. The opaque areas of our products are made from many forms of different materials like glass, natural stones, man made stones, metal panels of all kinds, and a multitude of composite materials, the list of which just keeps going. Neither

the N.F.R.C., the D.O.E. or A.S.H.R.E. has a fair and comparable rating system for these areas of a building. These organizations do not have a reasonable default table we can use. We are therefore allowed to use untested ambiguous trade R values to calculate the efficiency of these multi composite areas. Why you should be concerned: In a curtain-wall system where my product is the entire building envelope, including the vision and non vision areas I am allowed to make decisions on the energy rating of the opaque areas building for more than 50% of the buildings skin based on not a lot! I am then making decisions on the lesser part of the building skin, the vision areas, by using the N.F.R.C. rating system that counts to the 3rd or 4th place of decimal. When the entire building envelope does not conform to the D.O.E. requirements what stops the unscrupulous contractor from overstating his opaque areas to justify his vision areas? Why would I spend thousands of dollars to perform N.F.R.C. simulations and tests for a standard size rating that is different to my actual use, especially when I can guess at the performance values of the greater part of the building? 2) Available products I believe your goals in bringing down energy usage in commercial buildings is a good and just cause. The U factor numbers I have seen bantered around will be difficult to achieve with the most common of commercial fenestration framing products, that is aluminum. Arcadia is not an extruder of aluminum and we will adapt to market trends as they happen. I ask that you consider the feasibility at this time of setting U factors so low as to make aluminum obsolete. Consider the limitations of the following materials. Steel: Currently there are no steel window shapes rolled in the United States. There are only 4 manufactures worldwide with a very limited product offering. Although a strong material those products are not suitable for spanning multi story (3 or more floors), and cannot adapt to take account of all of the multiple uses required of them (see list at conclusion). Further more there are only about 4 or 5 manufactures in all of the U.S. Should this be the answer to our needs the industry is not big enough to respond to the sudden demand that we would create. U.P.V.C. This product shows great energy saving performance values, but suffers badly in its structural abilities. The only way it can be used, if at all, is to use it as a cladding for stronger stiffer materials like aluminum. The industry is a very large and well established, we would be fools to believe that this industry has not tried to break into the commercial market more than it currently has. It cannot bridge over into commercial construction quickly or easily. PULLTRUSIONS. This is by far the best competitor to aluminum for commercial systems. It is strong, durable and a good insulator. Its problems are in the intricate details of the shapes and again this small cottage industry's ability to pick up the demand that would be brought on by the sudden loss of aluminum. Wood. This product has become very scarce around the world and the thought that we could grow trees fast enough to replace the demand is frightening. It is strong, uneconomical, good insulator and in constant need of painting. My conclusion is that at this time there is no substitute for aluminum. How do we find a way to phase aluminum out and introduce a better insulating material that is equally as strong? And what is that material? I don't have any quick answers or suggestions I am afraid. 3) Performance requirements of a commercial fenestration product. To make you better understand the differences between the residential and commercial window I have listed the additional things we have to provide design solutions to a) Most commercial systems fasten to the floor you are standing on and the floor above. If you have ever walked across a floor and felt that it is a little springy then you have experienced live load deflection. We must accommodate this movement in our frames. b) Tall buildings sway in the wind. We must allow our window wall to sway with it. c) All areas of the U.S. require some form of earthquake resistance. We must allow for that. d) Just like the residential counterparts we must resist wind gusts. However in larger buildings the gusting is greater, sometimes 4 times greater. All these forces require a strong durable framing material. Aluminum is the only material that I know of that is economical and meets all of these criteria. Again as a non

extruder of aluminum we will entertain things like U.P.V.C. when those manufactures can show us viable products. To date they don't exist.

**Replied By:** Ivan Paredes from General Aluminum Co.

18 - Mar - 2004

1:34  
PM

**Director of Engineering**

Each time I attended the meetings you have sponsored, you have requested a feed back from the attendees, so I decided to do it. At this point probably you had heard every argument in the book from both sides. I read many of those arguments, but I did not see any emphasis on one of the points used on the Draft Paper form LBL, which is the Adverse Market Impact. Many window manufactures do not want to share the market, they want to take Aluminum Windows out of the Market through more stringent codes or the Energy Star Program, with unrealistic numbers that aluminum windows can not meet. I believe each product has good application for determined areas, aluminum works well in the South and South Central Climate Zone because of the warm weather and the high pressures. There are arguments against the trade offs for the South Central, but if we use the Resfen (with LBL update) Program you can determine accurately the right product for the right area. You know there are many cities in the states of Texas, Arizona, California and Las Vegas, that easily qualify for trade offs. When Title 24 was established in California, aluminum window and door products were affected the most. Many companies had to close their doors and thousands of workers were laid off. Aluminum companies in the fenestration industry would like to compete with the vinyl and wood product companies fairly, however with the proposed changes it seems to be that the Title 24 situation(with lower numbers) is going to be repeated. If these changes are imposed on us, and you realize that it is not completely justified, it will be too late for the aluminum industry. My concern is that we are eliminating almost every market for the Aluminum Window except the South Climate Zone. I feel that we are singling out the aluminum product industry for the benefit of the vinyl and wood industry. In summation, if we consider the Long Term Energy Performance, Long term Durability Environmental Impact and Recyclability, the Aluminum products are superior. Knowing you, I believe that you will take in account all factors before any final consideration.

