AGC
BEYOND GLASS™

BUILDING

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Re: Criteria Revision – Public

Dear Doug and Emily:

Attached are AGC Glass Company North America's comments to the new Energy Star Window criteria.

Sincerely,

Jon Hughes
Director Marketing & Programs

C.C Christopher F. Correnti
Vice President, General Counsel and Secretary

Comments of AGC Glass Company North America
To Energy Star Version 6.0 Product Specification
Framework Document For Windows, Doors and Skylights dated October 2011

AGC Glass Company North America appreciates the opportunity to comment on the Framework Document for Windows, Doors, and Skylights. As one of five (5) manufacturers operating float glass facilities in the United States, AGC is a long time Energy Star stakeholder.

Before commenting on the specifics of the Framework Document, AGC would like to respectfully suggest that the EPA consider delaying implementation of the next updates to the windows, doors, and skylights Energy Star Criteria. We would suggest that any new criteria changes take effect in 2015. This delay would allow more time for an economic recovery. AGC is concerned that changing the criteria for windows, doors, and skylights which will, inevitably, increase the cost of these Energy Star products will result in fewer consumers upgrading to Energy Star windows.

Summary of AGC Glass Company North America Comments.

AGC Glass Company North America would like to express its sincere appreciation and support for the significant involvement the Environmental Protection Agency ("EPA") is offering stakeholders in the development of the Version 6.0 ("V.6") Framework Document ("Framework Document") for the product specifications ("Criteria") applicable to Energy Star Windows, Doors and Skylights ("Energy Star") dated October 2011.

AGC Glass Company North America supports the determination that regional climate zones are appropriate and that they should remain in place. Choosing the most appropriate window for a specific climate is key to energy savings realized by that window. Through the climate zones, the Energy Star program provides consumers a reliable means of determining the most energy efficient windows for their climate.

With regard to the specifications outlined in the Framework Document, AGC Glass Company North America's comments urge EPA to establish the following U-factors and SHGCs in the northern and north-central zones:

Comment 1A. A ***northern*** U-factor Criteria ≤ ***0.25***.

Comment 1B. A ***northern*** SHGC Criteria ≥ ***0.32***.

Comment 2 A . A ***north-central*** U-factor Criteria ≤ ***0.28.***

Comment 2 B. ***Any*** SHGC in the ***north-central*** zone.

Energy Star's proposed permission to use "Any" SHGC in the northern zone makes it possible for the largest national window makers to market a single, ultra-low SHGC product from Miami, Florida in the south, to the Canadian border in the north. The hidden and unintended consequences of this include (i) a failure of Energy Star to deploy an effective strategy for using the sustainable energy of the sun to heat homes in northern climates, resulting in (ii) a loss of aggregate annual energy efficiencies due to (iii) the consumption of more fossil fuels than would otherwise be necessary if only higher SHGC window products were Energy Star labeled in the northern zones.

These unintended consequences of this nationwide marketing strategy will be explored throughout the remainder of the following comments.

Comment 1 A:
Establishing a maximum 0.25 U-factor in the northern zone.

The U-factor range set out in the Framework Document for the northern climate zone is from 0.25 to 0.27. The Framework Document says that "EPA is looking to establish criteria that recognize the highest-performing doubles and bring a greater number of triple pane windows into the mainstream."

Setting the U-factor at 0.25 in the northern zone is the best, possibly, the only, way to require the highest-performing doubles ("DGUs") while bringing a greater number of triple pane windows ("TGUs") into the mainstream. Setting the U-factor at 0.27 will not result in Energy Star labeling of the highest-performing doubles in the northern zone and it will discourage moving the market toward the use of more TGUs.

A 0.25 U-factor Criteria can be achieved in two ways. The first is to use a DGU with two low-e coatings, namely, either a single, a double or a triple sputter low-e coating on the #2 surface paired with a pyrolytic low-e coating on the #4 surface ("Double Low-e Product"). The second is to use a TGU. Because a TGU has twice the number of insulating air gaps as a DGU, it only requires a single low-e coating on the # 4 surface to achieve a 0.25 U-factor or lower. The low-e coating used on the TGU may be pyrolytic; or a single; a double; or a triple sputter coating.

