

September 28, 2012

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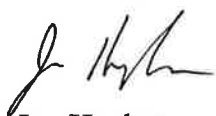
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**Re: Comments to Energy Star for Windows, Doors, and Skylights  
Version 6.0 Draft 1 Criteria and Analysis Report**

Dear Doug and Emily:

Attached are AGC Glass Company North America's comments to the new Energy Star for Windows, Doors, and Skylights Version 6.0 Draft 1 Criteria and Analysis Report.

Sincerely,



Jon Hughes  
Director Marketing & Programs

cc: Christopher F. Correnti  
Vice President, General Counsel and Secretary

## **AGC Public Comments**

### **Energy Star for Windows, Doors and Skylights Version 6.0 Draft 1 Criteria and Analysis Report**

**September 28, 2012**

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**Comments of AGC Glass Company North America to  
Energy Star for Windows, Doors, and Skylights  
Version 6.0 Draft 1 Criteria and Analysis Report**

AGC Glass Company North America (“AGC”) submits the following comments to the Energy Star for Windows, Doors, and Skylights (“Energy Star” or “Energy Star Program”) Version 6.0 Draft 1 Criteria and Analysis Report dated July 2012 (“Draft 1 Criteria” or “Draft 1 Criteria Report”).

**Executive Summary**

The Draft 1 Criteria in the northern zone suffers from several serious deficiencies.

By including “any” as the northern zone SHGC criteria, the criteria abandons any effort to guide northern consumers to the most efficient windows for use in the heating dominated northern zone. Worse, those criteria will mislead consumers to select ultra-low SHGC windows bearing an Energy Star label that are far from the most energy efficient in the north and which will result in northern consumers paying unnecessarily high utility bills over their entire useful life.

In order to avoid misleading northern Energy Star consumers; differentiate the most efficient products for use in the north from those which are more appropriate for the south; and to move the northern market to more energy efficient designs, the Energy Star criteria must include a minimum SHGC and additional U-factor/SHGC combinations to the one alternate path currently included in the Draft 1 Criteria.

Unless Energy Star reduces the northern U-factor below the 0.27 currently proposed, it is likely that the Version 6.0 criteria in the north will be obsolete by the time it takes effect. Given the availability of #4 Surface Products capable of delivering a cost effective U-factor of 0.25, EPA should reduce the northern U-factor to 0.25.

**I. A Minimum SHGC in the Northern Zone is  
Critical to the Continued Credibility of the Energy Star Program.**

To the vast majority of consumers, the Energy Star label means one thing - energy efficiency:

*By far, the most common message associated with the [Energy Star] label was ‘energy efficiency or energy savings,’ which is considered high understanding of the label. Sixty-four percent of households surveyed associated the ENERGY STAR label with this message.<sup>1</sup> (Emphasis added).*

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<sup>1</sup> EPA Office of Air and Radiation, Climate Protection Partnership Division. *National Awareness of Energy Star for 2011: Analysis of 2011 CEE Household Survey*, p.13, U.S. EPA, 2012.

The significance of this is that the credibility, and value, of the Energy Star brand depends on criteria that directs consumers to the most energy efficient products. Indeed, the Energy Star website, under “How a Product Earns the ENERGY STAR Label,” specifically tells consumers that:

**New Products in Development**

One of the *main goals* of the ENERGY STAR program is to develop performance-based specifications that determine the *most efficient products* in a particular category. Products that meet these specifications earn the ENERGY STAR label.

**Revision to Existing Products**

ENERGY STAR specifications are then periodically revised to ensure relevancy under current market conditions. EPA and DOE strive to make certain that specifications *differentiate the most efficient products and move the market toward more energy-saving designs*. (Emphasis added.)

This is repeated in the Draft 1 Criteria, p. 8: “ENERGY STAR seeks to identify *the most energy-efficient products available*.” (Emphasis added).

If an Energy Star criteria is fashioned which knowingly allows inferior products to bear the Energy Star label, the public will be misled, rather than benefitted, by the Energy Star label. Such a criteria would seriously jeopardize the credibility and value of the brand associated with the Energy Star label.

The Draft 1 Criteria has great potential to mislead, rather than benefit, the consuming public in several ways. First, it will mislead the public and damage the Energy Star brand if it does not include a minimum SHGC in the northern zone because it will knowingly allow inferior products to be Energy Star labeled in the north. Second, it will mislead the public, damage the brand and cause serious injury to numerous products offered by participating stakeholders if additional alternate paths for equivalent energy performance are not included in the northern zone.

AGC has a strong stake and dedicated interest in ensuring that the value of the Energy Star brand is properly protected.

**A. A minimum SHGC is needed in the northern zone to differentiate the most efficient products and to move the market toward more energy efficient designs.**

If a minimum SHGC is not included in the northern zone, the Energy Star goals to differentiate the most efficient products in the north and to move the market toward more energy efficient designs will be frustrated. Worse, northern consumers will be misled by the Energy Star label into buying ultra-low SHGC windows designed specifically for use in the far south. Because they are designed to meet building code requirements in the far south, ultra-low SHGC

windows are generally designed to block from 70 to 80% or more of the sun's radiation from entering a home.<sup>2</sup>

In the far south, reducing cooling loads by blocking solar energy is the very definition of an energy efficient window. However, in the north, using ultra-low SHGC windows forces consumers to *burn more fossil fuels to heat their homes* in order to make up for the free solar energy that is blocked by the use of ultra-low SHGC windows. This not only increases aggregate national energy consumption, but costs consumers more money to heat their homes every year throughout the entire 25-35 year life span of their so-called "Energy Star" labeled windows.

As written, the Draft 1 Criteria strongly encourages the use of these ultra-low SHGC windows in the northern zone. It does this by specifying an ultra-low SHGC criteria in the most southern zone ( $\text{SHGC} \leq 0.25$ ) and then allowing that same ultra-low SHGC window to be Energy Star labeled in each successive climate zone moving northward (South-Central  $\leq 0.25$ ; North-Central  $\leq 0.40$ ). Finally, in the northern zone, the Draft 1 Criteria abandons any effort to provide consumers with any SHGC guidance. Instead, it offers the Energy Star label to windows with "Any" SHGC in the north. This, of course, includes windows designed specifically to comply with the ultra-low  $\leq 0.25$  SHGC mandate of the 2012 International Energy Conservation Code ("IECC") in its southernmost climate zones (zones 1 through 3) and as now proposed in Energy Star's corresponding southern and south-central zones.

**1. Currently, the mean and median window SHGC performance of the inventories of the top 20 window manufacturers is 0.22. This is significant because it clearly evidences that national window makers are limiting their inventories largely to a single SHGC product that can be labeled for use in all four Energy Star Climate Zones.**

In an effort to assess the "availability" of products in the current marketplace, D&R International ("D&R") conducted research which resulted in what EPA calls its Products for Sale Analysis. Although this analysis will be addressed in greater detail below, the methodology that D&R employed consisted of a review of double- and single-hung windows available on the websites of the so-called "top 20 window manufacturers." Fourteen of these "top 20" are national manufacturers that sell windows in all 50 states. Draft 1 Criteria Report, pp. 18-19.