**Replied By:** Chris Rix from General Aluminum Co.

18 - Mar - 2004

1:40  
PM

**President**

I realize that a considerable amount of time and effort has gone into the Energy Star Program and I want to begin by stating our company's position. General Aluminum has always supported strict adherence to energy and building codes. In fact when Title 24 became a reality in California, we were the first thermally broken aluminum product to be certified. We currently have our entire product line certified for use in Florida and registered with the state in conjunction with the new structural codes. In keeping with our philosophy we fully support the Energy Star Program but the new 4 zone map has created a dilemma that the DOE must recognize. The map itself should be re-examined. The U-value requirements in all zones with the exception of the south zone will effectively rule out the use of aluminum windows. A more in-depth look at the performance based trade-off method is in itself a band-aid to the real problem of the south-central and north central zones which contain wide ranges of climates. To think that the south central zone would contain

Phoenix and Atlanta makes no sense. Secondly, if the current map remains in place you are forcing builders and homeowners to choose vinyl windows over aluminum windows, effectively constricting the available options. The cost of homes in the entry level category as well as move-up homes would likely increase, thus prohibiting some folks of home ownership. Additionally, aluminum is a more stable material than vinyl. Aluminum does not expand and contract at the same rate as does vinyl. Exposure to the ultra violet rays of the sun has almost no effect on aluminum, but can cause a durability issue in vinyl. Although we produce vinyl windows, we do not sell them into the desert climates where the ultra violet rays are the most harmful. Has long term product efficiency been seriously considered? Lastly, aluminum is 100% recyclable. Aluminum is by far the most environmentally friendly building material currently being used. Thank you for your time. As an aluminum window company in Dallas, TX with over 600 employees, 150 active distributors, and in business for over 50 years we respectfully request that you please give further consideration to this important subject.

**Replied By:** Michael Nau from PGT Industries

18 - Mar - 2004

2:27  
PM

Product Engineering

The Analysis Results for Performance Based Ratings for ENERGY STAR Windows Program by LBNL confirms our belief that a trade-off between U-factor and SHGC is possible to some degree just about anywhere in the United States, however coming up with one common equation for each of the four current Energy Star climate zones are not. One area that everyone seems to agree on is the South Zone. SHGC, in this zone, has so much influence on cooling that small incremental reductions will allow substantial increases in U-factor. This has also been confirmed using FSECs EnergyGauge program. The software used in Florida to determine energy compliance. This zone, without question, should be considered for a performance alternative. Regarding the other zones such as South Central. This area has so many varying climates within it that no one trade-off equation can be derived. This leads us to believe the evaluation that was made, during the development of the prescriptive Energy Star plan, gave up some real energy saving opportunities in favor of simplicity. While we support the idea of a simple four-zone system we believe that there should also be the opportunity to make a more energy efficient product by the use of equations more specific to the location, region or city that the product is sold. These equations would be transparent to the consumer. They would only be aware that the product they purchased meets Energy Star for their location. I'm sure there are a lot of logistical issues that must be resolved in implementing a plan like this, but the point here is that there exists an opportunity for a greater variety of products that meet Energy Star. In conclusion if there is an opportunity to trade-off between U-factor and Solar heat gain we should seize the opportunity. The end result can only mean greater variety of energy efficient products. This greater variety means more consumers will likely choose energy efficient products. This can result in significant additional energy savings. If we first focus on the straightforward tradeoffs such as the South Zone and consider, even though there are technological limitations, the Northern Zone, and then work into developing more regional equations for the Central Zones, this will put on a clear path to expanding the use of Energy Star overall. The types of window frame material play an important role in window choice here in Florida and moving up the eastern coastal regions. Aluminum has been the premium material of choice for these hurricane prone regions. We would like to continue to offer these products in energy efficient configurations, and be able to participate with them in the Energy Star Program.

**Replied By:** [kory miller from winco window company](#)

18 - Mar - 2004

3:41  
PM

**Gantt Miller, WINCO CEO**

I m both disappointed and annoyed that the Energy Star Program has not moved to a Performance based standard from the current Design or Material based standard. An enormous amount of taxpayer money is being spent with questionable results. Let s stop wasting time, effort and money so that a performance standard can be developed, based on the real world conditions, not on the theoretical, which has been proved and proved again to not measure up. The standard should use AAMA test methods that include the effect of air infiltration and use. Sincerely yours, Gantt W. Miller, A.I.A. CEO Winco Window Company

**Replied By:** [James Rafferty from Rafferty Sales Company Inc](#)

18 - Mar - 2004

3:48  
PM

**President**

I am an independent manufacturer's agent, and my main product lines are windows and patio doors. I have seen some of the points used on the Draft Paper from LNBL, and feel I must make a statement about this. I believe this is an attempt by the vinyl window industry to circumvent normal trade practices and create a 'monopolistic' sales advantage for the vinyl industry. As written, this code would basically do away with the entire aluminum window industry. There are areas of the country where aluminum may not be a viable product (sub-freezing areas for extended periods of time), however, there are many other areas of the country (mainly in the Southern zones - which just happens to be most of the areas that will feel the greatest impact from the retirement of the 'baby-boomers') where aluminum remains a viable product. Aluminum windows can achieve impressive numbers in the U-Value, R-Value, SHGC, and visible light areas through the use of standard tinted glass, coated glazing products, and/or thermally-broken frames. Although the numbers may not be as high as vinyl (or wood), they are more than sufficient to enable the builders and contractors to achieve beneficial Energy Star Program ratings in most areas. They also offer the builder viable products that are proven to withstand the rigors of the Southern climates; with-out rotting (as some wood products do); without losing their structural ratings (as some vinyl products will as they degrade); and with a long term Durability, Environmental Impact, and Recycle-ability that is superior to both wood and vinyl. Truth be told, many of the vinyl manufacturers use aluminum (and steel) as the strength in their products to meet the requirements of the Hurricane Wind and Impact codes (which also affects their energy ratings). I strongly urge you to NOT follow the road that Title 24 went in California. There was a significant impact on the aluminum window industry in California, (and the numbers in the Draft Paper are lower than those in Title 24), and a viable; economic (aluminum products tend to be lower in cost); proven product was removed from the inventory of products available to the home and multi-family contractors: at a marked financial impact on the end user/consumer.