The lowest U-factor that can be achieved with a DGU with a single low-e coating is a proprietary, triple silver sputter coated DGU Product ("Proprietary Product" or "Proprietary Triple Silver DGU").[1] Because the Proprietary Triple Silver DGU can achieve a 0.27 U-factor, if Energy Star sets the northern zone U-factor at 0.27, it will proliferate and dominate the market in the northern zone because a Proprietary Triple Silver DGU costs significantly less than a TGU with a single low-e coating[2] and because the same Proprietary Product is now being mandated, prescriptively, in the south.

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[1] Cardinal, PPG and Guardian offer Proprietary Triple Silver DGUs capable of achieving a 0.27 U-factor.

[2] According to the 2013 CASE Report dated September 2011 and prepared for non-residential fenestration in California, a Triple Silver DGU Product in the hands of the consumer has a price premium of $6.78/per sq.ft. for the low-e coating compared to uncoated glass plus a $3.83/sq.ft. premium for a DGU over a single pane product. A TGU with a single pyrolytic coating has a price premium of $4.24/sq.ft. for the low-e coating compared to uncoated glass plus an $11.18/sq.ft. premium for a TGU over a single pane product. As a result, it is reasonable to expect a single low-e coated TGU to cost approximately $9.32/sq.ft. more than a TGU.

A Proprietary Triple Silver DGU can achieve an SHGC of 0.25 or less. The 2012 International Residential Code ("IRC") now mandates a 0.25 SHGC in climate zones 1, 2 and 3 for both new home construction and retrofit windows.[3] If a 0.27 U-factor is selected as the Energy Star U-factor Criteria in the northern zone, Energy Star will match its Criteria to the U-factor performance of a Proprietary Product. Since the IRC has now established an SHGC criteria in climate zones 1, 2 and 3 which also matches the SHGC performance of that same Proprietary Product, the largest national window manufacturers will quickly merge the northern Energy Star U-factor Criteria with the prescriptive SHGC criteria established by the IRC in the south to secure the economies of achieving a nationwide market for a single, Proprietary Product from Miami, Florida in the south to the Canadian border in the north.

This strategy of being able to market a Proprietary Triple Silver DGU nationwide will be further enabled by Energy Star's proposed use of "Any" SHGC Criteria in the northern zone. This is true because the Proprietary Triple Silver DGU's ultra-low 0.25 SHGC will not only be mandated for use in the south by the IRC, it will also enjoy the benefits of an Energy Star label in both the northern and north-central climate zones by virtue of its ability to comply with the lack of "Any" SHGC Criteria being proposed in Energy Star's northern zone and the maximum SHGC Criteria of 0.35 to 0.40 being proposed in its north-central zone.

If the objective is to use the Energy Star label as a nationwide marketing vehicle for a single product, namely, the Proprietary Triple Silver DGU, then selecting a 0.27 U-factor and "Any" SHGC as the northern zone Criteria will certainly move that objective forward to becoming a reality. However, doing so will not achieve the best possible performance that

[3] The climate zones found in the IRC are the same as those found in the International Energy Conservation Code. All residential provisions have been deleted from the 2012 edition of the IECC, and are now found exclusively in Chapter 11 of the IRC.

DGUs are capable of providing in the north, nor will it drive the market in the direction of using more TGUs. At the same time, allowing the ultra-low SHGC performance of the Proprietary Triple Silver DGU to be Energy Star labeled in the northern zone will result in a significant loss of energy efficiencies and the burning of more fossil fuels than would be necessary if only higher SHGC products were awarded the Energy Star label in the north.

Comment 1 B:
Establishing a Northern SHGC Criteria ≥ 0.32.

