

Response to Comments on Specification Framework Document

ENERGY STAR® for Interior and Exterior Storm Panels

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Definitions

Comment 1 – Definitions: Exterior Storm Panels

Several commenters suggest that EPA not limit the definition of “exterior storm panels” to residential buildings only, as storm panels are also widely used in low-rise apartment buildings, light commercial buildings, churches, clinics, schools, etc. One commenter believes that restricting storm panels from use in these types of buildings is counterproductive to the ENERGY STAR program’s guiding principle of saving energy on a national basis.

EPA Response: EPA appreciates the commenters’ suggestion. EPA agrees that storm panels are sometimes used in commercial applications. However, the ENERGY STAR Windows, Doors, and Skylights program is designed around improving energy performance in residential buildings of three stories or fewer. In addition, the research that has been published to date has been limited to residential single-family applications. It is important to note that the product definition is meant to differentiate products that are intended for use in commercial applications from products that are intended for use in residential applications. EPA understands that commercial storm panels can be fundamentally different from residential storm panels, often requiring custom designs and different installation methods, but there are also commercial applications where residential-style products are used. Under the proposed definition and scope, a storm panel would be eligible for ENERGY STAR certification as long as its intended use was for residential buildings, which typically have 3 stories or fewer, but may have 4 or 5 stories.

Comment 2 – Definitions: Interior Storm Panels

Several commenters suggest that EPA remove “without the use of nails, screws, or adhesives” from the definition of “interior storm panels.” One commenter believes that in addition to providing a robust mounting method, such fasteners ensure that product stays in place long term to deliver the intended energy efficiency, and the use of adhesives and sealants can minimize air leakage. One commenter believes that the definition should not include the attachment method, but rather, that the attachment method should be defined by the application.

EPA Response: EPA agrees that the installation method does not need to be specified in the definition of the product and will revise the definition in the Draft 1 Specification.

Comment 3 – Definitions: Low-E Coatings

Several commenters suggest that EPA not limit the categories of low-emissivity coatings to pyrolytic and sputtered because there are new coatings that are durable enough to be used in this application. One commenter suggests defining low-emissivity coating as: “A microscopically thin metal or metallic oxide composition that is deposited directly on a glazing surface to reduce its thermal infrared emittance.”

EPA Response: EPA thanks the commenters for the suggestions. EPA agrees that it is not necessary to define the specific technology used to produce low-emissivity performance levels. ENERGY STAR specifications are intended to be technology neutral. EPA will remove those definitions from program materials to allow a variety of pathways to meet the performance criteria.

Comment 4 – Definitions: Air Leakage

One commenter suggests that EPA revise the definition of “air leakage” to be: “The volume of air flowing per the area of a fixed window unit and per lineal feet of operable crack perimeter.” This metric is included in ASTM – E283-04.

EPA Response: EPA appreciates the commenter’s suggestion. The current definition is also used for the ENERGY STAR program for windows, doors, and skylights. In the interest of providing consistency among product specifications, EPA believes that the current definition is adequate.

Comment 5 – Definitions: Multi-family Building

One commenter advises EPA that the definition of “multi-family building” in the specification document excludes buildings containing 2 to 19 living units. Commenter also suggests that EPA revise the definition to “... two or more residential living units.”

EPA Response: EPA thanks the commenter for the suggestion. The proposed definition should have specified buildings with 2 or more units. EPA will correct this issue in the Draft 1 Specification.

Comment 6 – Definitions: Operable Products

One commenter suggests modifying the definition of “operable products” to read “...to accommodate ventilation and/or egress needs.” The commenter notes that an interior storm panel installed over an outswing casement window provide customers with the ability to save energy when the ability to ventilate isn’t a requirement, and such products may still be designed to enable the storm panel to be removed easily for egress purposes.

EPA Response: EPA appreciates the commenter’s suggestion. In future specification documents, EPA will not include definitions of terms that are not directly cited in the document. EPA will consider this definition for the term “operable products” if the term is used in future specification documents.

Comment 7 – Definitions: Operator Type

One commenter recommends that the types of products be changed to a. Fixed Panels, b. Removable panels, c. Vertical sliding (double-hung), d. Horizontal sliding (slider or glider), e. Hinged (casement, awning and hopper).

EPA Response: EPA appreciates the commenter’s suggestion. In future specification documents, EPA will not include definitions of terms that are not directly cited in the document. At this time, EPA does not believe it is necessary to define all operator types for the purposes of this specification, as the program requirements do not change based on operator type.

Comment 8 – Definitions: Primary Window

Several commenters suggest that EPA remove “residential building” from the definition of “primary window” as it is also used in building types other than residential buildings.

EPA Response: EPA thanks the commenters for the suggestion. The current definition of “primary window” is used for the ENERGY STAR program for windows, doors, and skylights. In the interest of providing consistency among product specifications, EPA believes that the current definition is adequate. See the response to Comment 1 regarding the inclusion of “residential buildings” in the definition of “exterior storm panels” for additional context.

Comment 9 – Definitions: SHGC

One commenter suggests that EPA rephrase the definition of “Solar Heat Gain Coefficient (SHGC)” to “The ratio of **solar radiation** that passes through a fenestration system to the incident solar radiation.”

EPA Response: EPA thanks the commenter for the suggestion. EPA will revise the definition in the Draft 1 Specification.

Comment 10 – Definitions: Solar Control

One commenter suggests replacing “heat” with “energy” in the definition of “solar control” so it reads “... while radiating and reflecting away a portion of the sun’s energy.”

EPA Response: EPA thanks the commenter for the suggestion. EPA plans to limit the terms defined in future specification documents to those that are directly cited in the document. The term “solar control” is not referenced in the program requirements, and therefore is not necessary to include. EPA will remove this definition in the Draft 1 Specification.

Comment 11 – Definitions: Storm Panels

Several commenters suggest that EPA refer to storm panels as “secondary windows” or “secondary glazing systems.” Another commenter notes that exterior storm panels are referred to as “storm windows,” while interior storm panels are generally referred to as either “storm windows” or “storm panels” within the industry.

EPA Response: EPA thanks the commenters for their suggestions. In the interest of selecting a common term that differentiates exterior and interior storm panels from primary windows, EPA chose to use the shorthand term “storm panels” to describe all such products.

Comment 12 – Definitions: Thermal Break

One commenter suggests that EPA add specifics about appropriate materials to the definition of “thermal break,” namely “wood, plastic or other nonmetal materials.”

EPA Response: EPA appreciates the commenter's suggestion, and agrees that additional specifics would be helpful. EPA will add specifics to this definition in the Draft 1 Specification document.

General Comments

Comment 13 – General: Additional Research

Several commenters submitted additional studies with their comments and several provided references to additional studies for EPA to consider. Here are several references commenters provided:

D. Charlie Curcija et al. 2013. *Energy Savings from Window Attachments*. Lawrence Berkeley National Laboratory, Berkeley, CA.

Patrice Frey et al. 2012. *Saving Windows, Saving Money: Evaluating the Energy Performance of Window Retrofit and Replacement*. National Trust for Historic Preservation/Preservation Green Lab, Washington, DC.

Lara Bonn et. al. 2015. *LO(W-E) AND BEHOLD: Low-E Storm Windows Provide a New Way to Solve the Window Conundrum*. Efficiency Vermont, Burlington, VT.

EPA Response: EPA appreciates the commenters' suggestions. EPA is interested in reviewing all relevant published research regarding this product category. EPA will consider all the suggested materials when developing the Draft 1 Specification.