**Replied By:** [Richard Voreis from](#)

19 - Mar - 2004

5:34  
AM

**Recommendations**

My letter will address the Energy Star design based standard vs. the performance based standard rating system for windows. I will focus on the Lawrence Berkeley National Laboratory (LBNL) Analysis Results for Performance Based Ratings for the Energy Star Window Program Report dated January 23, 2004. I will organize my comments by the four climate zones following my overview of the LBNL Report. Overview of LBNL Report After reading and studying this LBNL Report I believe their analysis went beyond the directives discussed at the workshop and those outlined in both the August 1, 2003 paper entitled Performance Based Ratings for the Energy Star Windows Program: A discussion of issues and future possibilities , and the October 30, 2003 memo to Those interested in the Development of a Performance Based Rating System for Energy Star Windows . Clearly, they decided a performance based alternative must result in equal or greater energy savings for each specific city analyzed within a climate zone. The regression equation developed for each of the four climate zones yields results on a city by city specific basis. In my opinion, the results must be weighted by population so energy savings on a climate zone level can be obtained. The fact of the matter is that performance based standards should provide overall energy savings for the zone equal to or better than the existing Energy Star design based standards. The method of analysis LBNL pursued focused entirely on U-factor and SHGC options for each city and if an option was not feasible for each city in the climate zone, then a performance based option was not acceptable to them. This approach is not a fair comparison between design based standards and performance based standards within the Energy Star program. In other words, this is an apples to oranges comparison. It is my understanding the existing Energy Star design based standards were not developed in this manner. Thus, the performance based standards should not be developed this way either. Under the existing design based standard, Energy Star windows installed in different cities within a climate zone do not save the same amount of energy. The Energy Star windows program was not intended to provide the optimum window choice on a city by city basis, but instead, the design based standards enacted provide a balance between a number of climate factors within a climate zone to provide overall energy savings within the zone. As I understand it, the existing design based standards in the latest revision to the Energy Star standards were evaluated against one another by calculating population weighted energy savings for each climate zone. In other words, you did not compare performance on a city by city basis, but instead, on energy savings within each climate zone. This is how a performance based alternative should be evaluated, too. Southern Climate Zone LBNL believes that selecting a SHGC lower than the required 0.40 might allow an increase in U-Factor while maintaining constant energy use. I agree with their findings. South Central Climate Zone LBNL feels the climate variations with this region are too complex to produce a technically defensible single trade-off equation. However, while this is a valid scientific point about the climate variability, this also holds true for the existing design based standard, but it is presumed to be ignored. As I've pointed out previously, we need an apples to apples comparison, not an apples to oranges comparison. From a slightly different perspective, these climate zone boundaries as originally established by Energy Star are flawed based upon this same LBNL analysis of wide climate variability within the same zone. There are a great many cities in this climate zone where a trade-off equation is viable such as Dallas/Fort Worth, TX, Austin, TX, San Antonio, TX, El Paso, TX, Tucson, AZ, Phoenix, AZ, San Diego, CA, Riverside, CA Sunnyvale, CA, Oakland, CA, Las Vegas, NV, as well as many other cities that were not analyzed. In most of these cities there are also very large population centers. Thus, as I've previously stated, the results must be weighted by population so that energy savings on a climate zone level can be obtained and a performance based standard on average would still give equivalent performance. Alternatively, shift the Southern Climate Zone boundary to the north so that cities such as Dallas, Phoenix,

Tucson, Riverside, San Diego, Riverside, Oakland, etc. are then included in the Southern Climate Zone. South Central and North Central Climate Zones (Request DOE Comments) Currently, there is no distinction between U-Factors in the South Central and North Central Climate Zones. Also, the change for the South Central Climate Zone was extremely aggressive. I think it is a normal reaction to wonder why this occurred; especially, since there was such a large U-Factor change in the South Central Climate Zone compared to what existed before in that region of the county. The U-Factor performance standard changed from 0.75 to 0.40 for the geography that is now known as the South Central Climate Zone, which represents a U-Factor improvement of almost 50%. As you know, this one change created a tremendous problem for aluminum windows since the most energy efficient and cost competitive residential window can achieve a 0.42 U-Factor based upon a design based standard. These facts motivate me to recommend that Energy Star increase the U-Factor from 0.40 to 0.42 in the South Central Climate Zone, unless a performance based standard alternative is implemented. By the way, this proposed change takes back only 3% of the almost 50% reduction that resulted in changing from a 0.75 to a 0.40 U-Factor in this Climate Zone. North Central Climate Zone LBNL believes that small increases in U-Factors can be offset with relative large increases in SHGC. Because the cities analyzed had either no solution or small negative trade-offs, they do not believe that a trade-off equation is technically defensible. Once again, the regression equation developed for this climate zone yields results on a city by city specific basis. In my opinion, the results must be weighted by population so that energy savings on a climate zone level can be obtained. To repeat for emphasis, like you did during the development of the existing design based standard. LBNL is not optimistic about a performance based standard in the North Central Climate Zone because the cities analyzed had either no solution or small negative trade-offs, they do not believe that a trade-off equation is technically defensible. Nevertheless, I believe the performance based alternative should be available for selected cities and in case future research and development produces enhancements that will make this approach very feasible in most cities. North Climate Zone LBNL believes the U-Factor in this zone should be 0.35 or below and thus no trade-off is possible in terms of SHGC. In other words, they have made a unilateral decision that the 0.35 U-Factor is unchangeable no matter what happens. I believe the LBLN position of meeting existing code requirements that in themselves vary widely and dictating a 0.35 U-Factor with no specified SHGC is totally arbitrary. This imposes a restraint on the performance based alternative that is not justifiable. It is still my belief the North Climate Zone should have a SHGC standard. I have been shown independent research indicating in a sample of 9,300 windows with U-Factors and SHGC's in the NFRC database that the largest percentage of windows with U-Factors at or below 0.35 had a SHGC of less than 0.30. Therefore, I recommend a base SHGC of 0.30 for the North Climate Zone. My support of a SHGC standard is validated by using performance based alternative U-Factors higher than 0.35 since the energy savings through the use of such windows will meet or exceed energy savings of windows currently having an Energy Star label. If DOE decides the 0.35 U-Factor is not changeable in the North Climate Zone to permit a performance based standard, then I believe the performance based alternative should be available for the three other Climate Zones based upon what I have outlined previously. Energy Star Precedent Finally, I'd like to add that it is a fact 43 of 46 other Energy Star programs are on a performance based standard with only three established on a design based standard. It is my belief fenestration products and especially aluminum fenestration products as well as consumers are placed at a disadvantage under a design based standard. Clearly, Energy Star prefers a performance based standard on the vast majority of your programs and for very good reasons, too. Let's base fenestration products on this same standard.