In the process of conducting that research, D&R "determined that the mean and median SHGC" of the windows available for sale was 0.22.<sup>3</sup> This is significant, because it establishes that the national window manufacturers are largely following what they are being encouraged to do by the current Energy Star criteria, namely, stocking their inventories, nationwide, with ultra-low SHGC window products that are designed to meet:

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<sup>2</sup> A window with a center of glass 0.25 SHGC will block 75% of the sun's solar radiation from entering a home. That same window may well have a 0.20 SHGC or lower when it's SHGC is measured on a "whole product" basis which includes its opaque frame components. A 0.20 SHGC window blocks 80% of the sun's energy from entering the home. Energy Star is a "whole product" criteria.

<sup>3</sup> *Technical Support for ENERGY STAR Windows Version 6.0 Specification Revision*, Lawrence Berkely National Laboratory, July 1, 2012, p. 2.

(i) the  $\leq 0.25$  SHGC currently prescribed for zones 1 through 3 by the IECC and the proposed criteria for the southern and south-central Energy Star zones,

but, which can also meet:

(ii) the  $\leq 0.40$  SHGC criteria for the north-central Energy Star zone, and

(iii) the “Any” SHGC criteria proposed for the northern Energy Star zone.

This ultra-low 0.22 SHGC window that is being inventoried, Energy Star labeled, and sold to consumers in all *four* Energy Star zones is not only misleading, but damaging to northern consumers and to the credibility of the Energy Star brand.

**2. Adding a 0.35 minimum SHGC to the northern Energy Star criteria would *DOUBLE* the aggregate energy savings captured in the northern zone.**

In evaluating the aggregate national energy savings attributed to the revisions proposed in the Draft 1 Criteria Report, the Lawrence Berkeley National Laboratory (“LBNL”) selected a 0.27 SHGC for its modeling. It did this as a “conservative compromise” between the 0.30 SHGC used in performing these same computations for the last Energy Star revision cycle in 2008 and the 0.22 SHGC revealed in D&R’s Product for Sale Analysis.<sup>4</sup>

Using this 0.27 SHGC, LBNL calculates that a total aggregate national energy savings of 0.51 Trillion Btu’s would result from the Draft 1 Criteria in the northern zone. However, in presenting its conclusions at EPA’s Stakeholder Meeting on August 27, 2012, LBNL concluded that the inclusion of a minimum 0.35 SHGC in Energy Star’s northern criteria would double the national aggregate energy savings captured in the northern zone:

Setting a minimum SHGC higher would result in *significantly larger savings (e.g. double the savings for SHGC = 0.35)*.  
Emphasis added.<sup>5</sup>

This doubling of the national aggregate energy savings that would result by, simply, adding a minimum 0.35 SHGC in the northern zone would actually represent the accumulated energy savings attributable to all the homes that install Energy Star labeled windows with a

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<sup>4</sup> Id.

<sup>5</sup> EPA’s ENERGY STAR for Windows, Doors and Skylights Draft 1 Criteria and Analysis Report Stakeholder’s Meeting, *Energy Star Program Savings Estimates*, Lawrence Berkeley National Laboratory, August 27, 2012, slide 98.



minimum 0.35 SHGC during the first year of the revised Energy Star criteria.<sup>6</sup> This, too, is significant because it means that the homeowner using windows with a minimum SHGC, rather than the 0.22 SHGC that currently represents the SHGC of products being sold by the national window manufacturers, will enjoy significant savings from lower aggregate utility bills. The first year savings would then compound by a factor of 25 to 35 as the windows that are installed in their homes with a minimum SHGC continue to generate lower aggregate utility bills throughout their entire useful lives. Stated otherwise, by ignoring the role of SHGC in the north, EPA's proposed criteria will force homeowners to sacrifice ½ the energy savings they would otherwise enjoy by forcing them to pay higher utility bills than necessary over the entire useful life of the ultra-low SHGC windows they are led to purchase by relying on a flawed northern Energy Star criteria.

In short, *including a minimum 0.35 SHGC in the northern zone would result in:*

- significant dollar savings for consumers;
- a significant increase in the energy efficiency of windows used in the northern zone;
- a doubling of the aggregate national energy savings attributable to the Energy Star criteria in the northern zone;
- a differentiation of the most efficient products used in the northern zone; and
- moving the northern window market toward more energy efficient designs.

**B. Rationales advanced by EPA in support of its decision not to include a minimum SHGC in the north are seriously flawed.**

EPA advances several reasons for allowing “Any” SHGC in the north. None are correct.

The first reason advanced by EPA is that it will allow *all* products, whether high or low SHGC, to freely compete for acceptance in the northern market place. On its face, this rational is antithetical to the very reason that the Energy Star Program exists.

This is the 20<sup>th</sup> Anniversary of the Energy Star Program. In announcing that on its website, EPA wrote:

Through our vast network of partners, ENERGY STAR helps Americans make *informed decisions* about cost-effective ways to save energy in every facet of our lives – at home, at work, and in our communities. (Emphasis added.)

Again, in “ENERGY STAR Overview of 2011 Achievements,” EPA writes:

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<sup>6</sup> Id, at slide 89.

The American public trusts ENERGY STAR as the national symbol for energy efficiency *to inform their purchasing decisions, save them money, and protect the environment*. By relying on ENERGY STAR for efficient products, Americans know they can save on utility bills while reducing GHG emissions. (Emphasis added.)

Abandoning northern consumers to “competition” between high and low solar gain windows in the north by failing to provide any SHGC criteria capable of differentiating the most energy efficient products is tantamount to abandoning the very purpose for which the Energy Star Program exists. By using “any” SHGC in the north, the Energy Star label does nothing to assist consumers in making *informed decisions* about energy efficiency. Instead, it abandons them to whatever SHGC windows that window sellers in the north choose to sell. Of course, as set out above, the current structure of the Energy Star criteria from south to north *strongly* encourages the use of ultra-low SHGC windows in all four Energy Star zones. This, in turn, enables the national window makers to inventory a single SHGC product for Energy Star labeling and sale in the southern, south-central, north-central and northern zones. And, as EPA’s Products for Sale Analysis now establishes, that is exactly what the national window makers are doing, namely, inventorying and selling ultra-low 0.22 SHGC Energy Star labeled windows nationwide.

Second, the Draft 1 Criteria Report claims that the Products for Sale Analysis shows no windows listed or promoted with a high SHGC and a low U-factor. According to EPA, at p. 27 of the Draft 1 Criteria Report:

[t]he ENERGY STAR guiding principles require that ‘products are broadly available.’ This lack of availability of high-gain windows in the current market was another key piece of information EPA used to decide not to set a minimum SHGC rating in the Northern Zone.

This reason for failing to provide an SHGC criteria capable of differentiating between the use of ultra-low SHGC windows and the more energy efficient high SHGC products in the north is also incorrect.

EPA has drawn this conclusion concerning a lack of “product availability” from its Products for Sale Analysis. The methodology used to develop this Products for Sale Analysis is described at p. 18 of the Draft 1 Criteria Report:

The products for sale analysis began with the identification of the top window manufacturers. *Window & Door Magazine* publishes an annual list of the Top 100 window and door manufacturers based on revenue. The top 20 companies on the list represent 79.7% of the market, so EPA concluded that focusing on products from these 20 companies would generally reflect the products available on the market. Further, each of the top 20 manufacturers

produces ENERGY STAR qualified products and 14 of the top 20 sell to customers in all 50 states.