Comment 14 – General: Additional Research

One commenter notes that the research cited in the Framework Document was conducted largely by the same participants, and that the results show that performance can greatly vary. The commenter suggests that EPA consider more research. Another commenter suggests that EPA take more time to determine whether the program should be expanded to storm panels because of data variability.

EPA Response: EPA appreciates input from the commenters on this issue. EPA acknowledges that the majority of the research cited in the Framework Document was conducted by researchers on behalf of two independent national research laboratories, Pacific Northwest National Laboratories (PNNL) and Lawrence Berkeley National Laboratories (LBNL). Each of these institutions has stringent publishing requirements and review processes. Therefore, EPA has full confidence in the research published by PNNL and LBNL, is considering the additional research suggested by commenters, and will evaluate further research that becomes available.

Furthermore, EPA acknowledges that savings may vary depending on a variety of characteristics and conditions, especially with studies conducted in a small sample of occupied homes. Based on the published research that EPA has reviewed to date, EPA believes that the bulk of the research supports the conclusion that, regardless of house characteristics and primary window characteristics, low-e storm panels save energy over clear glass storm panels. The ENERGY STAR program seeks to differentiate better-performing products, and EPA believes that the proposed approach for this product category will deliver energy savings to consumers, though those savings may vary depending on the installed conditions.

Regarding the specification timeline, EPA plans to diligently review available research and present technical support for specific proposals in a criteria analysis report that will accompany the Draft 1

Specification. Stakeholders will have an opportunity to review and comment on EPA's analysis and conclusions at that time.

Comment 15 – General: Consumer Education

One commenter suggests that EPA include information on primary windows relative to storm panels to help consumers evaluate the best option for their needs.

EPA Response: EPA thanks the commenter for the suggestion and will consider providing educational information for consumers on the ENERGY STAR website if the specification is implemented.

Comment 16 – General: Consumer Guidance

One commenter suggests an alternative approach to promote storm windows that involves providing guidelines and recommendations to consumers, as opposed to expanding the ENERGY STAR brand before a third-party testing, rating, and labeling system has been established.

EPA Response: EPA thanks the commenter for the suggestion. As stated in the Framework Document, EPA believes that research published to date supports a process to consider development of an ENERGY STAR specification for this product category. EPA agrees that an established third-party testing, rating, and labeling system will be necessary for the implementation of a specification for this product category. Implementation of the specification is not guaranteed, and EPA plans to follow the specification development process to give full consideration to whether a new product specification is warranted. Alternative approaches to promoting storm panels may be considered at a later date if the specification development process results in a decision not to implement a specification.

Comment 17 – General: Comment Period

One commenter suggests that EPA be receptive to submission of comments beyond February 12. The commenter notes that the time that EPA allowed was not long enough to fully assess cited documents.

EPA Response: EPA appreciates the commenter's suggestion. EPA is open to requests for additional time to review materials and develop comments. In the future, please contact EPA to request additional time to submit stakeholder comments if necessary.

Comment 18 – General: Component

One commenter asserts that expanding ENERGY STAR recognition to storm panels would establish a program for a component as opposed to a whole product, and that a program for storm panels would function differently from any other ENERGY STAR product categories. The commenter urges EPA to be cautious in extending the ENERGY STAR brand to a component where the overall performance is in large part reliant on an unknown existing window.

EPA Response: EPA thanks the commenter for the concern. Interior and exterior storm panels are different in nature from what industry generally considers to be components of fenestration products, such as insulated glazing units, frames, or spacers. Instead, storm panels are sold as stand-alone consumer products, and have energy performance characteristics that can be measured independently of the primary window.

EPA acknowledges that overall performance of the fenestration system is affected by the characteristics of the primary window; however, the research that EPA cited in the Framework Document addresses this issue by evaluating several common primary window scenarios. In all cases, storm panels with low-emissivity coatings resulted in better energy performance than storm panels with clear glass.

Comment 19 – General: Cost-Effectiveness

Several commenters agree with the research that low-emissivity storm panels have an expected payback period of 5 years or less, and state that such a payback is acceptable in the context of adopting building codes. One commenter also believes that low-emissivity storm panels offer significant promise for cost-effectiveness.

EPA Response: EPA thanks the commenters for their input and insight on this issue.

Comment 20 – General: IGDB Data

One commenter provides data from the International Glazing Database (IGDB) on the performance of glass options that meet the proposed requirements.

EPA Response: EPA thanks the commenter for providing data and will consider it when developing the Draft 1 Specification.

Comment 21 – General: Energy Savings

Several commenters agree that storm panels will improve the thermal performance of homes and that significant energy savings can be achieved with ENERGY STAR storm panels. Several commenters also note that the use of low-e coatings and tints will enhance performance of storm panels.

EPA Response: EPA thanks the commenters for their input and insight on this issue.

Comment 22 – General: Interior Storm Panel Energy Savings

One commenter notes that information provided by EPA shows that interior storm panels exhibit better insulating performance than exterior storm panels. The commenter questions how both products can be ENERGY STAR if one performs better, and whether only interior storm panels should qualify for ENERGY STAR.

EPA Response: EPA appreciates the commenter’s question. The choice between interior and exterior storm panels depends on consumer preference and other factors, such as the operator type of the primary window. For both interior and exterior storm panels, low-emissivity products will save energy compared to clear glass products. Therefore, consumers will benefit from either low-emissivity product type, and will be able to choose the product type that matches their preferences and primary window operator types.

Comment 23 – General: Variability of Primary Window

Several commenters are concerned that the performance of storm panels relies on the existing window. One commenter questions what baseline window performance is assumed when developing the performance metrics. Another commenter is concerned that adding an ENERGY STAR certified storm panel over an ENERGY STAR certified window has a smaller effect. The commenters question how this limitation is communicated to consumers.

EPA Response: EPA thanks the commenters for their input. The full impact of storm panels on a consumer’s energy consumption depends on a number of variables, including the characteristics of the primary window, the existing heating and cooling system, and the climate zone where the home is located. To address this variability, the research that EPA cited in the Framework Document evaluated several common primary window scenarios across multiple climates. In all cases, storm panels with low-emissivity coatings resulted in better energy performance than storm panels with clear glass. EPA will continue to consider multiple scenarios when evaluating proposed qualification criteria.

EPA plans to provide some basic information for consumers on the ENERGY STAR website, including highlighting scenarios where low-emissivity storm panels would provide the greatest benefit. EPA acknowledges that if consumers already have ENERGY STAR certified primary windows, low-emissivity storm panels will provide less of a benefit (e.g. less savings, less improvement in comfort). EPA believes that it is reasonable to assume that consumers are most likely to install storm panels over poor-performing primary windows, where they are likely to enjoy the most benefit, rather than high-performing ENERGY STAR certified primary windows.

Comment 24 – General: Variability of Installation

One commenter notes that the performance of storm panels depends on the quality of installation, which can be highly variable, especially when performed by homeowners. The commenter questions how EPA intends to address this variability with consumers.

EPA Response: EPA thanks the commenter for the concern. Similar to other ENERGY STAR product categories that depend on proper installation, such as windows, insulation, and roof products, EPA helps customers identify the best-performing products and practices, but does not certify the quality of each installation. In the Framework Document, EPA proposed that manufacturers be required to provide installation instructions accompanying the product. EPA believes that these instructions will help ensure that product installation will be done correctly.

Comment 25 – General: Glass Performance

One commenter notes that simulations performed by an NFRC-certified simulation lab clearly show that glass type is the primary driver of storm window performance.