Recommendations In spite of my constructive and critical comments



regarding the LBNL analysis I still believe based upon my comments, which recommend a different application of their findings, that a performance based alternative is viable and total energy savings will be at least equivalent to existing Energy Star design based standards. While the city by city evaluation showed variations in energy savings, on a population weighted approach the overall energy savings are equivalent when using a performance based alternative. As I have reiterated throughout this letter, the performance based standard should be evaluated just like the design based standard that Energy Star used to establish the existing standards. Thank you for considering my input.

**Replied By:** patrick muessig from azon

19 - Mar - 2004

6:08  
AM

**Comments**

Azon comments to the U.S. Department of Energy regarding the Lawrence Berkley National Laboratories analysis of a performance based approach to ENERGY STAR compliance for windows. Azon would like to thank the Department of Energy for the opportunity to comment on LBNL's Analysis Results for Performance Based Ratings for Energy Star Windows Program. In many of the discussions surrounding the Energy Star program it has been declared that the current compliance criterion for fenestration products is in the vast minority by being a prescriptive venue. This classification also holds true when compared with the compliance criteria of fenestration products around the world. In understanding that energy conservation is the ultimate goal Europe, Canada and others have already implemented a performance approach. LBNL's analysis supported what was already known for the Northern and the Southern zones. A trade-off between U-factor and SHGC in these climates does allow for similar energy efficiency and provides consumers and manufacturers with a greater degree of options and customization. It was mentioned that a trade-off criteria in the North would render an Energy Star window non-compliant with the 2003 IECC codes. This assumes that all northern states have adopted the 2003 IECC standard which is not true, in fact there are over 15 states in this region that have not. Additionally, for new homes with over 15% window area in certain locations within this zone the code is already below 0.35 and this has not been deemed as an obstacle to currently achieving Energy Star status. Energy Star should not be benchmarked against other codes that are readily subject to change and have discretionary implementation. Presently Energy Star does not have a SHGC standard in the North and when LBNL performed its calculations for this zone they chose a SHGC of 0.40. We realize this number was somewhat insignificant at the time, since the study was simply to see if a tradeoff was feasible. However, when looking at the current Northern Climate Energy Star products the average SHGC is below 0.30. We feel starting the tradeoff allowance with a SHGC of 0.30 would be a much more realistic representation of the products currently available. In the Central Zones, both North and South, a performance approach seemed to be dismissed because there was not a single criterion that would work in each city due to the fact of large climate variability within each zone. In the North Central it could not readily be established if a greater SHGC would increase or decrease savings, interestingly enough this statement will then hold true for the prescriptive approach as well, however current energy star criteria has chosen to set a maximum SHGC? This means that products are encouraged to have a lower SHGC which may or may not lend itself to overall energy savings in each respective city within this region. However, taken the entire zone as one entity it has been deemed efficient, this approach of total energy savings within each respective zone can be used to establish a performance approach for both the Central Zones as well. The focus cannot be on the U-Factor alone,



an intelligent SHGC has been shown by LBNL to be a critical instrument in saving energy and should play an active role in Energy Star compliance not only in the South but in the North and the Central Regions as well. As long as Energy Star is divided into zones there will not be one prescriptive criterion that will save the same amount of energy in every city throughout that region. However when taken as a whole there is viable criteria that can be established within each to maximize the overall energy savings. Just as the NFRC has set up a Task Group to look at RESFEN and its current assumptions, eventually the zones will have to be reexamined as well. The study has shown that there are too many climatic variations within each respective zone with Costal California and Phoenix at the heart of this discussion. More so, if Energy Star is to be compared against the IECC codes then to do so it must contain similar zone structure. The rest of the world realizes that in order to allow market diversification and implementation of future energy saving technology then a performance based approach to fenestration compliance is essential. For the United States Energy Star compliance via a U-Factor and SHGC tradeoff is a crucial first step towards this goal.

**Replied By:** BOB POOL from THERMAL WINDOWS, INC.

19 - Mar - 2004 6:51 AM Chairman

I believe the DOE/LBNL adopting a U factor below .45 in any part of the Energy Star program will be a disservice to the American People and should be withheld until further information is developed regarding a window as a whole. A lower number will only serve to put Quality Thermally Improved Aluminum Windows out of the market because the American Public will assume Energy Star windows are the best and Aluminum Windows cannot qualify. We all know Wood Windows, regardless of the brand, will swell when wet and shrink when dry and if not kept maintained, will rot. This is Energy Star quality?? Vinyl Plastic windows have a lower U frame factor, but what about expansion when hot and shrinkage when cold. What if it is hot inside and cold outside or visa versa. Does the frame bow in or out?? To pass structural tests, most Vinyl Windows are reinforced with aluminum or steel. How does this affect the U factor??? Consideration should also be given to Environmental Factors . The manufacture and disposal of PVC produces carcinogenic compounds. Hopefully this won't create an ASBESTOS type problem in the future. This is Energy Star quality?? A quality Single Hung/Slider Window, whether it is Thermally Improved Aluminum, Wood or Plastic will be approximately 70% Glass. A Fixed Picture Window will be approximately 90% Glass. Why isn't the glass considered the most important part of a window and rated so?? True window performance could and should be determined by a complete window in a test chamber, similar to AAMA Structural, Air and Water tests. A test to evaluate energy gain/loss of a completed window over a period of time could be developed and would be much more informative to the American Public. We believe this would favor the Thermally Improved Aluminum Products which achieves long-term, consistent energy savings.