There are a number of serious flaws in EPA's use of this Products for Sale Analysis to make northern zone criteria decisions.

**1. EPA's Products for Sale Analysis is an inappropriate de facto delegation of decision-making authority from EPA to a select group of window manufacturers.**

First and foremost, EPA's Products for Sale Analysis looks *only* to windows that a designated group of "top 20 window manufacturers" have *selected* to include in their *current* inventories for sale to the public. In using this Products for Sale Analysis to make decisions concerning its Draft 1 Criteria in the north, EPA has, in effect, made those window manufacturers *de facto* decision makers as to what products are "available" for purposes of Energy Star labeling in the northern zone of the Draft 1 Criteria. Windows that are currently sold by these select manufacturers are anointed as "available" for Energy Star labeling. Windows that are not currently sold by those manufacturers are deemed to lack adequate "availability" for inclusion in the Draft 1 Criteria.

One of EPA's obligations is to develop a criteria that will "*move the market toward more energy-saving designs,*" consistent with the goals of the Energy Star Program. By using its Products for Sale Analysis, EPA has chosen, instead, to accept the existing inventories of windows of a select group of window makers as constituting the universe of windows "available" for purposes of developing the Draft 1 Criteria in the north. EPA cannot properly defer its decision making authority to a group of window makers based on products they have unilaterally selected to include in their inventories. This is tantamount to EPA delegating to a select group of manufacturers the power to determine the limits of revisions that will be made to the northern Energy Star criteria.

**2. EPA's Products for Sale Analysis skews product "availability" heavily in favor of national window manufacturers that have a strong interest in a single, nationwide SHGC criteria.**

Second, the "top 20 window manufacturers" used in EPA's Products for Sale Analysis, includes 14 national manufacturers that sell to customers in all 50 states. Draft 1 Criteria Report, p. 18. This skews the analysis heavily in favor of the inventories selected by national window manufacturers that have a strong interest in limiting their inventories to a single SHGC window that can be Energy Star labeled for sale in all 50 States. The EPA Products for Sale Analysis ignores local or regional window manufacturers that may well be selling different SHGC windows depending on the climate zone in which they are to be used, that is, high SHGC windows in northern homes and low SHGC windows in southern homes.

**3. EPA's Products for Sale Analysis accounts for only 2.5% of entities involved in the manufacture of windows and doors.**

Third, EPA's Products for Sale Analysis assumes that 100% of the windows are sold by the top 100 window makers listed in *Door & Window* magazine. That is, simply, not true. NFRC identifies 820 participants in its certification program. Accordingly, the top 100 window and door makers listed in *Door & Window* magazine, simply, do not represent 100% of the universe of window manufacturers. Indeed, the top 100 represents only 12.5% of those involved in making window and doors.

Simply put, looking at the inventories of only 2.5% of those participating in NFRC's certification program, of which, 70% are national window makers, is, simply, not a reasonable or accurate basis upon which to determine whether windows with low U-factors and high SHGCs are "available" for purposes of developing a northern SHGC criteria.

**4. EPA's Products for Sale Analysis ignores the fact that high SHGC glass is readily "available" from five different U.S. primary glass manufacturers.**

There are five primary glass manufacturers in the United States. They supply the U.S. and Canada with architectural and other forms of glass. These 5 primary manufacturers offer a total of 13 different types of high-solar gain products for sale in the U.S. and Canada:

- PPG Industries offers three high-solar gain products:
  - Sungate 400, Sungate 500 and Sungate 600.
- Guardian Industries offers four high-solar gain products:
  - ClimaGuard 75/68, 80/70, IS-15 and IS-20.
- Cardinal Glass offers two high-solar gain products:
  - LoE-180 and LoE-i81.
- NSG/Pilkington offers one high-solar gain product:
  - Energy Advantage.
- AGC offers three high-solar gain products:
  - Comfort E2, E-PS, and Ti-PS.

In concluding that a "lack of availability of high solar-gain windows in the current market" was a "key" factor supporting EPA's decision not to include a minimum SHGC in the northern zone criteria, EPA ignored the fact that 13 different high solar-gain glass products are readily available right now from 5 different U.S. manufacturers and that all that is needed to **"move the market toward more energy efficient designs"** in the north is to adopt a minimum SHGC that would motivate window makers to **"differentiate the most efficient products"** for use in the north from those that are the most efficient for use in the south.

**5. EPA also ignored the many thousands of high solar-gain products that are found in the Natural Resources Canada's ("NRCan") windows database. Windows available in Canada are readily available in the United States.**

In its Draft 1 Criteria Report, EPA notes that the NFRC's Certified Product Directory ("CPD"), lists 4,562 products having a U-factor  $\leq 0.27$  and a SHGC  $\geq 0.32$ . Additionally, it notes that another 933 products have the same U-factor and a SHGC  $\geq 0.40$ . However, the Draft 1 Criteria Report completely ignores Natural Resources Canada's ("NRCan") Energy Star window database. Windows available in Canada are also available to the United States.

As noted above, the same 5 primary glass manufacturers that supply glass to the U.S. also supply glass to Canada. Indeed, many of the same window manufacturers included in the "top 20" window manufacturers studied in connection with the development of EPA's Products for Sale Analysis, also have products listed in the NRCan window database. Many of those products are high solar-gain windows.<sup>7</sup>

Canada, like the Energy Star Program's northern zone in the U.S., is heating dominated. Unlike the U.S. Energy Star Program, however, Canada's Energy Star Program encourages the use of high-solar gain products by virtue of its Energy Rating ("ER") system. The ER system matches an appropriately high SHGC with an appropriate U-factor to achieve equivalent energy performance relative to a U-factor criteria alone.

In the NRCan windows database, which is ignored by the Draft 1 Criteria Report, there are:

- 47,399 windows with a SHGC of  $\geq 0.32$  and a U-factor of  $\leq 0.28$ ,
- 12,976 windows with a SHGC of  $\geq 0.37$  and a U-factor of  $\leq 0.29$ , and
- 10,036 windows with a SHGC of  $\geq 0.42$  and a U-factor of  $\leq 0.30$ .

Not only does this show that high solar-gain windows are readily available in Canada, it also shows that these products are available from U.S. window manufacturers doing business in Canada. It also shows that other U.S. window manufacturers are equally capable of offering high solar-gain windows in Energy Star's northern zone which shares a border with Canada.

All of these 70,000+ windows found in the NRCan database have actually been designed and simulated or tested. Moreover, as set out in greater detail below, all of these windows provide an energy performance equivalent to a window with a U-factor of 0.27.