EPA Response: EPA appreciates the commenter providing this information. EPA believes that this information supports the approach that EPA proposed in the Framework Document, which focused on glass performance metrics.

Comment 26 – General: Flexible Frames

One commenter believes that flexible frames, which are created from silicone and/or polyurethane foam and are designed to fit into the window opening without the use of screws, nails, adhesives, etc., are important to the evolution of storm panels as they help overcome the need for storm panels to match the exact size of the window, as well as the difficulty of installing storm panel in many window openings, particularly brick and sheet rock openings. The commenter recommends that EPA not require that the storm panel match the operator type of the primary window or that the storm panel be permanently installed in order to allow products with flexible frames to be ENERGY STAR certified.

EPA Response: EPA thanks the commenter for the input. EPA does not believe that the proposed specification framework would make products with flexible frames ineligible for certification. EPA has not proposed that storm panels be required to match the operator type of the primary window. However, the proposal for installation instructions would require manufacturers to provide guidance on the applicability of the storm panel operator type to the primary window operator type, especially with respect to any egress requirements. EPA believes that guidance from the manufacturer is sufficient to address this issue.

EPA has not proposed that storm panels be permanently installed. In proposing an air leakage metric, EPA would require that product installation be robust enough to withstand the proposed air leakage test procedure. EPA encourages manufacturers to evaluate their flexible frame products for the performance metrics that are being considered.

Comment 27 – General: Insulated Glazing Units

One commenter notes that the proposed scope in the Framework Document excludes storm panels that use insulated glazing units rather than monolithic low-emissivity glass to deliver insulating value.

EPA Response: EPA thanks the commenter for the concern. EPA is aware of one manufacturer that currently makes storm panels with insulated glazing through a customized, on-site design process. EPA believes the approach proposed in the Framework Document would successfully differentiate better-performing products for the vast majority of the storm panel market. EPA is interested in additional information on storm panels with insulated glazing that are currently offered on the market. In addition, EPA is open to considering alternative certification pathways for products that do not use low-emissivity glazing.

Comment 28 – General: Market Barriers

One commenter notes that the storm panel market faces a number of challenges, including an identity crisis, stigma, lack of recognition by rating systems, code barriers, concerns related to do-it-yourself installation, and industry structure. The commenter also asserts that there is no evidence that the ENERGY STAR brand would help overcome these barriers.

EPA Response: EPA thanks the commenter for the concerns. In the Framework Document, EPA cited a study from PNNL titled “Low-E Storm Windows: Market Assessment and Pathways to Market Transformation.” This study evaluated the market barriers mentioned by the commenter and the conclusions support the idea that ENERGY STAR would help overcome some of these barriers. In addition, a number of stakeholders have expressed support for ENERGY STAR recognition of storm panels. EPA agrees that ENERGY STAR alone will not alleviate all market barriers; however, EPA believes it is appropriate to continue to assess this product category for ENERGY STAR recognition.

Comment 29 – General: Operability

One commenter suggests that storm panels can be made operable, but it is not recommended for better energy savings in commercial applications.

EPA Response: EPA appreciates the commenter’s input. As stated in the Framework Document, EPA is considering a product specification only for storm panels intended for use in residential applications. In addition, EPA believes that it is important to allow the choice of operable products for the purposes of egress requirements, ventilation, and other customer preferences.

Comment 30 – General: Product Availability

One commenter notes that EPA’s guiding principle “qualifying products are broadly available” can be satisfied only once an established testing, certification, and labeling program is in place and sufficient data is available to assess availability. Alternatively, two commenters state that low-e storm panels are broadly available nationally from more than one manufacturer.

EPA Response: EPA thanks the commenters for their input. As stated in the Framework Document, EPA has reviewed market research from national laboratories, qualification criteria from regional utility programs, and performance data from the IGDB. This research, combined with stakeholder feedback, suggests that a variety of low-emissivity storm panel products are currently available on the market. EPA plans to evaluate product availability in the context of the proposed specification in a criteria analysis report accompanying the Draft 1 Specification.

Comment 31 – General: Ratings and Certification

Several commenters are concerned about the lack of existing rating procedures and suggest that a specification development process for storm panels is premature at this time. One commenter supports third-party certification as a prerequisite for entry into the ENERGY STAR program. Another commenter

also notes that performance certification criteria, process, and labeling requirements were in place and well-established for many years when the window, door, and skylight program was developed.

EPA Response: EPA thanks the commenters for their input. EPA agrees that third-party certification is a prerequisite for entry into the ENERGY STAR program; however, EPA can propose qualification criteria while the full details of a third-party certification program are still in development. EPA expects that the iterative specification development process will help identify issues and concerns regarding the certification process before the specification has been finalized. EPA will not finalize a specification until the certification process has also been finalized and stakeholders have had an opportunity to comment on EPA's proposal in light of the certification requirements.

Comment 32 – General: Support

Several commenters support the development of an ENERGY STAR program for exterior and interior storm panels. One commenter notes that EPA should move forward with specification development for storm panels without delay because such products are a credible, affordable, and cost-effective way for consumers to improve the energy performance of old, single pane, clear glass windows. One commenter also notes that the lack of a window attachment rating system or ENERGY STAR label was identified in the market assessment as a key barrier to market uptake of this technology. Several commenters believe that ENERGY STAR labeling will solve the issue of consumers having trouble distinguishing between clear and low-e glass, and note that there is no confusion between replacement windows and storm panels. Another commenter also notes that industry professionals are seeking a means to evaluate the effectiveness of storm panels and that ENERGY STAR is the recognized and preferred method for identifying the most energy-efficient products in a particular category.

EPA Response: EPA appreciates the commenters' support for considering an ENERGY STAR specification for storm panels.

Comment 33 – General: Usage Guidelines

One commenter believes that it is important to maintain the installation of storm panels throughout the year, but that it is unrealistic to enforce this requirement. The comment alternatively suggests creating a proper usage guideline for the homeowner to achieve the desired result.

EPA Response: EPA appreciates the comment and agrees that ENERGY STAR cannot ensure proper installation and maintenance of storm panel products. EPA has proposed that manufacturers provide installation instructions with the products. In addition, EPA will consider providing additional guidance for consumers on the ENERGY STAR website.

Comment 34 – General: Verification Testing

One commenter urges EPA to implement an after-market verification testing program. Another commenter questions how will EPA verify the attributes proposed in the specification, assuming that

any product under the ENERGY STAR brand must be subject to ENERGY STAR's Independent Verification Program.

EPA Response: EPA thanks the commenters for their input. Verification testing is a requirement for all ENERGY STAR product categories. If a specification for storm panels is finalized, EPA will work with participating certification bodies to develop and implement verification testing requirements. At this stage of the specification development process, it is premature to define verification testing procedures.

Installation Instructions

Comment 35 – Installation Instructions: Care and Maintenance

One commenter suggests that care and maintenance procedures also be required, including procedures for properly cleaning low-e glass.

EPA Response: EPA thanks the commenter for the suggestion. EPA believes that guidance on proper maintenance for individual products should be provided by the manufacturers of those products.

Comment 36 – Installation Instructions: Egress

Two commenters suggest including information about egress windows and recommend that the installed storm panel be of the same operator type as the primary window.

EPA Response: EPA thanks the commenters for the suggestion. EPA has proposed that installation instructions would require manufacturers to provide guidance on the applicability of the storm panel operator type to the primary window operator type, especially with respect to any egress requirements. Because EPA cannot certify individual product installations, EPA does not plan to require that installed storm panels be of the same operator type as the primary window.

