



# ENERGY STAR® Windows, Doors, and Skylights Version 7.0 Specification Discussion Guide

September 2019

## Introduction

The U.S. Environmental Protection Agency (EPA) is pleased to share with stakeholders the ENERGY STAR® Version 7.0 Windows, Doors, and Skylights Discussion Guide. Through the Discussion Guide, EPA invites stakeholder input on key topics prior to considering a Draft 1 Version 7.0 specification proposal.

EPA reviews all ENERGY STAR specifications regularly to determine whether a revision would help consumers identify units that will further reduce energy use in a cost-effective manner. This Discussion Guide informs stakeholders about key topics that EPA would explore in a potential specification revision and provides questions for stakeholders in each section to facilitate the collaboration process.

EPA is committed to transparency and will publish all publicly available background data and analytical results on the specification revision webpage. At the same time, EPA recognizes that some stakeholders may need to submit data confidentially to protect proprietary or competitive information.

Stakeholder engagement is a vital aspect to the success of the ENERGY STAR program, and EPA looks forward to collaborating with all parties before making a determination to consider whether an ENERGY STAR Version 7.0 specification is warranted. Please submit any formal comments on this document to [windows@energystar.gov](mailto:windows@energystar.gov) by **October 4<sup>th</sup>, 2019**.

## Background and Process

EPA published the current (Version 6.0) Windows, Doors, and Skylights (WDS) specification in January 2014. This specification had a two-part effective date, with most of the criteria taking effect in January 2015 and the Northern climate zone prescriptive and equivalent energy performance criteria for windows taking effect in January 2016.<sup>1</sup>

In December 2014, just prior to the first effective date, EPA held a Stakeholders' Meeting during which it reviewed the specification revision process and ENERGY STAR Guiding Principles, proposed certain research and analysis methodologies, and encouraged stakeholder participation in future specification development efforts. EPA requested general and specific feedback from stakeholders and published that feedback in March 2015. Stakeholder feedback included the following subjects, which EPA plans to revisit in this Discussion Guide:

- Aligning U.S. and Canadian ENERGY STAR criteria.
- Setting a minimum Solar Heat Gain Coefficient (SHGC) in the Northern climate zone.
- Combining the Southern and South-Central climate zones.

---

<sup>1</sup> EPA provides background documents on previous specification revisions and specifications currently in development on the following web page:

[https://www.energystar.gov/products/building\\_products/residential\\_windows\\_doors\\_and\\_skylights/partners](https://www.energystar.gov/products/building_products/residential_windows_doors_and_skylights/partners)

- Adopting the latest building energy models to calculate energy savings.
- Refining methodologies for product availability and cost analyses.

### Guiding Principles and the Specification Revision Process

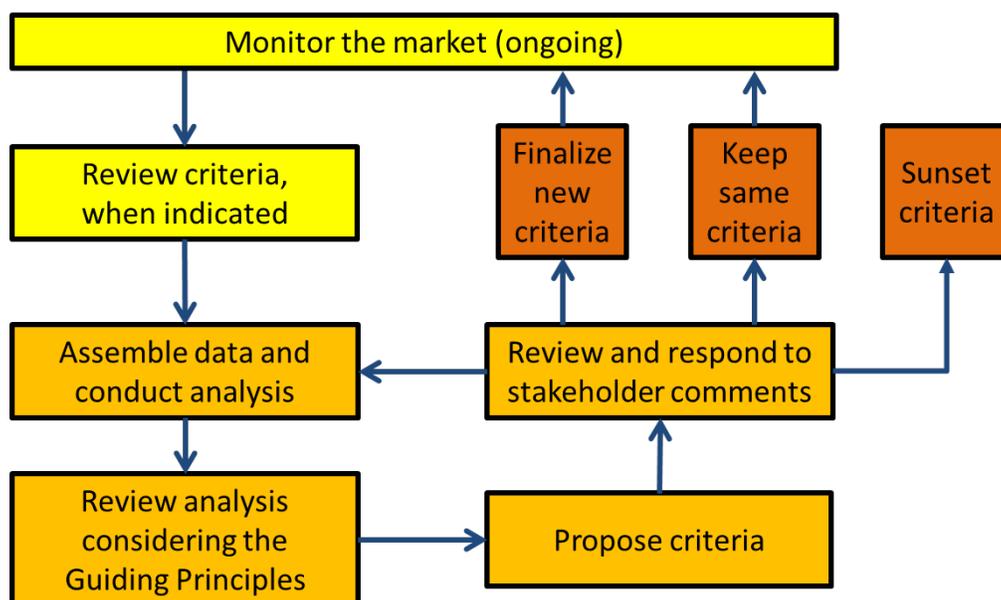
In establishing or revising an ENERGY STAR product performance specification, EPA employs a set of six key principles:

1. Significant energy savings can be realized on a national basis.
2. Product performance can be maintained or enhanced with increased energy efficiency.
3. Purchasers will recover their investment in increased energy efficiency through utility bill savings within a reasonable period of time.
4. Energy efficiency can be achieved through one or more technologies such that qualifying products are broadly offered by more than one manufacturer.
5. Product energy consumption and performance can be measured and verified with testing.
6. Labeling would effectively differentiate products and be visible for purchasers.

It is important to note that these principles are not applied as a strict checklist. The ultimate viability and environmental impact of an ENERGY STAR specification in the marketplace depends on many factors. The principles are used as guidance during an iterative process to achieve the desired balance among the principles, using the best available market information. The success of a specification can be more reasonably ensured through the application of these principles.

Figure 1 illustrates the general process that EPA uses to monitor the market, begin potential specification revision efforts, and make decisions. EPA presented this figure during the December 2014 Stakeholders' Meeting.

Figure 1. Specification Revision Process



## Current Market Assessment

EPA has continued to monitor developments in the market since the implementation of Version 6.0 and has determined that conditions indicate it should consider a new specification revision process. Specifically, EPA has found that the market share for ENERGY STAR certified WDS products remains high, and recent developments in energy codes and other product specifications may surpass the current ENERGY STAR specification levels. Despite these preliminary indicators, EPA must still conduct additional analyses before deciding to propose to revise the specification. Therefore, the release of this document is not a definitive indicator that EPA will propose a specification revision.