## **II. Equivalent Energy Performing Products Are Entitled to Bear the Energy Star Label.**

EPA is not allowed to use the Energy Star Program to pick "winners" and "losers" in the marketplace from among products that have equivalent energy performance. For that reason, if a product provides an energy performance equivalent to the prescriptive performance criteria

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<sup>7</sup> Approximately 11 of the "top 20" manufacturers used in the Products for Sale Analysis are listed in NRCan's Energy Star database, including 4 of the top 5. Indeed, 6 of the "top 20" window manufacturers that are studied in connection with EPA's Products for Sale Analysis, have more than 16,000 high solar gain products listed in NRCan's Energy Star windows database. Of course, if all of the top 20 manufacturers are included, the total number will be even higher.

established for the Energy Star Program, that product is entitled to bear an Energy Star label. Depriving such a product the Energy Star label would not only damage that product in the marketplace, it would also damage the credibility of the Energy Star brand. Consumers are entitled to choose between equivalent energy performing products. The Energy Star label cannot deprive them of choice by picking “winners” and “losers” from products that provide equivalent energy performance.

This is significant because, the Appendix charts following these Comments, show specific examples in International Falls, MN; Chicago, IL; and Pittsburgh PA where consumers are being prevented from selecting products that perform the same or better than the proposed Energy Star criteria. In fact, using D&R’s product availability data, the number of products being excluded despite equivalent or better performance is actually larger than the number of products allowed by the proposed criteria. This is clearly misleading and restricts the ability of consumers to choose among equivalent energy performing products.

The current Energy Star criteria developed by the U.S. Department of Energy (“DOE”) in 2008, specifies a northern zone U-factor of  $\leq 0.30$ . However, in connection with that criteria, LBNL developed regression modeling that revealed how changes in U-factor and SHGC affect aggregate energy consumption. DOE published LBNL’s regression modeling in connection with its issuance of the current Energy Star criteria. From it, DOE found that in the northern zone, a 0.01 reduction in U-factor produces the same energy benefits as a 0.05 increase in SHGC.<sup>8</sup> As a result, windows with (i) a 0.31 U-factor and a  $\text{SHGC} \geq 0.35$  or (ii) a U-factor of 0.32 with a  $\text{SHGC} \geq 0.40$  were also included in the northern criteria because they deliver equivalent energy performance.

The Draft 1 Criteria acknowledges the validity of the equivalency relationship that LBNL developed between U-factor and SHGC by including a single northern trade-off in its Draft 1 Criteria. However, other equivalent U-factor and SHGC combinations need to be included in the northern criteria. Otherwise, a large number of products that provide equivalent energy performance will be damaged by virtue of being deprived the Energy Star label.

Specifically, in addition to the 0.28 U-factor coupled with a  $\text{SHGC} \geq 0.32$  already found in the Draft 1 Criteria, these two additional U-factor/SHGC combinations should be included in the northern criteria:

- U-factor = 0.29 coupled with a  $\text{SHGC} \geq 0.37$ , and
- U-factor = 0.30 coupled with a  $\text{SHGC} \geq 0.42$ .

As set out above, these products are certainly “available” to U.S. consumers. Over 70,000 windows with these performance characteristics have been designed and simulated or tested and are currently included in NRCan’s Energy Star database.

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<sup>8</sup> *ENERGY STAR Program Windows, Doors, and Skylights Draft Criteria and Analysis*, Prepared by D&R International for the U.S. Department of Energy, August 6, 2008, pp. 10-11.

The same 5 primary glass manufacturers supply glass to both the U.S. and the Canadian window markets. Between them, they offer 13 different types of high solar-gain glass to window manufacturers in the United States and Canada alike. Many of the same window manufacturers that are supplying ultra-low SHGC windows to consumers under the Energy Star label in the northern zone of the United States, are supplying high SHGC windows to Canadian consumers just across the Canadian border. The only real reason for this is that the Canadian Energy Star Program's ER system encourages the use of high SHGC products in Canada to minimize the amount of fossil fuels that must be burned to heat Canadian homes. In the United States, however, flaws in its Energy Star Program's criteria actually encourages northern consumers to heat their homes by burning *more* fossil fuels, rather than relying on the free energy of the Sun. The U.S. Energy Star Program does this by selecting criteria that encourages the use of ultra-low SHGC windows in all four of its climate zones.

The objective of the Energy Star Program is to "differentiate the most efficient products and move the market toward more energy-saving designs." Doing this in the northern zone includes alternate paths that will differentiate between the use of ultra-low SHGC products and high solar-gain products in the north. The two additional U-factor and SHGC combinations set out above deliver the same energy performance as a 0.27 U-factor window and, therefore, should be included as alternate paths in the northern criteria.

### **III. The Northern U-factor Should be Lowered to 0.25.**

The Framework Document states that in the northern zone: "*EPA is looking to establish criteria that recognize the highest-performing doubles and brings a greater number of triple pane windows into the mainstream*"<sup>9</sup> The best performing doubles have a low-e coating on the #2 surface and a second low-e hard coat on the #4 surface ("*#4 Surface Products*").<sup>10</sup>

Adding a hard coat low-e to the #4 surface of a double with a low-e coating on the #2 surface will improve the U-factor of the window by about 20%. This is evident from Figure 14, p. 24, of the Draft 1 Criteria Report. The data presented there makes it clear that:

- 1- #4 Surface Products can achieve U-factors of 0.26, 0.25 and even 0.24, and
- 2- Some 7% of the double glazed windows in the CPD are #4 Surface Products with U-factors  $\leq 0.25$ .

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<sup>9</sup> ENERGY STAR for Windows, Doors, and Skylights Version 6.0 Product Specification Framework Document, October 2011, p. 6.

<sup>10</sup> In its comments dated November 18, 2011, to Energy Star Version 6.0 Product Specification Framework Document for Windows, Doors and Skylights, AGC set forth in detail the benefits relating to #4 Surface Products including their cost effectiveness. Those comments will not be repeated here, but are incorporated herein by reference.

Reducing the northern zone U-factor to 0.25 will achieve EPA's objective of "establishing a criteria that recognizes the highest-performing doubles and brings a greater number of triple pane windows into the mainstream.

**1. Number 4 Surface Products are readily available.**

Number 4 Surface Products are readily available. In that regard, every one of the 5 primary U.S. glass manufacturers offers a glass specifically made for #4 Surface Products.<sup>11</sup> Moreover, Figure 14 of the Draft 1 Criteria Report confirms the availability of #4 Surface Products.

**2. Setting the northern U-factor at 0.27 will not significantly reduce the market share for Energy Star Windows.**

According to the Draft 1 Criteria Report, Energy Star Windows market share has grown to over 80%.<sup>12</sup> EPA would like to see a market share of less than 50% after Version 6.0 specifications take effect.<sup>13</sup> Nevertheless, "[i]n the northern zone, approximately 41.5% of the products in the CPD *that meet the current ENERGY STAR specification* can meet the proposed U-factor of 0.27."<sup>14</sup>

Instead of leading the market to the best performing products, a 0.27 U-factor will permit window manufacturers to continue to use the same windows they are currently using to meet the existing Energy Star criteria. This means that a Version 6.0 criteria with a northern U-factor of 0.27 is not likely to result in any significant reduction in the market share for Energy Star windows. Moreover, it contradicts EPA's own stated goal of selecting "efficiency levels reflective of the top 25% of models available on the market."<sup>15</sup>

**3. A 0.27 U-factor will likely be overtaken by the IECC and the energy provisions of the International Residential Code ("IRC") as soon as Version 6.0 takes effect.**

The IECC and IRC development cycles for their 2015 editions begin in January 2013 and end by December 2013. The current timeline for Version 6.0 of the Energy Star Program takes its development cycle out to March 2013, with a new criteria to take effect on January 1, 2014. Consequently, just at the IECC and IRC development cycles close, the Version 6.0 criteria will be taking effect.