Comment 37 – Installation Requirements: Interior Storm Panel

One commenter suggests that interior storm panels will need some kind of screw or adhesive.

EPA Response: EPA thanks the commenter for the suggestion. As discussed above, EPA does not plan to specify the installation method for interior storm panels in the definition of the product. However, the proposed installation instructions require that manufacturers provide guidance on tools and hardware needed for installation.

Comment 38 – Installation Requirements: Professionals

One commenter suggests that storm panels should be installed only by professionals.

EPA Response: EPA thanks the commenter for the suggestion. While EPA agrees that professional installation may be ideal, EPA cannot certify how a product is installed. EPA will consider providing general guidance on its website regarding product installation.

Comment 39 – Installation Requirements: Supportive

One commenter supports the inclusion of installation instruction requirements in the specification. Another commenter states that the installation instruction requirements proposed in the Framework Document cover the most important elements.

EPA Responses: EPA thanks the commenters for their support of the installation instructions requirements.

Comment 40 – Installation Instructions: Thermal Break

One commenter suggests that EPA consider the need for a thermal break when a metal-framed storm window is used over a metal-framed primary window. The commenter also notes that this would happen only if the metal prime window were installed in a metal panning system to which the storm window was applied, creating direct, conductive contact.

EPA Response: EPA thanks the commenter for the suggestion and agrees that thermal breaks should be used when installing metal-framed storm panels over metal-framed primary windows. In the Framework Document, EPA proposed that manufacturers be required to provide guidance on appropriate use of thermal breaks in their installation instructions. EPA believes that individual manufacturers should provide guidance that is specific to their products.

Comment 41 – Installation Instructions: Weather Stripping

One commenter suggests that weather stripping for air sealing should be a requirement for storm panels.

EPA Response: EPA thanks the commenter for the suggestion and agrees that proper sealing should be used when installing storm panels. In the Framework Document, EPA proposed that manufacturers be required to provide guidance on proper sealing in their installation instructions. EPA believes that individual manufacturers should provide guidance that is specific to their products.

Negative Effects

Comment 42 – Negative Effects: Brand Credibility

One commenter believes that there is not enough customer experience with low-e storm panels to be certain that customers will be satisfied with the product. The commenter is also concerned that there is a potential for confusion about how storm panels compare to replacement windows, which could damage the credibility of the ENERGY STAR brand.

EPA Response: EPA thanks the commenter for the concerns. Low-emissivity storm panels have been available to consumers for more than 6 years and are currently carried by major home improvement retailers. Furthermore, EPA addresses concerns regarding the variability of the primary window and consumers' expectations for energy savings in its response to Comment 23, above.

The goal of labeling storm panels is to guide consumers to select better-performing storm panels. EPA believes that consumers will make their own decisions regarding whether to upgrade existing windows with low-emissivity storm panels or replace their windows, based on their own preferences. EPA plans to communicate the differences between the two product categories on the ENERGY STAR website. Based on these considerations, EPA does not believe that low-emissivity storm panels will damage the credibility of the ENERGY STAR brand.

Comment 43 – Negative Effects: Condensation

One commenter is concerned that storm panels can create condensation problems as a function of the air tightness of the storm panel and primary window. Another commenter also encourages EPA to discuss primary window condensation for interior storm panels in cold climates.

EPA Response: EPA thanks the commenters for their concerns. EPA understands that incorrect installation of storm panels can lead to condensation problems. To help decrease condensation, EPA has proposed that weep holes or other moisture management technologies be a requirement for certification. Regarding condensation related to interior panels in cold climates, EPA plans to seek additional input and encourages stakeholders to provide technical information on the issue.

Comment 44 - Negative Effects: Durability

One commenter states that their organization discontinued the use of hard-coat low-e coatings on the surface of single pane storm panels due to concerns of coating failures and warranty issues and started developing thermal and laminated glass storm window products to mitigate those issues.

EPA Response: EPA thanks the commenter for raising this issue. EPA believes that the experience described by the commenter is not typical of most low-emissivity coatings in use today. EPA understands that pyrolytic low-emissivity coatings are designed to be used on exposed surfaces, and that such coatings can be more durable than the substrate. In addition, glass manufacturers typically offer long warranty periods for low-emissivity glass, which suggests that durability is not a concern.

Comment 45 – Negative Effects: Permanence

One commenter questions whether customers will keep the storm panels installed if they are not satisfied with the product. The commenter also notes that if the storm panel does not remain in place, it will not save any energy.

EPA Response: EPA appreciates the commenter’s concern. The ENERGY STAR program is designed to help consumers purchase more energy-efficient products. However, consumers are free to choose whether and how to use those products in their own homes. This is similar to homeowners choosing to leave their ENERGY STAR windows open in the winter or summer, even though they are wasting energy.

Comment 46 – Negative Effects: Price Hike

One commenter suggests that an ENERGY STAR specification will force the pricing for storm panels closer to that of vinyl primary windows. The commenter also questions who will buy storm panels if a good primary window can eliminate the need of a storm panel.

EPA Response: EPA thanks the commenter for the concern. Low-emissivity storm panels are available today from a variety of manufacturers at a variety of retail sources. EPA believes that because these products are already widely available, market competition is likely to keep the prices reasonable for consumers. EPA believes that consumers will decide whether to upgrade existing windows with low-emissivity storm panels or replace their windows based on their own preferences.

Comment 47 – Negative Effects: Safety

Two commenters are concerned that storm panels can impede emergency egress and create significant safety concerns. One of the commenters notes that most homeowners are not aware of the need for egress windows and simply requiring instructions is not sufficient to address this major concern. One of the commenters recommends that EPA do the following:

- a. Require that installed ENERGY STAR certified storm panels do not inhibit egress functionality of opening dimensions and/or operability of windows
- b. Require that installed ENERGY STAR certified storm panels comply with code-required hazardous location safety-glazing provisions
- c. Require that ENERGY STAR certified storm panels be North American Fenestration Standard (NAFS) certified and labeled to ensure consistent, quality products, and to ensure proper glass strength in accordance with ASTM E1300
- d. Establish a maximum air leakage criteria that aligns with NAFS, for both interior and exterior panels

EPA Response: EPA thanks the commenters for their concerns. EPA takes the safety of consumers very seriously, and believes that it is important that consumers and installers do not inhibit egress functionality when installing these products. The commenters recommended that EPA have requirements related to how the products are installed, specifically with regard to egress functionality

and hazardous location safety-glazing provisions. Storm panels are installed almost exclusively in existing homes where no code enforcement occurs during the project. Therefore, there would be no way to enforce requirements that apply to the conditions present in the existing construction. Instead, EPA has proposed to address safety concerns by requiring that manufacturers include information on the applicability of the storm panel operator type to primary window operator type, especially with regard to any egress requirements. Ultimately, it is the responsibility of the consumer and installer to install products in a safe manner.

With respect to the recommendation that EPA consider NAFS certification in accordance with ASTM E1300 as a requirement for the program, EPA does not wish to include product design requirements that do not directly affect the energy performance of the product. EPA believes that air leakage performance is directly related to energy performance and is working toward developing air leakage criteria that are appropriate to the program. EPA will consider NAFS air leakage requirements as part of the specification development process.

Comment 48 - Negative Effects: Solar Control and Interior Storm Panel

One commenter believes that interior storm panels are poor applications for solar control (low solar transmittance) coatings due to trapped heat. The commenter also suggests that EPA allow only exterior storm panels with solar control to be certified.