**Replied By:** Joe Hums from Mikron

19 - Mar - 2004 8:58 AM AAMA VMC Position

The following is an excerpt from the AAMA VMC's latest Newsletter. The

AAMAVMC position is that we should not change the ENERGY STAR Program from its current format. We understand the long-term need for an annual energy usage program to demonstrate compliance with energy codes that will be more stringent in the future and to accommodate emerging dynamic glazing technologies. We do support DOE's long-term goal of creating an Annual Energy Usage Program. We believe it should be developed by the NFRC without the political and time pressures of an outside special interest group. However, in the short term, the current ENERGY STAR format of U Factor and SHGC is in the best interests of consumers and the window and door community for many reasons:

1. The ENERGY STAR program is not prescriptive. U Factor and SHGC are performance based test criteria. There is no prescription on how a manufacturer meets the standard. While tradeoff schemes might allow more flexibility than the current ENERGY STAR program, it uses the same general performance criteria and does not offer any significant improvement in energy savings.
2. The current system is straightforward and easy for consumers to understand. All of the tradeoff schemes are either very complex or rely on variables and assumptions for which there is little industry consensus.
3. The new ENERGY STAR values support DOE's stated goal of driving the window industry to more energy efficient windows. Windows that comply with both U Factor and SHGC values in a given ENERGY STAR zone generally exceed one or both target values. Allowing a tradeoff scheme based on a hypothetical window that exactly meets the U Factor and SHGC values of a given zone will result in reduction in overall energy savings since it is based on target values that most ENERGY STAR compliant windows exceed. Modifying ENERGY STAR to allow less energy efficient windows takes the program in the wrong direction.
4. The current ENERGY STAR values exceed local energy code requirements; one of the key tenants of this program. Code officials have adopted U Factor and SHGC requirements on a national basis. Modifying ENERGY STAR by allowing complicated tradeoff schemes not currently recognized by code compliance officials will be confusing and simply does not make sense at this time.
5. The Window industry has supported the ENERGY STAR program with its format of U Factors and SHGC values. Considerable resources have been spent in research and development, design, engineering, testing and marketing window systems to comply with ENERGY STAR. Infusing a trade-off scheme with unknown consequences is unfair to the large list of companies that have designed window systems around current ENERGY STAR criteria.
6. In general, better U Factors correlate to better condensation resistant characteristics. The various tradeoff schemes do not address this issue. With all of the concerns in the window industry regarding mold and moisture problems it would be irresponsible for DOE to reduce U Factor requirements that help prevent condensation.
7. Changing the ENERGY STAR program to allow tradeoffs creates a whole new ENERGY STAR program. VMC supports DOE's long term efforts of adopting an annual energy usage program. However, we do not support DOE's current methodology of rushing to overlay substantive changes to the current ENERGY STAR program based on an outside imposed special interest agenda.

**Replied By:** [Greg Patzer from Aluminum Extruders Council](#)

19 - Mar - 2004	10:20 AM	<b>AEC comments</b>
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The Aluminum Extruders Council (AEC) appreciates the opportunity to comment on the Lawrence Berkeley National Laboratory (LBNL) Analysis Results for Performance Based Ratings for the ENERGYSTAR Windows Program. At the conclusion of the Department of Energy's (DOE) 30 September 2003 workshop to discuss possible development of a

performance-based rating system for ENERGYSTAR windows, LBNL was directed to develop a regression equation (and corresponding table) for each of the four zones in the ENERGYSTAR windows program. We are pleased that LBNL has completed this task and shown that there are viable performance-based options that can save as much (or more) energy as the current design-based standards. We are very concerned, however, that the LBNL analysis went beyond the directives discussed at the workshop and those outlined in both the 1 August 2003 paper, "Performance Based Ratings for the ENERGYSTAR Windows Program: A discussion of issues and future possibilities", and the 30 October 2003 memo to "Those interested in the Development of a Performance Based Rating System for ENERGYSTAR Windows", and decided that a performance-based option must result in equal or greater energy savings for each specific city analyzed within a zone. The regression equation developed for each of the four climate zones yields results on a city-specific basis; AEC believes strongly that those results MUST be weighted by population so that energy savings on a zone level can be obtained. The qualifying test for performance based-standards should be whether they provide overall energy savings for the zone equal to or better than the current design-based ENERGYSTAR standards. The method of analysis LBNL pursued (U-factor and SHGC options for each city and if an option doesn't work for each city in the climate zone, then no performance-based ENERGYSTAR window option exists) is not a fair comparison between design and performance-based standards within the ENERGYSTAR program. ENERGYSTAR design-based standards were not developed in this manner. Under the current design-based system, ENERGYSTAR windows installed in different cities within a zone do not save the same amount of energy. The ENERGYSTAR windows program was not intended to provide an optimum window choice for a given city, but rather the standards chosen balance a number of climate factors within a zone to provide zone-level energy savings. The design-based options considered by DOE in the latest revision to the ENERGYSTAR windows standards were evaluated against one another by calculating population-weighted energy savings for a zone. DOE did not compare among the options on a city-specific basis, but rather on energy savings within a zone. The LBNL analysis does highlight that the current four zones chosen for ENERGYSTAR were not chosen to aggregate cities with similar needs with respect to window selection. For example, the individual city analysis for the south-central zone shows that with slightly increased values for a U-factor, the corresponding SHGC to equal ENERGYSTAR performance sometimes increases and sometimes decreases from the design-based standard. This shows that the existing ENERGYSTAR standard for a given city is not the best choice, but is the result of aggregating energy savings across a zone on a population-weighted basis. Any performance-based approach should be adopted using a similar methodology. The AEC agrees that there remain some technical issues limiting the application of performance-based standards at this time. While the population-weighted regression results for the north-central zone indicates that trade-offs in the U-factor would need to be balanced with SHGC that may not be achievable, the framework should remain in place as future technologies may allow these results to occur. In the northern zone, the rule of meeting existing code requirements of U-factor = 0.35 (with no specified SHGC) poses what appears to be an artificial constraint on developing performance-based standards there. The AEC also disagrees with the default SHGC of 0.4 chosen for the analysis; we believe a SHGC of 0.30 is more representative of current ENERGYSTAR windows sold in that zone and it should have been used to develop Table 11. Further, we find this methodology defensible for exceeding a U-factor of 0.35 as the energy saved through the use of such a window will meet or exceed energy saved by windows currently labeled ENERGYSTAR in the northern zone. The point of the ENERGYSTAR program is to save energy, not to comply with an arbitrary number. However, if the decision is that U-factor = 0.35 can never be