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<sup>11</sup> PPG offers Sungate 600; NSG/Pilkington offers Energy Advantage; Cardinal Glass offers LoE-i81; Guardian Industries offers both ClimaGuard IS-15 and IS-20; AGC offers Comfort E2 and Comfort EPS.

<sup>12</sup> Draft Criteria Report, p. 8.

<sup>13</sup> Id.

<sup>14</sup> Id. at p. 20.

<sup>15</sup> Id. at p. 7.



Given this timing, it is quite likely that a 0.27 northern U-factor will be higher than the U-factors that will emerge for the northern zone as a result of the IECC and IRC revisions cycles. This becomes evident from a review of a draft proposal recently published for public comment by the DOE. In it, DOE intends to propose a code change that would lower residential U-factors to a range from 0.32 to 0.20 in climate zones 4 through 8.<sup>16</sup>

In addition to the DOE proposals, given the availability of #4 Surface low-e at prices comparable to many doubles with a #2 surface triple silver low-e coating, it is likely that additional proposals to reduce the northern U-factors in the IECC and IRC to 0.25 or lower will be submitted. If any are adopted, it will render Version 6.0's northern U-factor of 0.27 obsolete by the time it takes effect in 2014.

#### **4. Condensation on #4 Surface Products is, simply, not an issue.**

Some window manufacturers have expressed concern that condensation may be an issue with the use of #4 Surface Products. This is, simply, not an accurate basis for concern.

Historically, residential windows moved from single panes of glass to double glazed, "insulated glass units" or IGUs more than 25 years ago. That move was motivated, in large part, by condensation, even ice, that formed at and above the sight line of single pane windows in cold climates. The advent of clear-on-clear 1/4" IGUs virtually eliminated that problem.

The type of condensation that causes damage in a home has not been a window problem since the advent of IGUs. Likewise, it will not be a problem with well-made #4 Surface Products either. In that regard, the surface temperature of #4 Surface Products are at least 4°F warmer at the center of glass than double pane clear glass with a 1/2" airspace.

In the wrong humidity combinations with very cold outdoor air, some condensation will sometimes form at the sight line of even the most well-made windows. However, it is never a problem at the center of glass of a well-made, double glazed IGU.<sup>17</sup> That is because the air or argon fills provide more than ample insulation to keep the center of glass temperatures from reaching the dew point where condensation will form. On the other hand, framing materials and spacers in the windows may not provide the same level of insulation as the air or gas fill. Accordingly, in some combinations of indoor humidity and low outdoor temperatures, some condensation may occur at the site line of the window where the frame and spacers make connections between the inside and outside of the home, but, if condensation does form for this reason, it would occur whether the window was a #4 Surface Product or not. However, this condensation is usually short lived and, if it is not, causes of excess humidity should be investigated rather than blaming the windows.

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<sup>16</sup> U.S. Department of Energy, Building Energy Codes Program, Residential Code Change Proposals for the 2015 IECC, <http://www.energycodes.gov/development/residential/2015IECC>.

<sup>17</sup> Unless of course, the window is in the bathroom and the homeowner enjoys taking long, hot showers, or, the window is in the kitchen and the homeowner is taken to boiling large pots of pasta for dinner. In these instances, temporary condensation across the entire window may be inevitable. However, such condensation is not the type that will cause damage to windows, sills, or other parts of the home.

Since damaging condensation is not a problem with clear on clear IGUs, there is no scientific basis upon which to believe that harmful condensation will pose any type of problem when a #4 Surface Product is used.

#### **IV. Conclusion**

The credibility of the Energy Star Program may be in serious jeopardy by reason of the northern Draft 1 Criteria. As written, it strongly encourages the labeling, marketing and sale of ultra-low SHGC windows to northern consumers. Such windows are, simply, **not** the most efficient products available for use in the north. This is clearly evidenced by the large number of high SHGC products available from the primary glass manufacturers; the use of high SHGC products by U.S. manufacturers in Canada; and, most importantly, LBNL's conclusion that including a minimum SHGC of 0.35 would **double** the aggregate national energy savings attributable to the northern zone. Knowing this information, if northern consumers are induced by an Energy Star label to purchase ultra-low SHGC windows that will **increase** their utility bills over windows with higher SHGCs, then the Version 6.0 criteria as currently written may render the Energy Star label subject to scrutiny as to whether it provides false or misleading information to northern consumers. Such a challenge to the credibility of the Energy Star label should be avoided at all cost.

There are several other U-factor and SHGC combinations that provide equivalent energy performance to a 0.27 U-factor window that must be included in the northern zone criteria. Otherwise, products that deliver an equivalent energy performance will be excluded from the Energy Star Program without justification. Their equivalent energy performance entitles them to an Energy Star label.

A 0.25 U-factor is achievable with #4 Surface double glazed products. All 5 primary glass manufacturers offer #4 Surface Products for sale. If the northern U-factor is not reduced, market share for Energy Star windows will not be reduced either. Additionally, a 0.27 U-factor may be rendered obsolete as soon as it takes effect if the northern U-factors in the IECC or IRC fall below 0.27 in their next development cycle.

The northern zone criteria should include a minimum 0.35 SHGC; additional alternate U-factor and SHGC alternate paths; and a 0.25 U-factor.

# APPENDIX

At AGC's request, Enermodal Engineering ("Enermodal") performed energy simulations to determine the impact of the proposed Energy Star criteria on product availability for a subset of the same cities that D&R used to determine the annual energy savings and payback periods referenced in Tables 7 and 8 of the Draft 1 Criteria Report.

All modeling done by Enermodal for this Appendix used RESFEN 6.0 and all the same assumptions that LBNL used as described in its *Technical Support for ENERGY STAR Windows Version 6.0 Specification Revision* dated July 1, 2012.

Figure 1 below shows the Heat Degree Days (HDD) and Cooling Degree Days (CDD) for various cities. ASHRAE references in Figure 1 are those cities with available weather data to perform whole house energy analysis using RESFEN6. LBNL Modeled Cities in Figure 1 are cities that LBNL used in simulations for D&R and EPA. Modeled Cities in Figure 1 are the subset of cities that Enermodal modeled for AGC to determine the impact of product availability for those cities.