### Market Share

A persistently high market share for ENERGY STAR certified products generally suggests that the current specification represents a widely achievable level of performance in the market and a specification revision may be needed to effectively differentiate more energy-efficient products. Table 1 shows that the market share for ENERGY STAR certified windows and doors are high and notably did not decrease substantially following the implementation of Version 6.0 in 2015 and 2016. EPA does not target a specific market share threshold for ENERGY STAR products; rather, EPA considers market share among a variety of other market indicators when deciding whether to propose a revised specification.

Table 1. ENERGY STAR Market Share by Year

Product Category	2009	2010	2011	2012	2013	2014	2015	2016	2017
Residential Windows	76%	81%	79%	77%	80%	83%	84%	83%	84%
Hinged Entry Doors	70%	71%	73%	74%	76%	77%	79%	78%	80%
All Patio Doors								81%	82%
Skylights – All	70%	70%	68%	62%	60%	62%	65%	64%	68%

Source: Ducker International

### Developments in Energy Codes

As part of its monitoring the fenestration market, EPA has noted a trend in WDS performance improvements for some building energy codes. It is important for the ENERGY STAR specification to keep pace with code improvements to align with the ENERGY STAR program's Guiding Principles for effectively differentiating energy-efficient products and contributing significant energy savings nationwide. In the following section, EPA outlines some building energy code improvements that may influence the fenestration market.

### International Energy Conservation Code (IECC) Building Energy Codes

IECC is a model code adopted by states and municipal governments to establish minimum design and construction requirements for energy efficiency. These codes are not adopted uniformly across the

United States; however, several jurisdictions have adopted the most recent 2018 IECC. This code establishes a minimum U-factor of 0.30 for the Northern climate zones, 0.32 for the North-Central and South-Central climate zones, and 0.40 for part of the Southern climate zone. These U-factor requirements are only slightly less stringent than the Version 6.0 ENERGY STAR criteria, and the SHGC requirements in the 2018 IECC match the Version 6.0 criteria for all zones.

Updates to the 2021 IECC are underway. Reports from the proceedings state that several proposals were made to revise code requirements to meet or exceed the current ENERGY STAR criteria.<sup>2</sup> EPA will continue to monitor the proceedings and take code proposals into consideration in evaluating a potential specification revision.

#### U.S. Department of Energy (DOE) Field Data

Field studies by DOE and the Pacific Northwest National Laboratory (PNNL) offer a clearer picture of the minimum window performance used by builders in a variety of states. EPA will refer to these publicly available data sets in its analysis, where appropriate.<sup>3</sup>

#### California Title 24

The California Title 24 Building Energy Efficiency Standards are reviewed and updated by the California Energy Commission on a regular basis.<sup>4</sup> With the 2019 Title 24 energy standards update, the maximum U-factor for all fenestration products (windows, glass doors, and skylights) has been maintained at 0.30 in all California climate zones, and the mandatory SHGC for California zones 2, 4, and 6 through 15 is set at 0.23, and zones 1, 3, 5, and 16 have no set SHGC requirements.<sup>5</sup> The lower SHGC requirement of 0.23 is more stringent than the current ENERGY STAR South-Central climate zone requirement.

#### ENERGY STAR Canada

EPA has continued to follow developments of the ENERGY STAR specification in Canada. There is a common market for fenestration products across the border, and many manufacturers are partners of both ENERGY STAR programs. Natural Resources Canada (NRCan) has finalized the ENERGY STAR specification Version 5.0 for WDS, effective January 2020. The specification sets a maximum U-factor for windows and doors at 0.21, with an alternate minimum Energy Rating (ER) of 34. The ER rating takes U-factor, SHGC, and air leakage into account and allows for higher U-factors in exchange for higher SHGCs. The maximum U-factor for skylights will be a maximum of 0.40 without an ER equivalent. Stakeholders have previously encouraged EPA to work with NRCan to align the specifications in both countries; however, EPA must evaluate a potential specification revision in the United States on its own merits.

---

<sup>2</sup> Vass, Drew. (2019, May 16). Code Hearings Show Promising Signs for Alignment. *Door & Window Market Magazine*. <https://www.dwmmag.com/code-hearings-show-promising-signs-for-alignment/>

<sup>3</sup> U.S. Department of Energy. Building Energy Codes Program, Energy Code Field Studies. <https://www.energycodes.gov/compliance/energy-code-field-studies>

<sup>4</sup> Energy Performance Services. Title 24 Express. <https://www.title24express.com/what-is-title-24/title-24-windows-skylights/>

<sup>5</sup> Excerpted from the 2019 Residential Compliance Manual for the 2019 Building Energy Efficiency Standards, Title 24, Part 6, and Associated Administrative Regulations in Part 1. <http://134.186.172.7/2018publications/CEC-400-2018-017/CEC-400-2018-017-CMF.pdf>

## National Fenestration Rating Council (NFRC) Certified Products

Another market indicator that EPA monitors is the performance of products listed in the NFRC Certified Products Directory (CPD). At a high level, analysis of the NFRC CPD allows EPA to evaluate the distribution of U-factor and SHGC performance among certified products and see what performance levels WDS products can achieve. To be transparent and collaborative, EPA published a Window Technology Pathways White Paper<sup>6</sup> in January 2017 that presented a new approach to analyzing the NFRC CPD and asked for comments from stakeholders. Based on the responses received, EPA released a spreadsheet<sup>7</sup> demonstrating how it intended to use this methodology to understand what technology pathways (i.e., component combinations) were certified to meet various U-factor and SHGC performance among product lines that manufacturers indicated were available for sale to consumers. Stakeholders provided feedback supporting EPA's proposal to use this methodology as a reasonable proxy for product availability in future analyses. The Proposed Methodology section below provides additional details on how this methodology may be applied. Figures 2 and 3 in Appendix A show the performance distribution of double-hung vertical sliders for ENERGY STAR certified windows product lines from 2017. Vertical sliders are considered to have the worst thermal performance of common window option types. Figures 4, 5, and 6 in Appendix A show the performance distribution of swinging doors, sliding glass doors, and skylights from 2017. These figures are presented as examples of the performance distribution but are not the data to be used for the criteria analysis. EPA will collect and analyze updated data for the criteria analysis.