exceeded, the framework should remain in place to spur technological innovations that will allow tradeoffs between SHGC and U factor. In conclusion, the LBNL analysis has proved that there are performance-based standards that result in total energy savings equivalent to ENERGYSTAR design-based standards for the four ENERGYSTAR window climate zones. While several of the zones show variations in energy savings among individual cities, on a population-weighted basis the overall energy saved for the zone is still equivalent to ENERGYSTAR. Large variations in energy savings within an ENERGYSTAR climate zone occur now with the design-based standards. The existing ENERGYSTAR windows program is not designed to provide the best choice window for a given city (or application), but to balance a number of factors that will result in superior energy savings for a zone when customers choose ENERGYSTAR windows over the status quo. Given that existing ENERGYSTAR design-based window standards were developed in this manner, this same method should be used for performance-based ENERGYSTAR window standards. The European Window Energy Rating System is already moving to a performance-based rating system and the U.S. should as well. As window technologies evolve, a performance-based rating system will be required. The DOE and its ENERGYSTAR windows program should adopt a performance-based rating system option now to allow manufacturers and code officials to become familiar with such a system.

**Replied By:** [Thomas Culp from ATOFINA Chemicals, Inc.](#)

19 - Mar - 2004

12:21  
PM

**Analysis comments**

Dear Marc: Thank you for the opportunity to comment on the recent analysis regarding performance-based ratings for the Energy Star Windows program. I congratulate you and LBNL on your hard work evaluating such a system. As you know, performance based rating systems are already used in Canada, Europe, and Australia, and it is important that the U.S. not fall behind. A performance-based rating system is the only fair way to compare different window technologies on the metric that actually matters ... energy consumption. Despite some of the ongoing debates, this should not be a material issue. It should not matter whether a window uses hard coat, soft coat, wood, vinyl, aluminum, fiberglass, or other materials as long as the overall energy performance is the same. It is the end result that matters - not how you get there. In fact, prescriptive systems tend to favor just a few product combinations which happen to give the correct combination of U and SHGC regardless of actual energy performance, stifling product flexibility as a result. The consequences include anticompetitive effects and less flexibility for manufacturers, less choice and competition for consumers, and constraints on the development of new advanced materials. By encouraging product flexibility, performance-based ratings would serve to accelerate penetration of Energy Star windows due to the broader selection of Energy Star rated windows available on the consumer market. Taking this next step would be a win for industry, government, and society. Below are my comments regarding the LBNL analysis, grouped by region. Southern Zone: The LBNL analysis showed that a trade-off approach for this region is technically sound. Regardless of your decision about the other regions, we encourage you to go ahead and implement the trade-off system in the Southern Zone as an important first step. The issue of minimum visible transmittance (VT) was raised as a possible limit when using low SHGC glass in the south. While the recommended 30% VT should not present any major difficulty, visible transmittance is an aesthetic consumer choice that should be left to the market rather than dictated by Energy Star. If low VT is a concern, by extension, walls should be discouraged and high window areas

encouraged! Although the glass and window industry would be very happy with this, the absurdity of VT requirements is obvious. Natural market forces will maintain a satisfactory level for VT without the need for limitations from the DOE. South Central and North Central Zones: The LBNL analysis did a nice job pointing out the issue of climate variability in the South Central and North Central regions, and I acknowledge this is an important issue. However, this issue must be put in the proper context. It must be remembered that the same climate variability exists in the current prescriptive requirements, and the goal of the program is to maximize the energy efficiency of the region and country as a whole, not city-by-city. The current prescriptive criteria were developed using a national model in which the energy usage and savings were aggregated over each region. By the same token, if one took the average energy usage predicted by the prescriptive criteria for each region, then compared it to the energy usage in individual cities, you would see the same issues where some cities would have lower energy usage and some would have increased energy usage or no solution. The point is that for the region as a whole, the overall energy performance is the same. NFRC recently voted to maintain the same RESFEN analysis assumptions for evaluation of the performance-based ratings as were used for the prescriptive criteria. Similarly, the same regionalized and national approach should be used to implement the equivalent performance tables as was used for the prescriptive criteria. This does not mean we stop the endeavor for improved methods. Just as NFRC is committed to continued improvement of the RESFEN and AEP analysis assumptions for future developments, DOE and LBNL should go forward with what we have today, but also continue the more detailed evaluation of climate aggregation issues for future use. J. Huang mentioned that one solution to the climate variability issue is to divide the South Central into two subregions, particularly because many of the cities with unusual behavior are grouped in California. One view is that further division into subregions adds unnecessary complexity to the program. However, remember that the complexity to the consumer is not changed one bit ... the consumer only looks to see whether the product has the blue Energy Star label or not. The added complexity is for the window manufacturer and distributor, but only for those manufacturers who choose to accept that complexity. The subregions would only be implemented for the performance-based rating, and window manufacturers who do not want to deal with the extra complexity can simply use the current prescriptive method. Moreover, although national manufacturers are naturally the most vocal and active in these forums, remember that the window industry is actually dominated by a larger number of regional companies. For regional manufacturers selling into one area, subregions are not an issue. If dividing the South Central into two subregions improves the technical viability of the performance-based ratings, we should not let this hinder manufacturers who are willing to accept this challenge. Northern Zone: Similar to the Southern Zone, the LBNL analysis demonstrated that a trade-off procedure is technically sound for the Northern Zone. In this case, small increases in U value can be compensated by requiring a higher SHGC. There is no scientific reason this should not be implemented. However, the issue was raised that a U value higher than 0.35 would not meet code requirements, and therefore the trade-off cannot be used at this time. This is based on the philosophy that Energy Star should always meet or beat energy code. However, the issue with the codes is oversimplified and not completely true. First, current Energy Star windows do not always meet code. For new homes with over 15% window area in locations above 6000 HDD, the 2003 IECC prescriptive requirements are already less than  $U = 0.35$ , the current Energy Star criterion. Therefore, while meet or beat code may be taken as a general concept, it can not be taken as an absolute, nor used as an excuse to not implement the trade-off criteria for windows with equivalent energy performance. Second, although the 2003 IECC does require  $U < 0.35$  for replacement windows, the simple fact is that the 2003 IECC is not the governing code in most of the north. When looking