As described above, the triple silver low-e sputter coating used to make the Proprietary Product not only yields a 0.27 U-factor, it also yields an ultra-low SHGC of 0.25 or less.[4] While a 0.25 SHGC is now the standard that has recently been adopted by the IRC for ***southern*** climate zones 1, 2 and 3, the further north from these southern zones you go, prescriptive SHGC values in the IRC increase. This is because higher prescriptive SHGCs are intended to provide northern homeowners with windows that permit more solar energy to enter their homes through the windows, thereby using the renewable energy of the sun to reduce the amount of fossil fuels that would otherwise have to be burned in order to meet winter heating loads.

However, use of "Any" SHGC Criteria as proposed by V.6 in the northern climate zone will not result in the use of higher SHGC windows in the north. Instead, allowing "Any" SHGC Criteria in the north will actually allow both high SHGC and ultra-low SHGC windows to be used in the north, even though there is no energy justification for the use of ultra-low SHGC windows in the northern zone. Since ultra-low, 0.25 SHGC windows are now mandated for use in IRC climate zones 1, 2 and 3, window manufacturers have no choice but to use them there. Since those same ultra-low SHGC Windows would be allowed to bear an Energy Star label in the

[4] The actual SHGC value will vary depending on the amount of framing in the window. More framing material typically reduces SHGC while less framing material typically increases SHGC.

northern zone by reason of the "Any" SHGC Criteria proposed there, this will naturally lead the largest, national window manufacturers to use the Energy Star label as a basis to market as "energy efficient" the same windows in the northern zone that they are obligated by the IRC to use in the south because of the amount of solar energy they block from entering the home. The resulting problem is that, while Proprietary Triple Silver DGUs are clearly energy efficient in the cooling dominated south, in northern heating dominated climates, these same ultra-low SHGC windows block 75% or more of the sun's energy, causing homeowners to burn more ***fossil fuels*** to compensate for that loss of the sun's renewable energy that would otherwise enter through the windows and heat their homes.

In a study performed for AGC Glass Company North America by Enermodal Engineering, a comparison was made of the energy performance of several different types of windows ranging from low SHGC to clear glass in an average house in Energy Star's northern zone.[5] The results of the study are set out below. It is interesting to note that ***in the northern zone, the high solar gain windows outperformed all the others, and, even the generic clear glass window out performed the low SHGC product on an annual energy performance basis.***

Annual results for an average house in the Northern zone.

Product Type	Heating (MBtu)	Cooling (kWh)	Energy Cost (USD$)	GHG Emissions (ton)
Low Solar Gain	73.7	456	1,059.90	5.27
Medium Solar Gain	71.2	560	1,035.43	5.29
High Solar Gain	65.6	865	986.43	5.02
Generic Clear	68.8	968	1,040.41	5.07

[5] The low solar gain window selected had a whole window SHGC of 0.22; the two medium solar gain windows had whole window SHGCs of 0.29 and 0.32; the two high solar gain windows had whole window SHGCs of 0.33 and 0.36. The generic clear window had no low-e coating and a whole window SHGC of 0.59.

While this loss of energy savings in the north may be an unintended consequence of allowing "Any" SHGC in the north, it will inevitably happen if low SHGC windows are Energy Star labeled in the northern zone. In a free market, window manufacturers are constantly looking for ways to simplify their manufacturing, inventorying and delivery costs for the windows they market. One way to reduce these costs is to use the Energy Star label to market a ***single*** product that can be used in Miami, the southernmost climate zone, all the way to those states in the northern most climate zone that border Canada.

The "Any" Criteria proposed in V.6 makes this manufacturing, marketing and delivery strategy possible. The only way to avoid it is to require a ***minimum*** SHGC in northern climate zones.