## Proposed Methodology

Evaluating windows, doors, and skylights for product availability, energy savings, and cost-effectiveness is complex because of the variety of product performance baselines, household characteristics, climates, and other market factors. In this section, EPA provides its proposed approaches to collect evaluation data and consider revising the specification.

### Product Availability

When considering a possible ENERGY STAR specification revision, EPA assesses whether a new specification would result in products that are broadly available, with non-proprietary technologies offered by more than one manufacturer. Unlike other ENERGY STAR product categories, EPA does not maintain a database of all ENERGY STAR certified WDS; instead, NFRC houses all data on certified products in the CPD. In the past, stakeholders have indicated that some product lines and product options listed in the CPD are not actually available for sale, and therefore the CPD, on its own, should not be used to assess product availability. However, as part of the NFRC FenStar certification program, manufacturers are required to identify the product lines that they plan to label for ENERGY STAR, and they must make those product lines available for verification testing. EPA proposes that the filtered list of product lines selected for FenStar is a reasonable proxy for products available for sale.

---

<sup>6</sup> U.S. Environmental Protection Agency. (2017, January). Window Technology Pathways.

<https://www.energystar.gov/sites/default/files/asset/document/Window%20Technology%20Pathways%20Methodology%20White%20Paper.pdf>

<sup>7</sup> U.S. Environmental Protection Agency. (2017, February). Window Technology Pathway Analysis Spreadsheet 2.15.17.

<https://www.energystar.gov/sites/default/files/asset/document/Window%20Technology%20Pathways%20Analysis%202.15.17.xlsx>

As previously mentioned, EPA has developed a methodology for analyzing the potential technology pathways of these available window products. Technology pathways represent unique combinations of the following elements: operator type, frame material, spacer system, glass configuration (including low-emissivity coatings), and gas fill. These variables are key drivers of U-factor and SHGC performance in a window system. This methodology enables EPA to group all product lines and options that use the similar technology pathways to better understand the distribution of performance within each pathway and how common each pathway is compared to other pathways. EPA understands that the number of certified product options is not equivalent to sales volume.

EPA proposes to use this Pathways Methodology to identify common pathways that manufacturers use to certify products at different performance levels and confirm that consumers will still be able to choose from several viable technology options under a potential revised specification. EPA also proposes to use the Pathways Methodology to inform product cost research (discussed in greater detail in the next section).

EPA encourages stakeholders to review the latest [pathways spreadsheet](#) on the specification revision [webpage](#). EPA seeks stakeholder feedback to learn more about particular pathways, including the cost and the availability of components.

**EPA requests stakeholder feedback for the following questions:**

1. Are there better data sources for available products than those proposed in this Discussion Guide?
2. What are the most common pathways (component combinations) that manufacturers use to make ENERGY STAR certified products?
3. Are there pathways represented in the NFRC CPD that should not be considered viable pathways?
4. Among the most common pathways, which (if any) energy performance ratings should EPA consider to be outliers?

### [Product Costs](#)

Cost-effectiveness is another key consideration for EPA when analyzing a potential revised specification. Specifically, consumers should recover their investment in increased energy efficiency through utility bill savings within a reasonable period of time. For WDS products, this cost is the incremental cost over the cost to purchase a non-ENERGY STAR product. Consumer costs for WDS products can vary significantly and are often driven by features unrelated to energy performance, such as material type, hardware, aesthetic design, and brand. When evaluating cost-effectiveness, EPA seeks to isolate the cost increases that come from features and components that affect energy performance. As with other ENERGY STAR product categories, EPA also focuses on the lowest cost options for improving performance, as opposed to high-cost specialty options.

In the past, EPA has considered a potential specification to be cost-effective if payback of the incremental cost is expected to occur within the lifetime of the product. Products like WDS have relatively long lifetimes compared to other ENERGY STAR products and can have warranties of 20 years or more. In previous specification revisions, some stakeholders have noted that homeowners do not stay in their homes for the entire life of the home. Therefore, EPA was asked to consider payback within

the length of time a typical homeowner stays in a home—around 10 to 13 years.<sup>8</sup> EPA will consider these approaches when evaluating cost-effectiveness.

**EPA requests stakeholder feedback for the following question:**

5. What sources should EPA consider when evaluating what is a reasonable payback period for building materials like WDS?

EPA is proposing three different methods for estimating the cost of ENERGY STAR WDS:

**Component Bill of Materials:**

Using the Pathways Methodology, EPA is able to isolate specific components that have the greatest impact on product performance and determine what combinations of components have been certified for different performance levels. EPA proposes to estimate incremental costs by comparing the total cost of the components needed to achieve performance improvements. D+R International, under contract to EPA, plans to conduct interviews with component suppliers under a non-disclosure agreement to collect cost estimates for different component categories, including frame material, low-e glass type and configuration, spacer material and performance tier, and gas fill. These categories align with the Windows Pathways Analysis Methodology. EPA plans to analyze component costs, assuming a standard 3-foot x 5-foot double-hung, residential grade window.

**Manufacturer Costs:**

In previous specification revision efforts, manufacturers have voluntarily provided incremental costs using a standardized spreadsheet template. EPA has developed an updated template to provide a standardized way to request manufacturer costs, which asks how manufacturers achieve a specific U-factor by using different components. Manufacturers will be able to choose categories from a drop-down menu for each component and input a cost for each specific combination of components.

The template also will ask manufacturers to indicate whether they produce 10 common pathways, and if so, how common those products are and what the cost to consumers would be. Manufacturers are invited to voluntarily provide this data under a non-disclosure agreement with D+R International.

**Retail Pricing and Mystery Shopping:**

EPA also will attempt to conduct research on pricing and confirm the availability of fenestration products through “mystery shopping” window dealers, installers, and big-box retail centers. This approach would provide a clear indication of the costs experienced by consumers; however, EPA recognizes that there are challenges to this research; namely, window prices vary between different sales channels and regions, and these price differences may not be solely due to the incremental costs related to energy performance. EPA proposes to mitigate this variability by focusing on low-cost and best-selling products and would use this approach to help confirm the accuracy of component bill of materials analysis and manufacturer cost estimates.