at the actual state-level mandatory requirements in the Northern Zone, it is my understanding that Energy Star windows with U over 0.35 could be used in AK, AZ, CT, IA, IL, IN, CO, KS, MA, ME, MI, MN, MO, MT, ND, NE, NJ, NV, SD, and WY. Are we justified in limiting the choice of Energy Star products to consumers in these states, which make up 60% of the Northern Zone? Third, the overriding question is does Energy Star want to lead the codes, or be led by the codes? Simply because the code is outdated and oversimplified does not mean Energy Star should follow the same path. If Energy Star accepts a window that has equivalent energy performance as a window which meets the prescriptive requirements, this clearly meets the intention of the code and the DOE. Fourth, we are not talking about large departures from the current requirement, no more than  $U = 0.40$ . This small change does increase product flexibility, but is not large enough to have any significantly adverse effects on side issues such as winter peak load or condensation resistance. Finally, although using a default SHGC of 0.4 for the analysis is reasonable, I maintain our belief that a default SHGC of 0.3 is much more realistic of the actual market. Moreover, if you use 0.4 as the default SHGC, the same energy analysis will show that the majority of current Energy Star products with low SHGC actually consume more energy than the prescriptive requirements, and thus would not qualify under the performance based rating, which is clearly not our intention. In any case, I commend your long term view for performance based ratings in the north. As energy efficiency is pushed to new levels with future developments, I fully agree that performance based ratings are required for proper comparison and promotion of these new technologies. Once more I applaud your efforts, and although there are challenges ahead, we will help strive to make the performance-based rating system a success. As always, please feel free to contact me if you have questions. Best regards, Tom Culp Manager - Energy Policy & New Technologies, Flat Glass Coatings ATOFINA Chemicals, Inc.

**Replied By:** [Mike Manteghi from Traco](#)

19 - Mar - 2004

1:03  
PM

**TRACO Comments and Recommendations**

As discussed September 30, 2003, the LBNL developed formulas for the Performance Based Standard for Southern & South Central regions. The formulas accounted for a tradeoff between SHGC, U-factor, and Air leakage but unfortunately there were not any formulas generated for North and North Central regions. The DOE asked the LBNL to develop a short term solution by continuing to generate formulas for all four regions. The LBNL has provided two reports that contradict each other in evaluating the Performance Based tradeoff formula. The LBNL's first report discussed at the September workshop was determined to be incomplete because the tradeoff formula was only developed for the Southern and South Central regions and not for all four. The group agreed with the direction of the first analysis and wanted the LBNL to finish developing a formula for the Northern and North Central regions (all four climate regions). This leads us to the second report that we are discussing. The second report or analysis focused on specific cities within the regions while the intent was to analyze the overall performance within each region. LBNL's evaluation suggests that the current 4 climate zones do not accurately illustrate the actual climate for each region. This was not the intent of the DOE's short term goal. If the climate zone map does not illustrate the true climate for each region, then a separate evaluation should be conducted for the climate zone map just as the NFRC formed a task group to look at RESFEN. The performance based tradeoff formulas should be derived using similar techniques like the current U-factors and SHGC were created for each of the 4 climate zones. I would also like to emphasize that an SHGC is needed for the Northern climate zone. The LBNL mentions in there



report that they are technically capable of deriving valid solution for a tradeoff with equal energy performance but they recommend not using the tradeoff because the U-factor would exceed code requirements. If we are considering the code then we should also consider the code map that has 8 climate zones but I do not think this is the intent of the DOE. But the Performance Based tradeoff for the window will still have the same overall energy performance which is the underlying goal. The DOE Energy Star rating is used as a marketing tool for energy efficiency and we should not lose focus on the task at hand. The LBNL was unsuccessful in generating formulas for all four climate zones. Now the analysis needs to be reevaluated by the DOE to develop a formula for the Performance Based Standard. It is critical that the DOE continue to consider the Performance Based tradeoff between the SHGC and the U-factor. For example, along the coastal areas from Texas to Maine, impact and structure are two major requirements and currently Aluminum is the only material capable of achieving them. Without the Performance Based tradeoff, Aluminum windows will not qualify for Energy Star ratings for those areas. TRACO continues to support the Performance Based Standard tradeoff and encourages the DOE to continue with the development of a formula for all four regions as it was discussed specifically in September's meeting.

**Replied By:** [Jerry Schwabauer from AAMA-AMC](#)

19 - Mar - 2004

1:19  
PM

**AAMA AMC Position**

The Aluminum Materials Council (AMC) of AAMA is very interested in the DOE Energy Star initiative because our group represents aluminum window manufacturers throughout the United States. The AMC strongly supports the adoption of a performance based rating system. There is definitive evidence which has been communicated in response to the LBL paper to support a performance based approach and to demonstrate that these aluminum products can save as much or more energy than the current prescriptive Energy Star labeled products. We know that U-Factor and SHGC are equally important when determining the ability of the unit to save energy. We support a performance based approach that allows for the trade-off between these factors as long as the end result is equally efficient. The AMC supports a SHGC of 0.30 in the northern region as a starting point for these trade-offs. This has been shown to be the most accurate representation of the energy star products currently being offered in this zone. We refute the notion that a performance based approach will be confusing to consumers. The appearance of the energy star label on the window product will confirm compliance. The consumer does not care how the product achieved the energy star label; they know the labeled product meets the requirements for energy savings. In closing, 43 of the 46 product categories currently operating under energy star labeling use a performance based approach. Products such as windows, which have the ability to make major contributions to energy savings deserve the same opportunities.