A minimum 0.32 SHGC in the northern zone is justified because it is the mid-point between the minimum 0.25 SHGC proposed by the Canadian Energy Star program in Canadian climate zone 2 (the equivalent of the northern zone in the U.S. Energy Star program) and the energy analysis that Lawrence Berkeley National Laboratory ("LBNL") prepared for DOE's proposed climate zones ES4 and ES5 in Phase 2 of the Draft Criteria and Analysis for Energy Star Windows, Doors and Skylights, dated August 6, 2008 ("LBNL Report"). In the LBNL Report, climate zone ES4 is the same as IRC climate zone 5 and ES5 is the same as IRC climate zones 6 and 7 and, together, ES4 and ES5 constitute the northern zone in the Framework Document. The energy savings analyses set out in graphic form in Figs. 7 and 8 on pages 15 and 16 of the LBNL Report clearly show that a 0.25 U-factor paired with SHGCs $\geq$ 0.40 would qualify for DOE's proposed Energy Star criteria in IRC climate zones 5, 6 and 7 and, if implemented as a part of Energy Star, would save many trillions of Btu's each year.

The Canadian Energy Star program is proposing a maximum 0.25 U-factor in its zone 2. The LBNL Report also points to a maximum 0.25 U-factor in the northern zone. The midpoint between the 0.25 minimum SHGC proposed in the Canadian Energy Star program and the minimum 0.40 SHGC that is paired with a 0.25 U-factor in the LBNL Report is a minimum 0.32 SHGC. Hence, 0.32 is an appropriate point at which to fix a minimum SHGC in the northern zone, especially since it will be the first minimum SHGC in the U.S. Energy Star program.

While some may argue that summer cooling loads in the north will increase with the use of higher SHGC windows, as the DOE Report documents, the savings resulting from reduced heating loads more than outweighs any anticipated increase in summer cooling loads. Moreover, the Energy Star label is primarily used to guide consumers that are retrofitting existing homes with new windows.[6] As a result, many, if not all, of the windows replaced by Energy Star windows will be single pane, clear glass windows. Such windows are likely to have a 0.65 SHGC or higher and an insignificantly high U-factor. Replacing those windows with Energy Star labeled windows that have a $\leq$ 0.25 U-factor and an $\geq$ 0.32 SHGC will not only save an enormous amount of energy but, at the same time, it will significantly reduce peak electric loads below those currently associated with the widespread use of single pane, clear glass windows currently found in the existing residential building stock.

Comment 2 A.
Establishing a Maximum 0.28 U-factor in the North-Central Zone.

[6] Minimum energy codes mandate the performance of windows in new homes whereas Energy Star attempts to exceed those minimum standards. Accordingly, Energy Star is not typically used in new home construction, but is, instead, primarily used by consumers selecting retrofit windows in the existing residential building stock.

The 2010 northern Energy Star U-factor Criteria was reduced to 0.30 in response to the 0.30/0.30 tax credit passed by Congress. In turn, that caused the final 2010 north-central zone U-factor to be set at 0.32.

The Framework Document proposes a U-factor range for the north-central zone between 0.28 and 0.30. While a 0.30 U-factor is the U-factor of the current northern Energy Star zone, moving the north-central zone to a 0.28 U-factor will not only represent a significant increase in U-factor stringency, but it will be entirely feasible, especially if the Criteria in the northern zone is established at 0.25. In that regard, many of the products that will be used to secure Energy Star labeling in the northern zone will also qualify for Energy Star labeling at the 0.28 U-factor level in the north-central zone. Exercising this option will, in effect, bootstrap the increased energy efficiencies from the northern zone into the north-central zone and is fully justified.

Comment 2 B.
Establishing "Any" SHGC in the North-Central Zone.

The chart that appears on the next page displays the results of applying the regression coefficients developed by LBNL in connection with the DOE Report to a fixed U-factor and multiple SHGCs in the north-central zone for both new construction and retrofits of the existing building stock:

Energy STAR® USA Windows LBNL Regression Coefficients

Floor Area **2,000** sq. foot Natural Gas Heating (combustion furnace)

Comparison	U-factor	SHGC	Heating Energy (kBtu/sf)	Cooling Energy (Wh/sf)	Total Energy Site (kBtu/sf)	Total Energy Source (kBtu/sf)	Heating Cost ($$)	Cooling Cost ($$)	Total Cost ($$)
Window 1	**0.28**	**0.40**	31.9	947.7	35.1	**42.3**	$ 638	$ 227	$ 865
Window 2	**0.28**	**0.60**	29.3	1176.0	33.4	**42.3**	$ 587	$ 282	$ 869