EPA Response: EPA thanks the commenter for the concern. EPA is considering allowing only exterior storm panels with low solar transmittance to be certified and encourages stakeholders to provide additional information about this issue.

Comment 49 – Negative Effects: Damage to Primary Window

Several commenters note that they are unaware of any scenario or application in which storm panels may damage or adversely affect the performance of primary windows. One commenter also provides analysis on the glass temperature of low-emissivity storm panels installed over single-pane and double-pane primary windows, which indicates that the maximum glass temperature is lower than the temperature at which vinyl frames could be distorted.

EPA Response: EPA thanks the commenters for this information. It is helpful to know that damage to vinyl framed primary windows is unlikely to be an issue with low-emissivity storm panels.

Comment 50 - Negative Effects: Undermines AERC

One commenter believes that setting a specification before the Attachments Energy Rating Council (AERC) has completed development of a performance rating system will cause manufacturers' interest in certified ratings to wane and adversely affect AERC's efforts.

EPA Response: EPA thanks the commenter for the concern. EPA understands that AERC is developing a consumer-focused energy performance rating system, which is independent of the ENERGY STAR specification development process. EPA is monitoring the AERC rating development process, and

believes that EPA's and AERC's efforts can proceed concurrently. In addition, AERC has expressed support for the ENERGY STAR specification development process in its submitted comments. EPA may ultimately propose initial qualification criteria that do not reference the rating that AERC is developing; EPA may still consider such a rating in future specifications.

Comment 51 – Negative Effects: Ventilation

One commenter believes that there is a significant potential negative effect on ventilation if the storm panel is not easily operable, or must now operate in tandem with another product that has different operability features. The commenter also notes that ventilation can be a positive for energy savings in many climates during swing seasons.

EPA Response: EPA thanks the commenter for the concern. To help address this issue, EPA has proposed that manufacturers provide guidance through their installation instructions regarding the applicability of the storm panel operator type to the primary window operator type. EPA understands that the newer generation of storm panels have options that are operable, giving consumers the choice to use natural ventilation during swing seasons.

Comment 52 – Negative Effects: Visual Transmittance

One commenter is concerned that there may be a negative impact to visual transmittance if a consumer adds low-SHGC storm panels to low-SHGC windows, as directed by southern state building codes. The commenter also raises the concern that a southern consumer may purchase a low-SHGC storm panel with the best intentions, but may end up with less-than-desirable visible light transmission of the total window.

EPA Response: EPA thanks the commenter for the concern. EPA will consider providing information about visual transmittance for this scenario (installing a storm panel with low solar transmittance over a primary window with low SHGC) on the ENERGY STAR website. EPA believes that the vast majority of existing primary windows in the southern climate zone use clear glass, and consumers would benefit from a storm panel with low solar transmittance.

Qualification Criteria

Comment 53 – Qualification Criteria: Acrylic

One commenter recommends that glazing materials be expanded to include acrylic. The commenter also notes that in the northern and north-central regions such acrylic could be clear acrylic and in the southern and south-central regions such acrylic could include IR-filtering acrylic.

EPA Response: EPA thanks the commenter for the recommendation. EPA believes that the proposed performance metrics that apply to the glazing material (emissivity and solar transmittance) could also apply to acrylic-based products. There are currently non-glass glazing materials listed in the IGDB, and the procedures for adding materials to the IGDB are publicly available at https://windows.lbl.gov/materials/igdb/IGDB_datasubmitters.htm. EPA notes that a goal of the ENERGY STAR program is to differentiate better-performing products from standard products. At this time, EPA is not aware of research that demonstrates that acrylic-glazed interior storm panels can provide energy savings that are similar to what has been observed with low-emissivity glass storm panels.

Comment 54 - Qualification Criteria: Air Leakage

One commenter suggests that EPA establish maximum air leakage criteria that align with NAFS for interior and exterior storm panels and minimum air leakage criteria for exterior panels only to avoid potential issues such as condensation, mold and mildew, wood rot, heat buildup, building damage, and permanent glass stain affecting visibility.

EPA Response: EPA thanks the commenter for the suggestions. As stated previously, EPA will consider aligning maximum air leakage requirements with existing standards, such as NAFS. EPA has proposed that exterior storm panels be required to have weep holes or other moisture-control features that would address the negative effects that the commenter identifies. EPA is open to considering a minimum air leakage requirement if it is evident such a requirement is necessary to avoid negative effects.

Comment 55 – Qualification Criteria: Air Leakage

One commenter suggests that EPA implement air leakage criteria in a later phase once more research on the test method and the appropriate criteria level has been completed.

EPA Response: EPA thanks the commenter for the suggestion. EPA believes that to propose requirements for air leakage, it will be necessary to develop a test procedure that reflects the installed performance of the storm panel, as well as evaluate typical air leakage performance of existing products. EPA is aware that a test procedure is currently in development, and will revisit this issue in the Draft 1 criteria analysis report.

Comment 56 – Qualification Criteria: Air Leakage

One commenter asks whether the reduction in air leakage that was evaluated in the cited research would be the same across all windows and/or mounting options.

EPA Response: EPA thanks the commenter for the question. The cited research provides energy savings estimates for low-emissivity storm panels with and without additional savings from reduced air leakage. EPA believes that it is sufficient to evaluate future proposed criteria without claiming savings from reduced air leakage. Therefore, variability among mounting options would not affect EPA's analysis. EPA has proposed an air leakage metric to help ensure a minimum level of performance. EPA will revisit this issue in the Draft 1 criteria analysis report.

Comment 57 - Qualification Criteria: Air Leakage

One commenter proposes that interior storm panels be allowed to qualify in the northern and north-central regions based exclusively on air leakage performance.

EPA Response: EPA thanks the commenter for the suggestion. The ENERGY STAR program seeks to differentiate better-performing products from more typical products. EPA understands that all typical storm panels, both interior and exterior, reduce air leakage. Therefore, a specification based solely on air leakage would not differentiate better-performing products.

Comment 58 - Qualification Criteria: Air Leakage

One commenter proposes that EPA set air leakage criteria of 0.15 and 0.50 cfm/lineal ft. crack perimeter at 75 Pa for fixed and operable storm panels, respectively. The commenter also suggests that exterior storm panels be tested with weep holes open.

EPA Response: EPA thanks the commenter for the suggestion. EPA believes that in order to propose requirements for air leakage, it will be necessary to develop a test procedure that reflects the installed performance of the storm panel, as well as evaluate typical air leakage performance of existing products. EPA is aware that a test procedure is currently in development, and will consider the commenter's suggestion in the development of the Draft 1 criteria analysis report.

Comment 59 - Qualification Criteria: Air Leakage

One commenter suggests that air infiltration should always be considered.

EPA Response: EPA thanks the commenter for the suggestion. EPA agrees and proposed an air leakage metric for consideration in the Framework Document.

Comment 60 – Qualification Criteria: Alternative Metrics

One commenter suggests that EPA consider the longevity of the program and a tiered approach to setting the proposed criteria that would help the adoption process. The commenter believes that if glass performance is used as the basis for storm panel performance ratings, there is little room for incremental improvement of that criteria. The commenter supports having an annual energy performance (ER) rating on the storm panel label, but suggests that such a metric could be adopted in later revisions, giving time for consumer recognition of the program, while postponing change to the manufacturing process, testing, and certification.

