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*Comment Received From: Eric Lacey*
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## Recommend Retaining Area-Weighted Averaging of Maximum Fenestration U-Factors

Please see the attached comments.

*Additional submitted attachment is included below.*

California Energy Commission Staff,

Thank you for the opportunity to comment on proposed changes to the 2025 California Energy Code. I have not reviewed all of the final CASE reports in detail, but at this point, one proposed change to the requirements for single-family homes stood out to me as important and potentially problematic, and I think it deserves reconsideration.

Specifically, the Final CASE Report for Single-Family High-Performance Windows and Walls includes a proposed code change to the language of Section 150.0(q) (which sets out the mandatory requirements for fenestration products), that would eliminate the option allowing code users to use an area-weighted average of all fenestration product U-factors to meet the overall mandatory efficiency requirement. (See page 80 of the Final Draft, excerpted below.) I recommend that the Commission not adopt this proposed change.

(q) **Fenestration products.** Fenestration separating conditioned space from unconditioned space or outdoors shall meet the requirements ~~of either Item 1 or 2~~ below:

1. Fenestration, including skylight products, must have a maximum U-factor of 0.4~~5~~0.

**Exception 1 to Section 150.0(q)1**: Up to 10 square feet of fenestration area or 0.5 percent of the conditioned floor area, whichever is greater, is exempt from the maximum U-factor requirement.

**Exception 2 to Section 150.0(q)1**: For dual-glazed greenhouse or garden windows, up to 30 square feet of fenestration area is exempt from the maximum U-factor requirement.

**Exception 3 to Section 150.0(q)1**: Replacement skylights in an alteration.

~~2. The area-weighted average U-factor of all fenestration, including skylight products shall not exceed 0.45.~~

Although there was discussion and analysis related to the proposed reduction of the mandatory maximum fenestration U-factor from 0.45 to 0.40, I did not see any discussion of or justification for the elimination of the area-weighted averaging alternative. I think the overall stringency improvement (0.45 to 0.40) is reasonable if the value can be met by an area-weighted average, but the elimination of area-weighted averaging is essentially a second increase in stringency that will unnecessarily limit the flexibility to use certain fenestration products.

Building envelope trade-off backstops such as the mandatory maximum fenestration U-factor are extremely important in building energy codes, and especially in codes that may allow trade-offs between envelope and non-envelope building systems (such as heating, cooling, and water heating equipment efficiency, lighting, etc.). The building envelope is less likely to be altered over the building's useful lifetime, and it is far more cost-effective to improve envelope efficiency at construction. A mandatory maximum U-factor backstop

helps to ensure a predictable level of long-term performance despite any efficiency trade-offs. The use of area-weighted averaging in Title 24 and in other building energy codes is a valid and accepted practice that ensures a reasonable overall performance of the particular envelope measure at a specified level, with most products performing at or better than the standard, offsetting the weaker performance of a few products or portions of the building assemblies. It is not necessary to require every product to meet the mandatory measure value; a weighted average provides the necessary flexibility to allow for design decisions and limited use of products that may not meet the mandatory value.

Based on some limited research, I found that although Title 24 has reduced single-family maximum fenestration U-factors at least once over the last few editions, an area-weighted averaging exception has been available since at least 2016.

**Single-Family Mandatory Maximum Fenestration U-factors in Section 150**

| *Title 24 Edition* | *Max U-factor* | *Area-weighted average alternative* |
|---|---|---|
| ***2016*** | **0.58** | **Yes** |
| ***2019*** | **0.58** | **Yes** |
| ***2022*** | **0.45** | **Yes** |
| ***2025 (Proposed)*** | **0.40** | **No** |

For reference, the residential IECC fenestration mandatory maximum U-factors are based on area-weighted averages, and have been since at least 2004. I think that approach has helped deflect some of the potential concerns about lack of flexibility or product choice as the overall mandatory stringency levels have been ratcheted down.

Area-weighted averaging is also allowed for other mandatory maximum U-factor requirements in the California Energy Code. For example, as far as I am aware, area-weighted averaging of maximum fenestration U-factors is not proposed to be deleted in the Final CASE Report on Multifamily Envelope. It does not make sense to single out residential fenestration in a way that could unnecessarily restrict the types of individual fenestration products that could be included in a single-family home. The overall efficiency will already be improved by reducing the mandatory maximum (average) fenestration U-factor from 0.45 to 0.40, while still preserving flexibility for code users and product suppliers.

**I recommend retaining the area-weighted averaging option for single-family fenestration maximum U-factors in 150.0(q)2.**