---

<sup>8</sup> Emrath, Paul. Latest Calculations Show Average Buyer Expected to Stay in Home 13 Years. National Association of Home Builders. <http://nahbclassic.org/generic.aspx?genericContentID=194717>

**EPA requests stakeholder feedback for the following questions:**

6. What other methods for estimating the incremental costs of energy performance improvements for windows, doors, and skylights should EPA consider?
7. Which incremental cost estimation methods are the most accurate?
8. Are there any additional component categories that EPA should consider researching?

Energy Savings

EPA and DOE have historically used the industry-standard RESFEN software from Lawrence Berkeley National Laboratories (LBNL) to calculate energy savings for individual households in different climates. To calculate national energy savings for the Version 6.0 specification, LBNL built a Microsoft® Excel-based model that compiled household-level energy savings calculations to develop regional and national energy savings projections using population weighting and regional window shipments data from Ducker International. However, EPA has received feedback from stakeholders that the current version of RESFEN does not use the best available energy model, known as EnergyPlus™.

To address these concerns, EPA has worked closely with technical experts at LBNL and the National Renewable Energy Laboratory (NREL) to refine the energy savings calculation methodologies. LBNL and NREL have each developed new building energy modeling tools that use EnergyPlus and consider updated data from the U.S. Census, Residential Energy Consumption Survey, and total meteorological year data for a range of U.S. cities.

The key differences between the two models are the baseline home characteristics for which energy consumption will be modeled. The LBNL model will calculate energy consumption for prototype homes developed by PNNL from geographically distributed U.S. cities. NREL's ResStock tool bases household characteristics on a sophisticated statistical sample that accounts for the diversity of the single-family housing stock and climates across the United States. If EPA decides to begin a specification revision process, it would run analyses using these new modeling tools to evaluate the local, regional, and national energy savings for a range of potential criteria and would publish the results from both models.

Additional Issues to Consider

During its research and analysis, EPA plans to evaluate several issues related to the specification. EPA and/or stakeholders have raised some of these issues in the past, while others have more recently arisen from developments in the market and fenestration technology.

Combining Southern and South-Central Climate Zones

EPA looks for opportunities to simplify specifications, when possible. One potential opportunity to simplify the WDS specification would be to combine the Southern (IECC zones 1 and 2) and South-Central (IECC Zone 3) climate zones. The DOE/PNNL field studies mentioned above suggest that builders in Texas (IECC Zone 2) and Alabama (IECC Zone 3) install windows of similar performance, with a U-factor of 0.35 or lower.<sup>9</sup> EPA plans to consider whether this indicates that consumers and partners would benefit from a simplified specification that combines these two zones, or whether there are

---

<sup>9</sup> Cohan, David, et al. Beyond Compliance: The DOE Residential Energy Code Field Study. Published for the 2016 American Council for an Energy-Efficient Economy (ACEEE) Summer Study on Energy Efficiency in Buildings. [https://aceee.org/files/proceedings/2016/data/papers/5\\_18.pdf](https://aceee.org/files/proceedings/2016/data/papers/5_18.pdf)

significant technical or market differences that support keeping the Southern and South-Central climate zones separate.

**EPA requests stakeholder feedback for the following questions:**

9. Should EPA consider combining the ENERGY STAR Southern and South-Central climate zones?
10. What impact would the potential merging of these climate zones have on consumers and partners?

[Establishing a Minimum Solar Heat Gain Coefficient \(SHGC\) for the Northern Climate Zone](#)

EPA plans to analyze the potential impact of establishing a minimum SHGC in the Northern climate zone. Previous analyses have suggested that significant energy savings may be possible with higher solar gain products in heating-dominant climates. In addition, some very low SHGC products also have very low visible transmittance (VT). These dark or tinted products reduce glare in southern, cooling-dominated climates, but are considered unacceptable to many consumers in the Northern climate zone. Establishing a minimum SHGC for the Northern climate zone could improve the veracity of the ENERGY STAR label by disqualifying excessively dark (low VT) products and possibly improving energy performance through passive solar heat gain.

**EPA requests stakeholder feedback for the following questions:**

11. Should EPA consider setting a minimum SHGC in the Northern climate zone?
12. What impact would a minimum SHGC have on product availability, consumer expectations, and the veracity of the ENERGY STAR label in the window market?

[Evaluating IECC Zone 5 for the Northern or North-Central Climate Zone](#)

IECC Zone 5 is on the southern edge of the current Northern climate zone and has more cooling degree-days than zones 6 through 8, leading EPA to consider moving IECC Zone 5 to the ENERGY STAR North-Central climate zone. The combination of zones that make up the ENERGY STAR North-Central climate zone is particularly important because it has the largest population concentration in the United States, resulting in a significant potential impact on national energy savings. The new energy models that EPA will use for its analysis have updated weather files that reflect the latest climate trends, which show that IECC Zone 5 may be more characteristic of the ENERGY STAR North-Central climate zone than the Northern climate zone. In analyzing the energy savings and cost-effectiveness of different potential criteria, including minimum SHGC, EPA will consider whether IECC Zone 5 is best suited to the ENERGY STAR Northern or North-Central climate zone.

**EPA requests stakeholder feedback for the following questions:**

13. Should EPA consider moving IECC Zone 5 out of the ENERGY STAR Northern climate zone and into the North-Central climate zone?
14. What impact would changing climate zone boundaries have on consumers and partners?
15. What characteristics are most common among ENERGY STAR certified windows sold in IECC Zone 5?

### [Applying the ENERGY STAR Windows Specification to Full-Lite Sliding Patio Doors](#)

Full-lite sliding patio doors, classified by NFRC product code DDSG, are virtually all glass and share more components and features with windows than swinging doors. Therefore, EPA is considering applying the windows criteria to full-lite sliding patio doors to simplify the specification. Partners have requested consistent requirements for windows and patio doors to make it easier to specify similar glass packages. Currently, patio doors are considered (greater than) > 1/2-lite doors for the purposes of the ENERGY STAR specification. Requiring that full-lite sliding patio doors have the same U-factor and SHGC as windows ensures that the products have a similar performance, ensures a more consistent glazing look to window and patio door products, and may reduce confusion for consumers when purchasing fenestration products for their home.