Existing, Furnace, Single story Energy Star Zone = North-Central (Average for 21 cities within this zone)

Existing, Furnace, Two story

Comparison	U-factor	SHGC	Heating Energy (kBtu/sf)	Cooling Energy (Wh/sf)	Total Energy Site (kBtu/sf)	Total Energy Source (kBtu/sf)	Heating Cost ($$)	Cooling Cost ($$)	Total Cost ($$)
Window 1	**0.28**	**0.40**	15.0	595.1	17.0	**21.5**	$ 300	$ 143	$ 442
Window 2	**0.28**	**0.60**	13.0	756.9	15.6	**21.3**	$ 260	$ 182	$ 441

New, Furnance, Single story Energy Star Zone = North-Central (Average for 21 cities within this zone)

New, Furnace, Two story

For Energy Star - North-Central Zone - U-factor = 0.28 Btu/hr-sf-F (max) and SHGC = Any
This zone is SHGC 'neutral' - heating energy consumption will balance cooling energy consumption – range of SHGC values
Relationship holds true for both Existing House and New Construction

The chart clearly displays that there is ***no*** energy justification whatsoever for capping SHGC in this climate zone at 0.40. The only thing a 0.40 SHGC cap does to eliminate products that perform as well with higher SHGCs as those with a 0.40 SHGC. As a result, there is no

technical justification for eliminating these equivalent performing products from qualifying for the Energy Star label.

The north-central zone is ***not*** sensitive to increasing SHGC over 0.40. Although the 2012 IRC mandates a maximum 0.40 SHGC in zone 4, it is, simply, wrong.[7] There is no technical basis upon which to exclude products with an SHGC higher than 0.40 in the north-central zone from an Energy Star label. "Any" SHGC should be permitted in the north-central zone.

Conclusion

The northern zone is very sensitive to SHGC. Allowing "Any" SHGC coupled with a 0.27 U-factor in the northern zone will inevitably result in the nationwide Energy Star labeling of the Triple Silver DGU because:

- In the northern zone, the Proprietary Triple Silver DGU, will achieve an Energy Star label at the 0.27 U-factor and "Any" SHGC as proposed in the Framework Document;
- In the north-central zone, the same Proprietary Product will achieve an Energy Star label at any of the U-factor's or SHGCs in the range proposed in the Framework Documents –or- the 0.28 U-factor and "Any" SHGC proposed by PNA;
- In the south-central and the southern zones, the IRC mandates use of the Proprietary Triple Silver DGU on account of its ultra-low SHGC of 0.25 or below.

While Energy Star labeling of the ultra-low SHGC performance characteristics of the Proprietary Triple Silver DGU will save energy in the southern and south-central zones, it will have no significant energy consequences in the north-central zone and its use in the northern

[7] The maximum 0.40 SHGC was included in IRC zone 4 as a result of the ICC's Final Action Hearing in Charlotte, NC ("Final Action Hearings"). Those Final Action Hearings resulted in the filing of multiple appeals by a wide variety of stakeholders on the basis of improprieties relating to the relationships that allegedly existed between the financial interests of various industries affected by the Final Action Hearings and the governmental members of ICC that voted at the Final Action Hearings. Details of these appeals can be provided to EPA on request. The appeals resulted in numerous recommendations by the Appeals Panel to institute significant changes to the way Final Action hearings are conducted.

zone will squander significant amounts of energy in comparison to the use of higher SHGC products in the north.

In order to achieve the stated goal of establishing "criteria that recognize the highest-performing doubles and brings a greater number of triple pane windows into the mainstream," AGC strongly urges EPA to adopt the following V.6 Energy Star Criteria:

- A northern U-factor Criteria $\leq$ 0.25.
- A northern SHGC Criteria $\geq$ 0.32.
- A north-central U-factor Criteria $\leq$ 0.28.
- Any SHGC in the north-central zone.

Thank you again for the opportunity to comment.