**Figure 1**

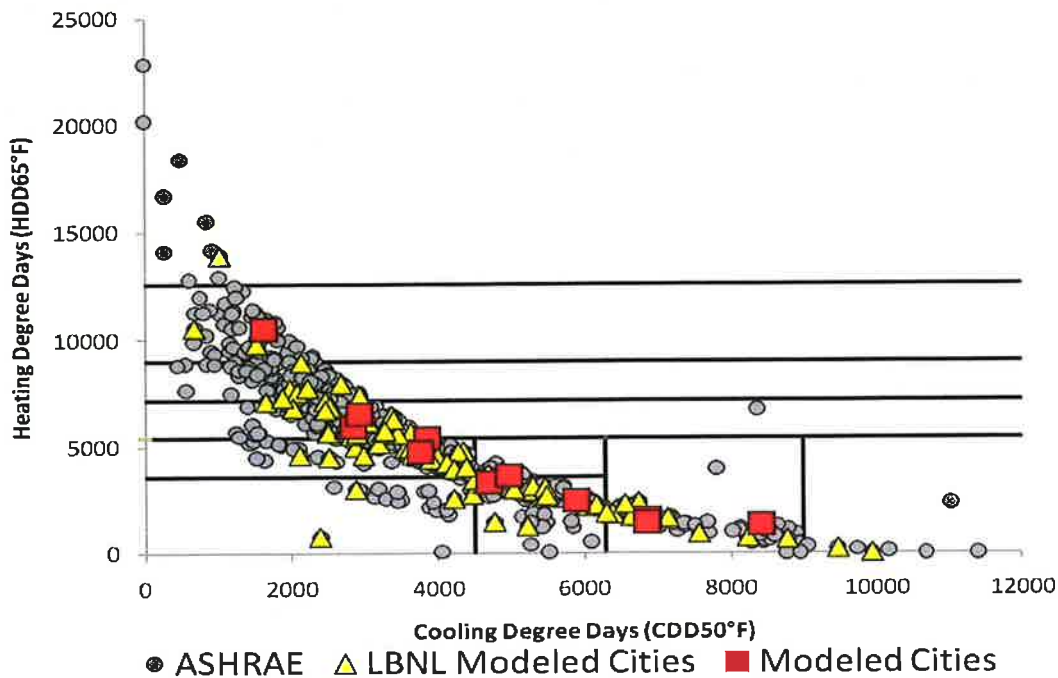


Figure 2 shows the monthly HDD & CDD for three of the “Modeled Cities” located in Energy Star’s Northern zone – HDDs are represented with the Red shading in the charts and CDDs are represented with the Blue shading in the charts.

**Figure 2**

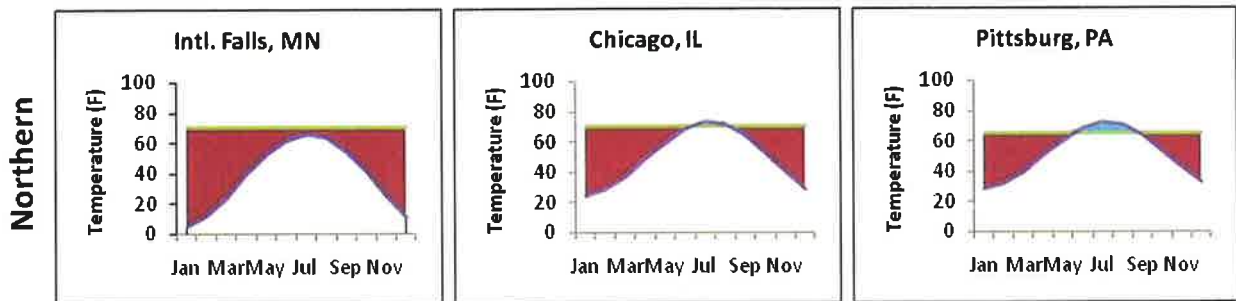
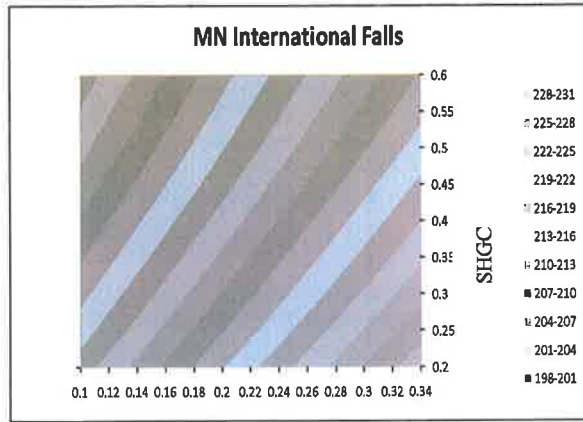


Figure 3 displays whole house (heating and cooling) energy consumption in Mbtu for the same three Energy Star Northern zone cities identified in Figure 2. The data reported is site energy. Each city has been charted and graphed. In each graph, each color band represents 3Mbtu’s of energy consumption – or shows the U-Value / SHGC combinations of windows that would result in whole house equivalent energy consumption.

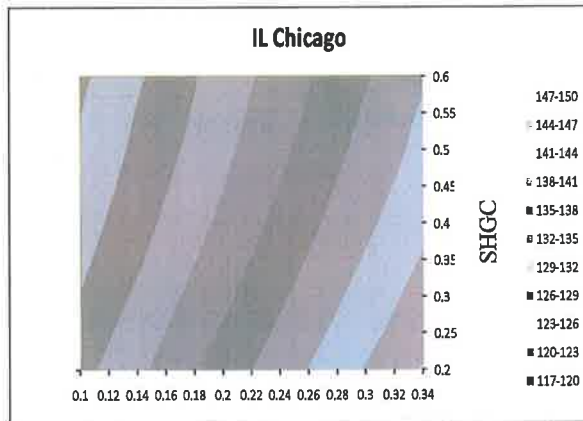
**Figure 3**



House Type: 2 Story Existing Frame  
House Name: MN International Falls  
Max: 229.96  
Min: 181.36  
Range: 3

Sum of Tot Column Labels

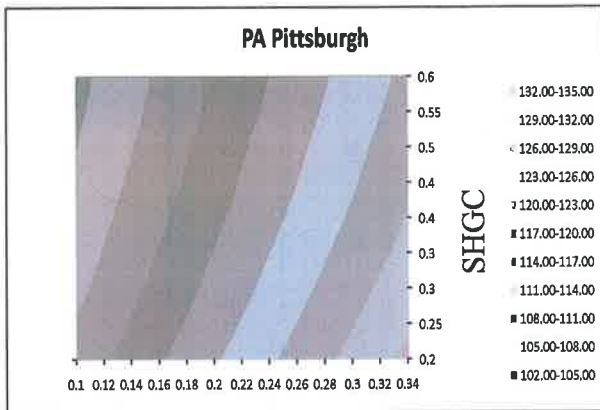
Row Label:	0.2	0.25	0.3	0.35	0.4	0.45	0.5	0.55	0.6
0.1	200	197	194	192	189	187	185	183	181
0.12	202	199	197	194	192	190	188	186	184
0.14	205	202	199	197	195	192	190	188	186
0.16	208	205	202	200	197	195	193	191	189
0.18	210	207	205	202	200	197	195	193	192
0.2	213	210	207	205	202	200	198	196	194
0.22	215	212	210	207	205	202	200	198	196
0.24	218	215	212	210	207	205	203	201	199
0.26	220	217	215	212	210	207	205	203	201
0.28	223	220	217	214	212	210	207	205	203
0.3	225	222	219	217	214	212	210	208	206
0.32	228	225	222	219	217	214	212	210	208
0.34	230	227	224	221	219	217	214	212	210