#### **EPA requests stakeholder feedback for the following questions:**

16. Should EPA consider including full-lite sliding patio doors in the ENERGY STAR Windows specification?
17. What impact would this potential change have on consumers and partners?

### [Sunsetting the ENERGY STAR Door Criteria](#)

EPA also will consider whether sunsetting the ENERGY STAR specification for swinging doors is appropriate. In previous criteria revisions, this category showed long payback periods for these products. EPA will study whether additional cost-effective energy savings are possible for swinging doors, and whether these products offer significant energy savings on a national level. However, EPA also understands the value of the ENERGY STAR brand in differentiating higher performing products for consumers and code officials, and is open to feedback and additional modeling to evaluate the issue.

#### **EPA requests stakeholder feedback for the following questions:**

18. Should EPA consider sunsetting the ENERGY STAR specification for swinging doors if the analysis does not reveal significant cost-effective energy savings for consumers?
19. Should EPA sunset just part the criteria if additional cost-effective energy savings are only possible for some products, such as glass-only doors?

### [Simplifying or Sunsetting the ENERGY STAR Skylight Criteria](#)

EPA is considering options for further streamlining the ENERGY STAR WDS specification for skylights, including tubular daylighting devices. EPA is seeking stakeholder feedback on two possible options:

#### [Simplification](#)

Analysis of skylights is difficult because there is a wide range of performance among a relatively small number of available ENERGY STAR certified products, and energy modeling involves additional technical complexities. For these reasons, it is difficult to know whether a proposed specification is consistent with the ENERGY STAR Guiding Principles. One option for streamlining the specification may be to rely primarily on the analysis of windows and then propose criteria for skylights based on an appropriate adjustment factor so that the criteria for windows and skylights promote similar energy-efficient features. EPA has performed a preliminary analysis to evaluate a new criteria development approach that compares the U-factor and the SHGC of windows with identical technical pathways at 90° and 20° angles. The preliminary results of EPA's modeling are shown in Appendix B.

On average, the U-factor for skylights was 0.037 (9 percent) higher than a window with identical technical pathways, with the largest difference found to be 0.076 (18 percent). EPA recognizes that the mounting method for skylights (i.e., curb-mounted vs. deck-mounted) has an impact on energy performance that should be considered, as well as other technical and market issues.

**EPA requests stakeholder feedback for the following questions:**

20. Should EPA consider including skylights in the ENERGY STAR Windows specification?
21. What significant technical and market differences between windows and skylights should EPA consider in its analysis?

### [Sunsetting](#)

EPA also will consider whether sunsetting the ENERGY STAR specification for skylights is appropriate. In previous criteria revisions, this category showed long payback periods for these products. EPA will study whether additional cost-effective energy savings are possible for skylights and whether these products offer significant energy savings on a national level. However, EPA also understands the value of the ENERGY STAR brand in differentiating higher performing products for consumers and code officials, and is open to feedback and additional modeling to evaluate the issue.

**EPA requests stakeholder feedback for the following questions:**

22. Should EPA consider sunsetting the ENERGY STAR specification for skylights if the analysis does not reveal significant cost-effective energy savings for consumers?

### [Dynamic Glazing and Shading](#)

Products with dynamic glazing and integrated shading systems are currently available for sale. EPA seeks to understand how common these products are, and whether the current approach for certifying these products is appropriate. Currently, NFRC certification for dynamic products provides performance ratings for products in the fully open and fully closed states; however, EPA understands that the schedule by which the product shifts between open and closed states may affect the overall energy performance of the dynamic product. EPA will consider clarifying criteria and/or including allowances for such dynamic products in a potential revised specification, provided that the energy performance can be measured and verified through physical testing of the product and the schedule properly modelled.

**EPA requests stakeholder feedback for the following questions:**

23. What is the market penetration of products with dynamic glazing or integrated shading systems for residential applications? Do stakeholders expect the market for such products to expand in the next few years?
24. How should the process for certifying and listing dynamic and/or integrated products be revised to better evaluate the performance and availability of such products?

### [High Altitude and Impact Resistance](#)

EPA is aware that proposals to provide allowances for impact-rated and high-altitude products were preliminarily accepted for the 2021 IECC. EPA has evaluated this issue in past specification revisions and has concluded that such allowances are not appropriate for the ENERGY STAR specification because they

would introduce significant complexity to labeling requirements, would save less energy over market baselines compared to other ENERGY STAR certified products, and there are products in the market that could meet even an improved ENERGY STAR specification in these locations.

**EPA requests stakeholder feedback for the following questions:**

25. What share of residential WDS are sold in places where high-altitude and/or impact-resistant products are necessary?
26. Should EPA reconsider allowances for high altitude and/or impact resistance in a potential revised specification, and why or why not?

### Extended Implementation Schedule

Typically, new criteria become effective 9 to 12 months after publication of a final specification document. However, EPA is open to extending the implementation schedule to help ensure that there will be products available for sale that meet a potential revised specification. EPA is interested in learning whether manufacturers would value an extension to give them more time to invest in process and capital improvements, if they so choose.

**EPA requests stakeholder feedback for the following questions:**

27. Should EPA consider extending the effective date beyond the typical 9 to 12 months after release of a final specification?
28. How would an extended implementation schedule make it easier to meet a potential revised specification?

### Next Steps

The process for considering a potential Version 7.0 specification revision for ENERGY STAR Windows, Doors, and Skylights will be iterative and offer multiple opportunities for stakeholder comment. The next step in this process is for stakeholders to provide comment on the issues and methodologies introduced above. **Please submit all comments on this Discussion Guide to [windows@energystar.gov](mailto:windows@energystar.gov) by October 4, 2019.** All comments received will be posted on the ENERGY STAR specification development webpage. In addition, interested manufacturers of finished window products or fenestration components are invited to provide voluntary cost estimates to D+R International, which will be held confidential. EPA also will publish written responses to the submitted comments.

If EPA determines that it is appropriate to propose a revised specification, it will publish a Draft 1 specification, along with a Criteria Analysis Report (CAR) that lays out the results of its analyses. EPA would then invite comment on Draft 1 and the CAR, and publish a Final Draft Specification that addresses stakeholder comments. Stakeholders would have a final opportunity to offer comment, following which EPA would publish a Final Version 7.0 Specification.