**Replied By:** [David Duly Duly from Pilkington NA](#)

19 - Mar - 2004

1:32  
PM

**Senior Engineer**

Pilkington North America supports the efforts of DOE to develop a Performance Based Ratings for the Energy Star Windows Program. The most accurate approach for determining the energy performance of windows must



include both fenestration variables that are highly dependent on the glazing the U-factor and the SHGC. We believe the Performance Based Ratings can be established for the entire United States and wish to specifically comment here on the Northern zone. The LBNL report clearly outlines a technical basis for performance based alternatives for the Northern Zone. The comment relative to the increased U-value would not meet code minimum thermal requirements needs additional clarification in our view. The current DOE submittal to the IECC for the deletion of Chapters 1, 2, 3, 4, 5, and 6 and substitute EC 48 with additional approved code changes during the September, 2003 code hearings offer two methods for compliance. In Section 402 of the DOE proposal, the fenestration U-factor requirement by component requires a maximum U-factor. However, Section 404 allows a Simulated Performance Alternative using computer software tools to compare the energy performance of a Standard Reference Design to the Proposed Design. Using the procedures outlined within Section 404, it is very likely the performance trade-off procedure outlined in the LBNL paper will allow windows with a specific U-factor greater than 0.35 and the corresponding SHGC greater than 0.40 for the proposed design to result in annual energy costs less than or equal to the annual energy costs of the standard reference design with U-factor = 0.35 and SHGC = 0.40. In conclusion, using the Simulated Performance Alternative section of the DOE code change submittal to the 2003 IECC will permit a window with a noted U-factor greater than 0.35 to meet the requirements of the next published Supplement to 2003 IECC.

**Replied By:** [David Thoman from Thermal Windows Inc.](#)

19 - Mar - 2004	3:54 PM	VP
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Marc, thank you for providing this opportunity to contribute. . The first paragraph of the Executive summary states that a performance based approach "only makes sense if it 1)can equal or exceed the nominal energy savings of the existing criteria, 2)has no other adverse market impacts, and 3) provides consistent and understandable results leading to enhancement of the value of the overall program" . I must respectfully disagree. A performance based approach is ALWAYS superior. Anytime you can have a performance based criteria instead of a prescriptive decree you unleash the creativity, initiative and invention of the free market to produce better and better solutions (good ol evolution). Why would we set out to limit innovation? It is not possible to know what improvements the future will bring. A performance based criteria will provide the most and best choices for the consumer now and into the future. . Air infiltration is an important determinant of energy consumption that can change with time, use and in some cases climate. The coefficient of thermal expansion for vinyl is very high as compared to other materials used for fenestration. This combined with its lack of rigidity creates unique challenges for designers. When a vinyl sash or frame member is subjected to a substantial temperature differential (interior/exterior) the warm side expands as the cold side contracts, thus bowing the part. This can have a substantial negative impact on air infiltration resulting in increased energy consumption. This does not happen with more rigid materials. In an attempt to limit this virtually all manufacturers use an aluminum or steel "stiffner" inside the vinyl shape. Obviously this has a negative impact on the U factor. Is that addressed in the theoretical numbers used to arrive at U value ? . Air infiltration must be addressed in a chamber with substantial differential temperatures in order to properly quantify the performance of different systems in a real world environment. The effect of reinforcement on U value must also be taken into account. . The durability study needed should focus on air infiltration and performance of the design and materials over time and use. Insulated glass units already have ample

standards and testing methods developed and in use by most manufacturers. . . While the Energy Star program has been billed as "voluntary" for the consumer in many parts of the country it is not. Therefore it is important that we not take away the consumers ability to choose products which provide better long term performance, security, safety, structural integrity and value; particularly if it is in exchange for higher energy costs due to a prescriptive standard which fails to address all pertinent variables while stifling competition and innovation. At Thermal Windows Inc. we manufacture both Vinyl and Thermally Improved Aluminum windows. Our customers today are able to choose the system that best meets their needs. Lets keep it that way. One size does not fit all.

**Replied By:** [Chuck Anderson](#)

19 - Mar - 2004 10:15 AM **Simonton Windows reply**

Simonton Windows strongly supports the Energy Star Program and DOE's initiative to implement a performance based method of compliance for windows. We believe that it is important to implement a trade-off method for the northern and southern zones today. In time, perhaps a similar concept can be developed for the other zones, but the data presented by LBNL suggests that the solution could be complex and is better left untouched at this time. Last September you shared DOE's vision of how the Energy Star requirements will tighten in the near future, so perhaps the next evolution can contain some geographical changes to support a new approach for the central zones. [More ...](#)

**Replied By:** [Gregory Patzer](#)

19 - Mar - 2004 10:18 AM **Aluminum Extruders Council reply**

The Aluminum Extruders Council (AEC) appreciates the opportunity to comment on the Lawrence Berkeley National Laboratory (LBNL) "Analysis Results for Performance Based Ratings for the ENERGYSTAR Windows Program." [More ...](#)

**Replied By:** [Garret Stone](#)

19 - Mar - 2004 10:28 AM **BRICKFIELD, BURCHETTE, RITTS & STONE, P.C. reply**

Per the request of the Department of Energy, I have set forth below our comments on the LBNL Draft Analysis: I. Energy Star Windows Must Meet IECC Minimum Requirements We agree with the conclusion in the LBNL Draft Analysis that the Energy Star program must always meet or beat energy code requirements. We suggest that the 2000 IECC, currently formally endorsed by DOE under the Energy Policy Act of 1992, is the obvious standard. Because the IECC replacement window requirements are entirely prescriptive (and cannot be traded off), in our view, these are the best benchmark. [More ...](#)

**Replied By:** [John O'Connell](#)

16 - Mar - 2004	2:51 PM	<b>Kinco LTD reply</b>
My letter will address the ENERGYSTAR design based standard vs. the performance based standard rating system for windows. <a href="#">More ...</a>		