House Type: 2 Story Existing Frame  
House Name: IL Chicago  
Max: 147.29  
Min: 122.39  
Range: 3

Sum of Tot Column Labels

Row Label:	0.2	0.25	0.3	0.35	0.4	0.45	0.5	0.55	0.6
0.1	128	127	126	125	125	124	123	123	122
0.12	130	129	128	127	126	126	125	125	124
0.14	131	130	130	129	128	127	127	126	126
0.16	133	132	131	130	130	129	128	128	127
0.18	135	134	133	132	131	130	130	129	129
0.2	136	135	134	134	133	132	131	131	130
0.22	138	137	136	135	134	134	133	132	132
0.24	140	139	138	137	136	135	134	134	133
0.26	141	140	139	138	137	137	136	135	135
0.28	143	142	141	140	139	138	137	137	136
0.3	144	143	142	141	140	140	139	138	138
0.32	146	145	144	143	142	141	140	140	139
0.34	147	146	145	144	143	143	142	141	141



House Type: 2 Story Existing Frame  
House Name: PA Pittsburgh  
Max: 132.72  
Min: 110.14  
Range: 3

Sum of Tot Column Labels

Row Label:	0.2	0.25	0.3	0.35	0.4	0.45	0.5	0.55	0.6
0.1	115.07	114.13	113.34	112.62	112.03	111.41	110.93	110.48	110.14
0.12	116.62	115.70	114.90	114.15	113.53	112.95	112.43	111.90	111.59
0.14	118.17	117.23	116.44	115.68	115.04	114.42	113.90	113.38	113.04
0.16	119.71	118.74	117.94	117.19	116.50	115.89	115.34	114.84	114.45
0.18	121.22	120.26	119.40	118.70	117.95	117.35	116.80	116.31	115.85
0.2	122.70	121.74	120.88	120.15	119.39	118.77	118.25	117.69	117.29
0.22	124.20	123.21	122.32	121.59	120.84	120.20	119.68	119.08	118.69
0.24	125.65	124.67	123.77	123.00	122.25	121.62	121.08	120.49	120.00
0.26	127.09	126.10	125.21	124.42	123.65	122.99	122.44	121.86	121.39
0.28	128.53	127.52	126.61	125.83	125.04	124.33	123.82	123.23	122.73
0.3	129.94	128.90	128.01	127.18	126.42	125.72	125.17	124.59	124.09
0.32	131.33	130.28	129.38	128.54	127.78	127.08	126.54	125.91	125.43
0.34	132.72	131.66	130.73	129.88	129.14	128.41	127.80	127.24	126.71

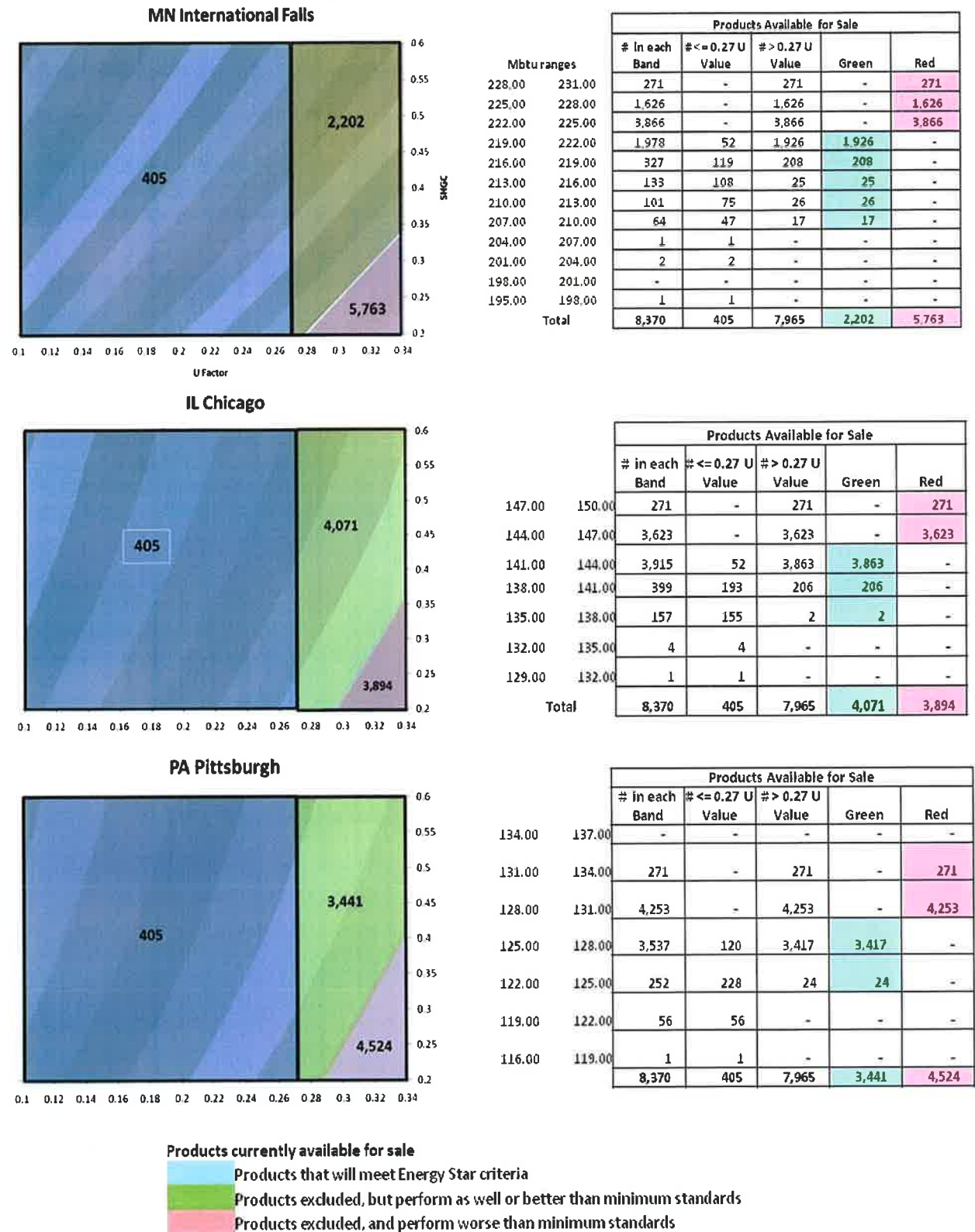
Based on whole house energy consumption for various U-Value / SHGC configurations, from EPA's Products for Sale Analysis and products listed in the CPD – we were able to determine the impact on available window choices in the selected cities. D&R supplied us with the data it used to develop Figures 8 and 9 of the Draft 1 Criteria Report at pp. 20 and 21, and we used this very same data for our analysis.

Figures 4 and 5 shows the results of our analysis. To determine products that meet the northern zone requirements, we looked at the whole house energy consumption for the window that consumed the most energy and still qualifies for the energy star criteria. Therefore, for each city the total Mbtu's for windows with 0.27 U-value and 0.20 SHGC were selected as the basis for comparison or "Benchmark". For each city modeled, there are three highlighted areas of interest (Blue, Green, Red). Energy performance and the number of available products that meet or exceed the benchmark are highlighted in blue. Energy performance and the number of products that are eliminated from the energy star program **but consume less energy than the benchmark** are highlighted in green. Energy performance and the number of products that are eliminated that consume more energy than the benchmark are highlighted in red.