### Appendix A: NFRC Certified Product Distributions

Figure 2. U-Factor/SHGC Distribution of ENERGY STAR Certified Window Product Lines, Double-Hung Vertical Slider, September 2017

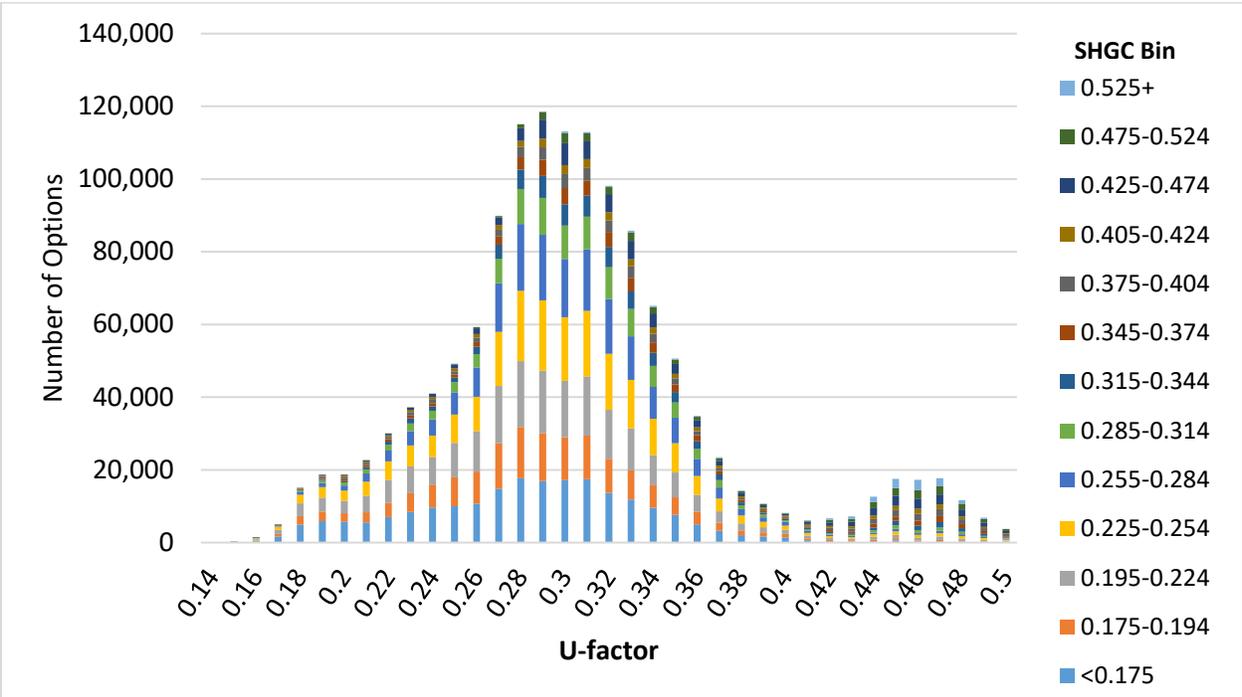


Figure 3. U-Factor Distribution of ENERGY STAR Certified Window Product Lines, Double-Hung Vertical Slider by Number of Panes, September 2017

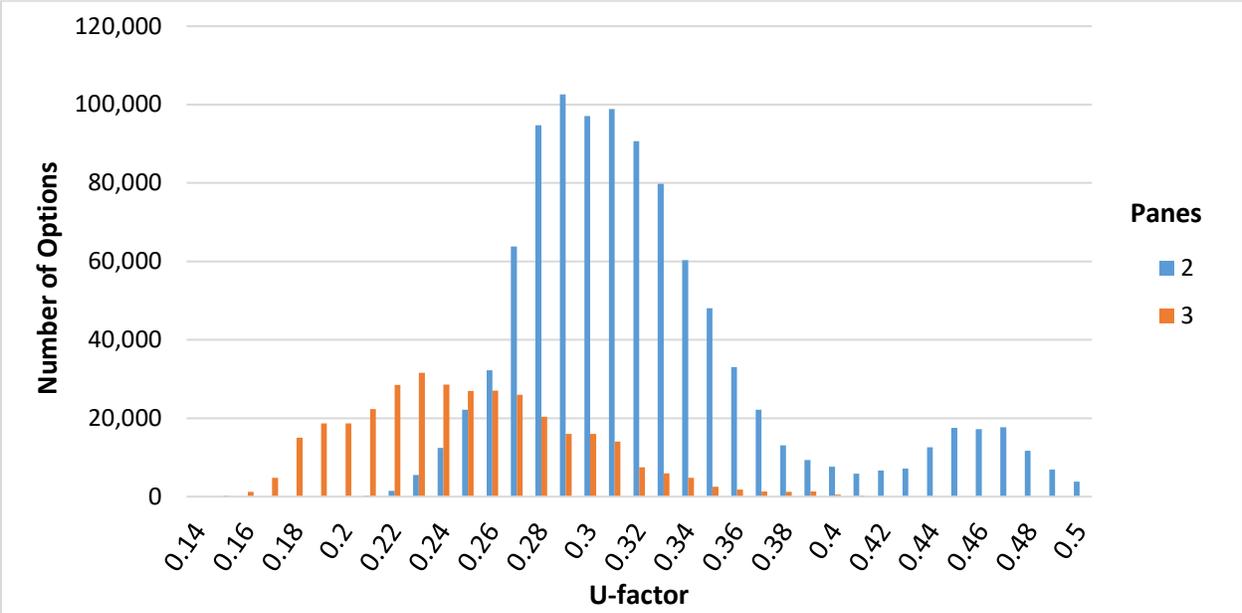


Figure 4. U-Factor Distribution of ENERGY STAR Certified Swinging Doors, September 2017