EPA Response: EPA thanks the commenter for the suggestions. The ENERGY STAR program evaluates products that are currently available on the market to differentiate better-performing products from typical products. As part of the development of a Draft 1 Specification proposal, EPA will consider the range of performance levels among available products. If a specification is implemented, EPA will continue to monitor how the market responds to the specification and may or may not choose to revise the specification again in the future. EPA is aware of efforts to develop an annual energy performance metric, and will consider including such a metric in the specification in the future.

Comment 61 – Qualification Criteria: U-factor and SHGC

One commenter suggests that EPA consider U-Factor and SHGC in the performance metrics. Another commenter encourages EPA to use the performance metrics designed by AERC once available. Another commenter notes that, even without a rating system for storm panels, products are commercially available today that were developed based on achieving certain levels of U-Factor and SHGC performance, and not simply emissivity. The commenter provides a paper from 2011 that evaluated options for upgrading the energy performance of historic windows, including an insulated doubled-glazed exterior attachment option.

EPA Response: EPA thanks the commenters for their suggestions. EPA believes that qualification criteria based on glass performance (specifically, emissivity and solar transmittance) would effectively differentiate high-performing products among the vast majority of the storm panel market. In addition, there is currently a process to certify glass performance through the IGDB, and regional energy efficiency programs have successfully used emissivity and solar transmittance as the basis for storm panel incentives. As discussed in section III.B.i, EPA did not propose using U-factor and SHGC because the cited research showed that the frame material had a negligible impact on energy performance.

EPA understands that dual-glazed storm panels that do not use low-emissivity glass are commercially available today from at least one manufacturer. EPA acknowledges that dual-glazed storm panels that do not use low-emissivity glass would not be eligible under the approach proposed in the Framework Document. EPA is open to considering an alternative certification pathway for U-factor, SHGC, and/or an annual energy performance metric. However, the process for certifying storm panels using those metrics is still in development. Once the certification process has been finalized, EPA can consider including alternative pathways.

Comment 62 – Qualification Criteria: Surface Temperature Delta

One commenter proposes a new metric that captures the temperature delta of the surface of the outermost layer of fenestration vs. the inside surface of the innermost layer of fenestration.

EPA Response: EPA thanks the commenter for the suggestion. Surface temperature delta is not typically used to measure energy performance in fenestration systems because it does not capture the full thermal performance of the products. EPA is interested in reviewing additional research that compares the commenter's suggestion to the approach proposed in the Framework Document. EPA is open to considering an alternative certification pathway for surface temperature delta if published research justifies including it in the specification.

Comment 63 – Qualification Criteria: Climate Zones

One commenter believes that the climate zones proposed in the specification document do not seem necessary and are potentially confusing if the primary goal is simply to promote the use of low-e glazing. The commenter also notes that using the same climate zones as the ENERGY STAR Windows program is likely to create confusion among the two products. Another commenter supports the proposed criteria variations for climate zone in the specification document.

EPA Response: EPA thanks the commenter for the concern. The goal of labeling storm panels is to guide consumers to select better-performing storm panels, not simply to promote the use of low-e glazing. The research conducted by PNNL recommended storm panels with low solar transmittance for cost-effective energy savings in southern climates. EPA believes that different qualification criteria based on climate zone will help achieve significant energy savings on a national basis. EPA also believes that the use of climate zones maps on a potential ENERGY STAR label for storm panel products would help consumers select the product that is right for them, just as it does for the ENERGY STAR program for windows, doors, and skylights.

Comment 64 – Qualification Criteria: Cumulative Performance

One commenter proposes that EPA consider cumulative energy saving performance of the fenestration system as a whole.

EPA Response: EPA thanks the commenter for the suggestion. EPA is open to considering alternative certification pathways, and is aware that a process for certifying storm panels using an annual energy performance metric is in development.

Comment 65 – Qualification Criteria: Visual Transmittance and Daylighting

Two commenters suggest that EPA consider additional metrics to account for decreased visual transmittance with the use of storm panels. One of the commenters suggests that EPA quantify the energy impact of diminished daylight from using storm panels.

EPA Response: EPA thanks the commenters for the suggestions. EPA understands that low-emissivity glass can have a wide range of visual transmittance ratings. For commercial applications, visual transmittance of fenestration has been shown to affect lighting energy use; EPA is not aware of any studies that demonstrate the same correlation in residential applications. Ultimately, consumers may have different preferences for the amount of light in their homes and should be able to choose storm panels that best meet their needs.

Comment 66 – Qualification Criteria: Whole Window Assembly

One commenter is concerned about the use of emissivity in performance metrics as it is a surface property and does not indicate thermal properties of the whole window assembly.

EPA Response: EPA thanks the commenter for the concern. The research cited in the Framework Document demonstrates that the use of low-emissivity glass improves the energy performance of storm panels. In addition, as discussed in Comment 25 above, other stakeholders indicate that simulations show that glass performance is the primary driver of storm panel performance. EPA believes it is not necessary to quantify the performance of the whole window assembly to differentiate better-performing storm panel products.

Comment 67 – Qualification Criteria: Emissivity Criteria

Several commenters suggest that EPA set the maximum allowed emissivity at 0.22, set by the RTF of the Northwest Power and Conservation Council and the Pennsylvania Weatherization Program. One commenter also notes that it is a reasonable criterion as multiple glass manufacturers offer compliant glass products, according to properties listed in the IGDB.

EPA Response: EPA thanks the commenters for their input. EPA plans to consider performance criteria used by other programs and the availability of qualified products when proposing a specification. EPA plans to provide additional discussion in a criteria analysis report that will accompany a Draft 1 Specification.

Comment 68 – Qualification Criteria: Energy Savings

One commenter believes that, if meeting a prescribed level of air leakage becomes a product specification for storm products, energy savings from reduced air leakage should be captured as part of the overall program justification.

EPA Response: EPA thanks the commenter for the suggestion. EPA understands that air leakage can have a significant impact on the energy performance of a window system. EPA proposed an air leakage requirement in the Framework Document to ensure that ENERGY STAR certified storm panels would provide a minimum standard of performance. When considering criteria for storm panels, EPA plans to analyze incremental savings over standard products. In many cases, low-emissivity storm panels may have the same air leakage performance as standard, clear glass storm panels. Therefore, there would not be additional savings from air leakage improvements.

Comment 69 – Qualification Criteria: Existing Programs

One commenter believes that emissivity and solar transmittance provide consistency with the metrics used by other programs, such as the RTF utility program in the Pacific Northwest, and it will not be confused with the U-Factor and SHGC ratings currently used in the ENERGY STAR Program for Windows, Doors and Skylights. Another commenter notes that an ENERGY STAR program based on glass properties would be very straightforward because verification would be a matter of simply verifying the glass type used by the manufacturer and confirming the glass properties in the IGDB.

EPA Response: EPA thanks the commenters for their support of the proposed approach.

Comment 70 – Qualification Criteria: Low-SHGC Surface without Films

One commenter notes that they are not aware of any low-SHGC exposed surface coatings currently available in the market without the use of films.

EPA Response: EPA thanks the commenter for the concern. EPA believes that qualifying glass options are available, but plans to conduct additional research on availability and present those findings in a criteria analysis report that will accompany a Draft 1 Specification.

Comment 71 – Qualification Criteria: Supportive

Several commenters note that the proposed criteria of emissivity and solar transmittance in the Framework Document are simple and appropriate, and will clearly differentiate energy-efficient low-e storm panels from conventional clear glass storm panels. One commenter also notes that product performance for storm panels is determined by the glass type and air leakage reduction. Unlike primary windows, differences in frame material have little impact, even for aluminum framed storm windows. Another commenter suggests that a number of different performance-related criteria, including U-factor and SHGC, could potentially be used to differentiate energy-efficient storm products from standard storm products, but the proposed glass properties of emissivity and solar transmittance are adequate to provide this differentiation and can be easily administered.