Figure 4 - Available Products for Sale dataset, 4.8% of the products meet the Energy Star criteria. International Falls, Chicago and Pittsburg have 26.3%, 48.6% and 41.1% respectively of the Products Available for Sale that consume less than or equal to the energy of windows that meet the Energy Star criteria. 68.9%, 46.6% and 54.1% respectively consume more energy than the benchmark and are properly eliminated from the Energy Star Program.

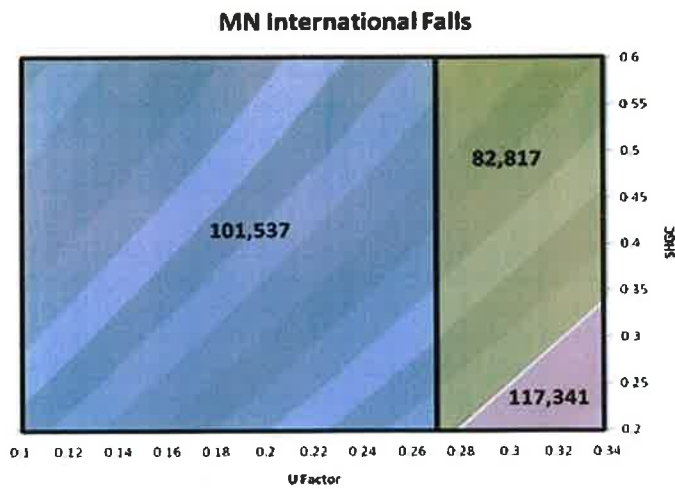
Figure 5 - CPD Available Products for Sale dataset, 33.6% of the products meet the Energy Star criteria. International Falls, Chicago and Pittsburg have 27.4%, 38.0% and 14.4% respectively of the Products Available for Sale that consume less than or equal to the energy of windows that meet the Energy Star criteria. 39.0%, 28.3% and 52% respectively consume more energy than the benchmark and are properly eliminated from the Energy Star Program.

**Figure 4 – Whole House Energy Consumption – D&R Products Available for Sale**





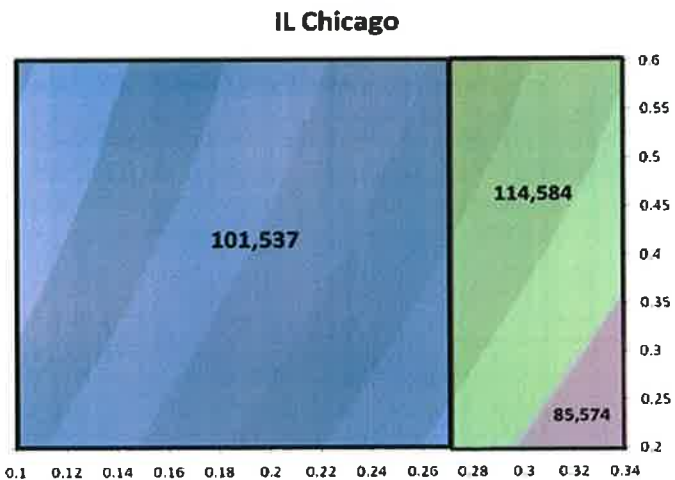
**Figure 5 – Whole House Energy Consumption – CPD Products available for sale**



**Mbtu ranges**

228.00	231.00
225.00	228.00
222.00	225.00
219.00	222.00
216.00	219.00
213.00	216.00
210.00	213.00
207.00	210.00
204.00	207.00
201.00	204.00
198.00	201.00
195.00	198.00
<b>Total</b>	

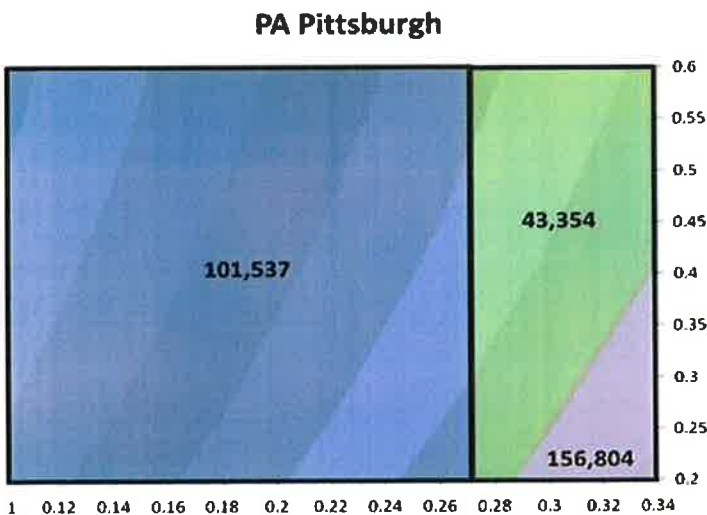
D&R All Products				
# in each Band	# <= 0.27 U Value	# > 0.27 U Value	Green	Red
10,707	-	10,707	-	10,707
47,033	-	47,033	-	47,033
59,601	-	59,601	-	59,601
70,450	20,394	50,056	50,056	-
55,526	33,129	22,397	22,397	-
37,510	29,193	8,317	8,317	-
14,479	12,803	1,676	1,676	-
5,405	5,034	371	371	-
885	885	-	-	-
98	98	-	-	-
-	-	-	-	-
1	1	-	-	-
<b>301,695</b>	<b>101,537</b>	<b>200,158</b>	<b>82,817</b>	<b>117,341</b>



**Mbtu ranges**

147.00	150.00
144.00	147.00
141.00	144.00
138.00	141.00
135.00	138.00
132.00	135.00
129.00	132.00
<b>Total</b>	

D&R All Products				
# in each Band	# <= 0.27 U Value	# > 0.27 U Value	Green	Red
10,707	-	10,707	-	10,707
74,867	-	74,867	-	74,867
117,056	20,394	96,662	96,662	-
69,440	51,518	17,922	17,922	-
29,179	29,179	-	-	-
445	445	-	-	-
1	1	-	-	-
<b>301,695</b>	<b>101,537</b>	<b>200,158</b>	<b>114,584</b>	<b>85,574</b>



**Mbtu ranges**

134.00	137.00
131.00	134.00
128.00	131.00
125.00	128.00
122.00	125.00
119.00	122.00
116.00	119.00
<b>Total</b>	

D&R All Products				
# in each Band	# <= 0.27 U Value	# > 0.27 U Value	Green	Red
-	-	-	-	-
37,716	-	37,716	-	37,716
119,088	-	119,088	-	119,088
102,690	59,707	42,983	42,983	-
40,785	40,414	371	371	-
1,415	1,415	-	-	-
1	1	-	-	-
<b>301,695</b>	<b>101,537</b>	<b>200,158</b>	<b>43,354</b>	<b>156,804</b>

Based on this analysis, it is fair to conclude that Energy Star criteria for the Northern Energy Star zone will mislead consumers in selecting and evaluating window performance, as well promote window performance that will increase whole-house energy consumption and national energy consumption.