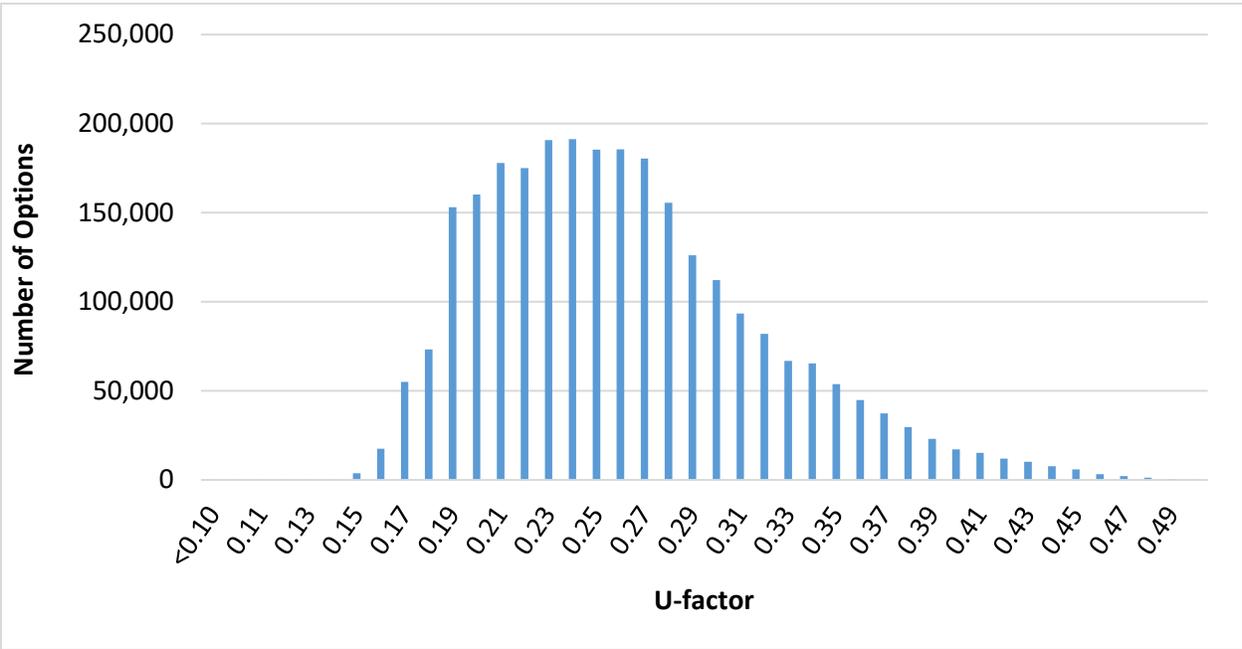


Figure 5. U-Factor/SHGC Distribution of ENERGY STAR Certified Sliding Glass Doors, September 2017

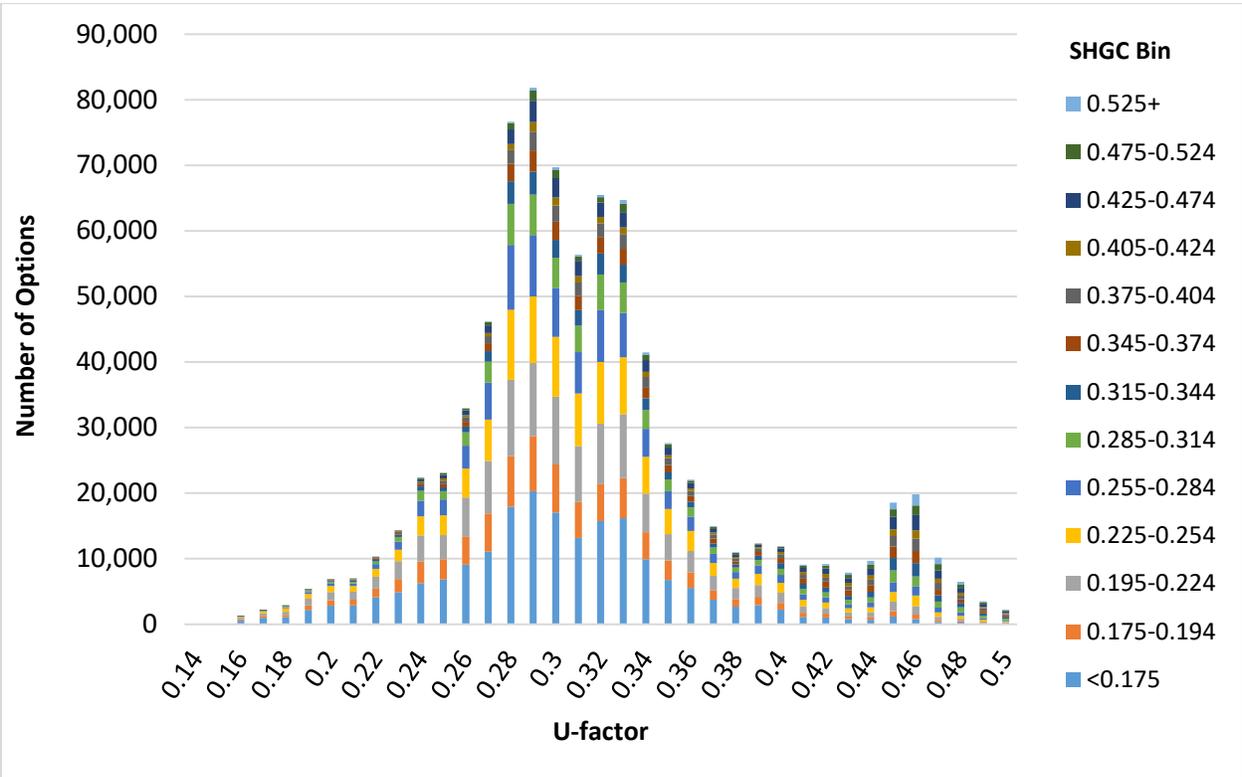
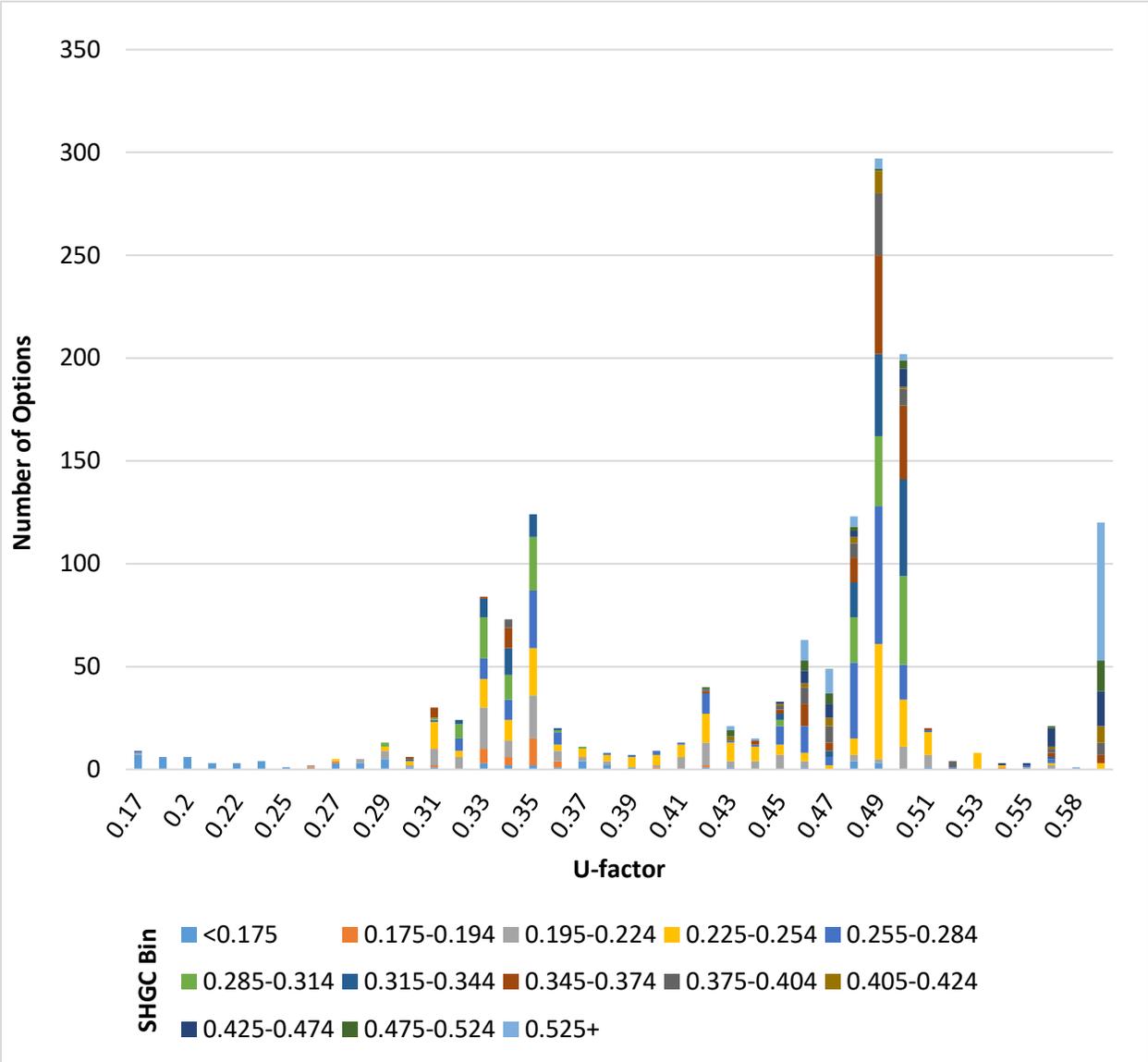