EPA Response: EPA thanks the commenters for their support of the approach proposed in the Framework Document.

Comment 72 – Qualification Criteria: Negative

One commenter believes that the proposed criteria would not adequately measure a product's entire performance, particularly as a system installed over an existing window. The commenter also notes that these metrics would not account for other possible energy efficiency technology improvements, such as IG storm panels, multiple low-e coatings, improvements in the effectiveness of the thermal break for metal products, and alternative frame approaches.

EPA Response: EPA thanks the commenter for the concern. EPA believes it is possible to differentiate better-performing storm panel products without quantifying the performance of the whole window assembly. The research cited in the Framework Document demonstrates that the use of low-emissivity glass improves the energy performance of storm panels in a wide range of applications. In addition, as discussed in Comment 25 above, other stakeholders indicate that simulations show that glass performance is the primary driver of storm panel performance. This suggests that different frame designs and materials for monolithic low-emissivity storm panels have a negligible impact on energy performance. Regarding the effectiveness of the thermal break for metal products, EPA is proposing to address this through required elements in the installation instructions. EPA believes that alternative efficiency improvements, such as IG storm panels and multiple low-e coatings, are currently not commonly used in the storm panel market. EPA is open to considering alternative certification pathways as they become available.

Comment 73 – Qualification Criteria: Performance Grade

One commenter recommends requiring that qualifying products have a performance grade of at least 15, and that systems relying only on compression, magnets, Velcro, or adhesives to secure part or all of an assembled interior secondary window be excluded for safety reasons.

EPA Response: EPA thanks the commenter for the suggestions. EPA proposed a requirement for air leakage because air leakage is directly related to energy performance. While air leakage is one element of the North American Fenestration Standards (NAFS) performance grade, EPA believes that the additional NAFS requirements do not appear to affect the energy performance of storm panels. In addition, performance grade does not appear to be a widely used metric in the storm panel market. EPA is sensitive to concerns about safety and plans to gather additional information about the risks associated with the attachment methods for interior storm panels.

Comment 74 – Qualification Criteria: Separate Criteria for Interior Storm Panels

One commenter suggests that EPA design separate criteria for exterior and interior storm panels due to their inherently different designs. Specifically, the commenter stated that exterior storm panels use glass and can qualify under the current proposed Product Certification and Test Methods.

EPA Response: EPA thanks the commenter for the suggestion. EPA acknowledges that there are inherent differences in the designs and applications of interior and exterior products. However, the research cited in the Framework Document supports the idea that the proposed performance metrics would successfully differentiate better-performing products of both types. As discussed in EPA's response to Comment 55 above, other glazing materials, such as acrylic, can be certified in the IGDB and could therefore be eligible for ENERGY STAR certification under the proposed approach. In the Framework Document, EPA raised the possibility of different SHGC requirements for interior and exterior panels. EPA plans to gather additional information on this issue in advance the Draft 1 Specification.

Comment 75 – Qualification Criteria: SHGC and Solar Transmittance

Two commenters believe that encouraging solar gain for storm panels in the north-central zone while discouraging solar gain for regular windows is inconsistent and unsubstantiated. One commenter notes that if solar control is ultimately a qualification criterion, a maximum solar transmittance requirement should apply nationwide as with ENERGY STAR doors or at least for all zones except the north, where there would be no requirement. One commenter suggests that EPA strike claims for cooling energy savings in the northern climate zone if the program sets a low solar heat gain requirement.

EPA Response: EPA thanks the commenters for their concern. EPA did not propose specific qualification criteria in the Framework Document, but instead referred to requirements used by the Regional Technical Forum (RTF) in the northwest as a possible model. The RTF criteria specify a minimum solar transmittance of 0.55 or higher. EPA understands that a solar transmittance of 0.55 represents the cut-off point between standard low-emissivity glazing and "solar control" low-emissivity glazing. The research that EPA cited in the Framework Document (PNNL-22864) supports the conclusion that storm panels with standard low-emissivity glazing save more energy in the north-central zone than storm

panels with solar control low-emissivity glazing. EPA believes that relying on cut-off points in existing technology is an effective way to differentiate better-performing storm panel products that are available on the market. In advance of the Draft 1 Specification, EPA plans to gather more information about storm panel products with solar control low-emissivity glazing and the performance of such products in various climate zones.

Comment 76 – Qualification Criteria: Solar Control Retrofit Films

One commenter notes that solar control retrofits already have a working program in NFRC. The commenter also believes that the energy savings from films are comparable to savings from storm panels and questions why EPA has not considered them.

EPA Response: EPA thanks the commenter for the input. As stated in the Framework Document, EPA has identified and reviewed numerous research papers on product performance and markets for storm panels that provide the basis for this specification development effort. EPA is open to considering recognition of other attachment products or energy-saving strategies as additional data is gathered and provided for consideration.

Comment 77 – Qualification Criteria: Solar Transmittance

Two commenters suggest minimum solar transmittance of 0.55, which was used by the RTF of the Northwest Power and Conservation Council and was the basis of PNNL's energy analysis. Another commenter suggests solar transmittance of 0.60-0.75 for high solar gain low-e products and 0.40-0.55 for low solar gain products. Another commenter states that they are not opposed to establishing separate criteria for solar transmittance based on climate zone, but recommends that this be limited to no more than two different levels of solar transmittance to minimize complexity in manufacturing, sales, marketing, and distribution. The commenter states that a solar transmittance of approximately 0.55 corresponds to a natural break between low solar gain and high solar gain glazing products.

EPA Response: EPA thanks the commenters for their support of the proposed approach. EPA will consider the suggested qualification criteria for the Draft 1 Specification.

Comment 78 – Qualification Criteria: Weep Holes

Two commenters believe that exterior storm panels must be allowed to weep moisture that collects on the surfaces of the primary window and storm panels in the airspace between them. Another commenter suggests that all storm panel applications require weep holes. One commenter also suggests that EPA perform further testing of storm panels in multiple scenarios, such as with weep holes, with covered weep holes, and with specialized slow expansion foam insulating tapes.

EPA Response: EPA thanks the commenters for their suggestion. In the Framework Document, EPA proposed to exclude exterior panels without weep holes or other features that allow moisture to drain from between the storm panel and primary window. EPA understands that moisture can be an issue in some scenarios with storm panels, and EPA believes that requiring moisture management features in the ENERGY STAR specification should help address this issue. EPA believes that this approach will

provide flexibility to manufacturers to use different moisture management features, such as those suggested by the commenter.

Scope

Comment 79 – Scope: Interior Storm Panel

One commenter believes that the performance of interior storm panels is insufficient for ENERGY STAR. The commenter also notes that little field testing has been done on this subject.

EPA Response: EPA thanks the commenter for the concern. EPA agrees that few low-emissivity internal storm panel field studies seem to be available at this time. However, in the Framework Document, EPA identified analysis in the existing research (PNNL-22864) that found that low-emissivity internal storm panels actually perform as well as or better than external storm panels. In addition, some regional programs allow low-emissivity internal storm panels and do not appear to have found problems with the product. EPA is open to receiving additional data or analysis that shows that existing analyses are incorrect or that there are performance problems with internal storm panels. At this time, EPA believes that the current data and analysis are sufficient to consider low-emissivity internal storm panels for inclusion in the Draft 1 Specification.