Figure 6. U-Factor/SHGC Distribution of Skylights, September 2017



## Appendix B: Windows vs. Skylight Performance Analysis

Table 2 WINDOW Modeling Results for Skylight and Projection Products

#	Frame	Gas Fill	Low-E Surface	Skylight (20° tilt)		Projection – Single Awning (90° tilt)		U-Factor Difference	SHGC Difference
				U-Factor	SHGC	U-Factor	SHGC		
1	Vinyl	Air	2nd Surface	0.414	0.238	0.338	0.216	0.076	0.022
2	Vinyl	Air	3rd Surface	0.414	0.317	0.338	0.289	0.076	0.028
3	Vinyl	Argon (90/10)	2nd Surface	0.369	0.236	0.311	0.212	0.058	0.024
4	Vinyl	Argon (90/10)	3rd Surface	0.369	0.319	0.311	0.292	0.058	0.027
5	Vinyl	Argon (90/10)	2nd/4th Surface	0.325	0.227	0.288	0.208	0.037	0.019
6	Vinyl	Krypton (95/5)	2nd Surface	0.326	0.233	0.301	0.210	0.025	0.023
7	Wood	Air	2nd Surface	0.436	0.244	0.368	0.224	0.068	0.020
8	Wood	Air	3rd Surface	0.436	0.322	0.368	0.297	0.068	0.025
9	Wood	Argon (90/10)	2nd Surface	0.391	0.241	0.341	0.220	0.050	0.021
10	Wood	Argon (90/10)	3rd Surface	0.391	0.325	0.341	0.299	0.050	0.026
11	Wood	Argon (90/10)	2nd/4th Surface	0.347	0.233	0.319	0.216	0.028	0.017
12	Wood	Krypton (95/5)	2nd Surface	0.348	0.239	0.331	0.217	0.017	0.022
13	Aluminum	Air	2nd Surface	0.546	0.278	0.515	0.270	0.031	0.008
14	Aluminum	Air	3rd Surface	0.546	0.360	0.515	0.349	0.031	0.011
15	Aluminum	Argon (90/10)	2nd Surface	0.499	0.275	0.486	0.266	0.013	0.009
16	Aluminum	Argon (90/10)	3rd Surface	0.499	0.363	0.486	0.352	0.013	0.011
17	Aluminum	Argon (90/10)	2nd/4th Surface	0.452	0.266	0.462	0.262	-0.010	0.004
18	Aluminum	Krypton (95/5)	2nd Surface	0.454	0.272	0.475	0.263	-0.021	0.009
<b>Average Difference</b>								<b>0.037</b>	<b>0.018</b>

**Assumptions for windows and skylights modeling include:**

- Frame dimensions: 47”x 59”
- Gap width: 0.5”
- Double pane
- Glazing options:
  - 2nd and 3rd surface: 4-mm Cardinal 366
  - 4th surface: 4-mm Cardinal i89