Comment 80 – Scope: Non-Residential

One commenters suggests that EPA not limit the program to residential buildings and encourages EPA to consider commercial/industrial/municipal buildings for the program.

EPA Response: EPA appreciates the commenters' suggestion. EPA agrees that storm panels are sometimes used in commercial applications. However, the research that has been published to date has been limited to residential single-family applications. Similar to the ENERGY STAR program for windows, doors, and skylights, the specification is designed to improve energy performance in residential buildings of three stories or fewer. Commercial buildings have different attributes and building codes, which may have more stringent requirements for structural performance. Furthermore, the ENERGY STAR program addresses commercial buildings through energy performance benchmarking based on energy use intensity (EUI) per square foot, which allows for all types of energy efficiency measures. While storm panels may provide significant benefits to commercial building applications, at the current time EPA believes that it is more appropriate to use the benchmarking process to track energy efficiency improvements from storm panels in the same manner as other commercial fenestration products.

Comment 81 – Scope: Other Products

One commenter encourages EPA to include additional attachment products in the ENERGY STAR program as AERC is developing the performance ratings for these products in addition to storm panels.

EPA Response: EPA thanks the commenter for the suggestion. EPA may consider ENERGY STAR specifications for other attachment products in the future through separate specification development efforts.

Comment 82 – Scope: Patio Storm Doors

One commenter suggests that EPA include patio storm doors in the ENERGY STAR Program. The commenter notes that the same glazing approach, including low-e glass, is used with patio storm doors as is used with the storm panels. Because the glazing area of a patio storm door is larger than that of a window, the benefit and energy savings from the patio storm door is magnified. The commenter recognizes that the research on storm doors is currently insufficient to support such a program.

EPA Response: EPA thanks the commenter for the suggestion. As the commenter states, the research that EPA cited in the Framework Document specifically focused on storm panels intended for use over primary windows. EPA is open to considering expanding the scope of the current proposal to include storm doors as additional information becomes available.

Comment 83 - Scope: Proprietary Technologies

One commenter asks for more information on the purpose of including the wording “feature proprietary technologies” in the proposed scope.

EPA Response: EPA thanks the commenter for their question. When developing and revising ENERGY STAR specifications, EPA seeks to avoid qualification criteria that can be met only through the use of proprietary technologies. Manufacturers are otherwise free to use proprietary technologies to meet the specification, if needed.

Comment 84 - Scope: Supportive

Two commenters support the scope of products included in the specification Framework Document. Another commenter indicates general agreement with the defined scope of this program focusing on low-rise residential buildings.

EPA Response: EPA thanks the commenters for their support of the scope proposed in the Framework Document.

Test Method

Comment 85 – Test Method: Supportive

One commenter supports the use of existing industry test standards for emissivity and solar transmittance to identify products in the market and encourages EPA to move forward. The commenter also suggests that EPA adopt the uniform standards developed by AERC for measuring and verifying the energy performance of storm panels.

EPA Response: EPA thanks the commenter for the support of the approach proposed in the Framework Document. EPA plans to review the metrics developed by AERC when they are available.

Comment 86 – Test Method: Air leakage Test Pressure

One commenter believes that 75 Pa pressure for air leakage testing is unrealistic as such pressure is rarely encountered in the real world. The commenter suggests using pressure of 25 Pa and normalizing the results at industry standard 50 Pa.

EPA Response: EPA thanks the commenter for the suggestion. EPA understands that a test pressure of 75 Pa is generally considered to be the industry standard when measuring air leakage for fenestration products. EPA believes that a test pressure of 75 Pa should be used when testing storm panels to provide consistency with existing test procedures. EPA understands that products that attach to the primary window without the use of nails, screws, or adhesives may have issues with higher test pressures, and is open to considering allowances for such products to facilitate testing at 75 Pa.

Comment 87 – Test Method: Air Leakage with Primary Window

One commenter suggests that air leakage performance be based on the combination of a storm window installed over a primary window. Several commenters note that AERC is working with ATI to develop a test method for air leakage that EPA could reference in the future.

EPA Response: EPA thanks the commenters for their suggestions. EPA plans to review the test method currently being developed and will consider proposing it in the Draft 1 Specification.

Comment 88 – Test Method: Air Leakage Infiltration Only

Two commenters suggest that air leakage should be specified with the existing test method ASTM E283 with pressure applied to the exterior of the products only.

EPA Response: EPA thanks the commenters for their suggestion. EPA believes that testing both infiltration and exfiltration is a better indicator of product performance than infiltration alone. Based on preliminary research, EPA understands that infiltration and exfiltration can be measured during the same test, without much additional effort or cost. EPA plans to gather additional information on this subject in advance of the Draft 1 Specification.

Comment 89 – Test Method: Baseline Performance of Primary Window

One commenter suggests that EPA consider a standardized double hung primary window as a baseline primary window in order to rate the product and compare the performance of storm panels.

EPA Response: EPA thanks the commenter for the suggestion. As proposed in the Framework Document, EPA believes that it is possible to differentiate better-performing storm panels through glass performance criteria. Taking this approach means that it would not be necessary to rate and compare products using a standardized double hung primary window. However, EPA understands that it will be necessary to make certain assumptions about the primary window when estimating energy savings for any proposed criteria. EPA believes that it makes sense to assume a standard double hung window for that purpose, but may also consider analyzing energy savings in other scenarios. EPA also understands that an alternative rating system that would rate the performance of a storm panel when used over a standard primary window is currently in development. EPA is open to considering other certification approaches when they become finalized.

Comment 90 – Test Methods: IGDB Rigor

One commenter notes that the IGDB has fairly broad submittal tolerances and does not require recertification or product validation from multiple production facilities. The commenter also notes that this lack of rigor conflicts with the effort in ENERGY STAR Windows and the NFRC's Independent Verification Program (IVP).

EPA Response: EPA thanks the commenter for the concern. According to the IGDB website (https://windows.lbl.gov/materials/igdb/IGDB_datasubmitters.htm), all glazing data that is submitted to the IGDB is reviewed by Lawrence Berkeley National Laboratories (LBNL) and undergoes a peer review. All submitters must also participate in and pass an inter-laboratory comparison (ILC) prior to data submission and again every 4 years. The glazing material ratings housed in the IGDB also serve to underpin the product simulations in NFRC's certification program for windows, doors, and skylights. EPA believes that the IGDB provides sufficient rigor to use as the basis for ENERGY STAR certification of interior and exterior storm panels.

Comment 91 – Test Methods: Certification Method

One commenter notes that to certify products, the certification body will simply have to verify the glass product being used and confirm that the properties from the IGDB meet the program requirement.

EPA Response: EPA appreciates the suggested approach and plans to work with certification bodies to develop specific certification procedures.

Comment 92 – Test Method: Market Assessment

Two commenters support the use of the IGDB to assess the availability of glazing options on the market and move forward with specification development.

EPA Response: EPA thanks the commenters for the support of the approach proposed in the Framework Document.

Comment 93 – Test Method: Insufficient Approach

One commenter believes that the approach outlined in Test Methods is not sufficient to fully evaluate potential qualification and certification criteria.

EPA Response: EPA thanks the commenter for the concern. EPA acknowledges that the Framework Document provided general proposals for test methods, and that further detail will be necessary to allow stakeholders to evaluate proposals. EPA would provide a more specific proposal for test methods in the Draft 1 Specification.