

C-2: Fenestration SHGC

Summary: The solar heat gain coefficient (SHGC) for fenestration indicates how much solar gain enters the space. The proposal would reduce SHGC requirements in warmer climate zones, which will result in reduced heat gain and less energy used for space cooling. Peak cooling and cooling equipment sizes may also be reduced.

A comment review for DOE proposal C-2 was added on December 18, 2015.

Stakeholder Feedback: There were four public comments received for proposal C-2. Comments are summarized below, followed by a DOE review:

- Concern was expressed about production availability of glazing that meets the 0.22 SHGC requirement.
Review: In ASHRAE 90.1-2016 there is expected to be a requirement for 0.22 SHGC in the new climate zones 0A and 0B, so there should be available product.
- Suggestion to add a minimum visible transmittance (VT) or VT/SHGC ratio as in ASHRAE Standard 90.1.
Review: While DOE supports a minimum VT when there is daylighting, it is more appropriate to address VT as a separate proposal.
- The focus for lower SHGC should be Climate Zones 4-6.
Review: The analysis for this proposal found the proposed changes cost-effective in climate zones 1 & 2.
- Add dynamic shading as an option to reduce SHGC.
Review: While such a proposal may have merit, it is beyond the scope of the current DOE proposal. It could certainly be proposed by others. Dynamic shading can also qualify using the performance path.

In response to these comments, DOE will submit proposal C-2 as originally posted.

== = IECC PROPOSAL:

Make the following changes to Table C403.4

**TABLE C402.4
BUILDING ENVELOPE FENESTRATION MAXIMUM U-FACTOR AND SHGC
REQUIREMENTS**

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7	
Vertical fenestration														
U-factor														
Fixed fenestration	0.50		0.50		0.46		0.38		0.38		0.36		0.29	
Operable fenestration	0.65		0.65		0.60		0.45		0.45		0.43		0.37	
Entrance doors	1.10		0.83		0.77		0.77		0.77		0.77		0.77	
SHGC														
Orientation ^a	SEW	N	SEW	N	SEW	N	SEW	N	SEW	N	SEW	N	SEW	N
PF < 0.2	0.252	0.33	0.252	0.33	0.25	0.33	0.40	0.53	0.40	0.53	0.40	0.53	0.45	NR
0.2 ≤ PF < 0.5	0.3026	0.37	0.3026	0.37	0.30	0.37	0.48	0.58	0.48	0.58	0.48	0.58	NR	NR
PF ≥ 0.5	0.4035	0.40	0.4035	0.40	0.40	0.40	0.64	0.64	0.64	0.64	0.64	0.64	NR	NR
Skylights														
U-factor	0.75		0.65		0.55		0.50		0.50		0.50		0.50	
SHGC	0.35		0.35		0.35		0.40		0.40		0.40		NR	

NR = No requirement, PF = Projection factor.

- a. “N” indicates vertical fenestration oriented within 45 degrees of true north. “SEW” indicates orientations other than “N.” For buildings in the southern hemisphere, reverse south and north. Buildings located at less than 23.5 degrees latitude shall use SEW for all orientations.

Reason: This proposed change modifies the Solar Heat Gain Coefficient (SHGC) requirements for fenestration in Climate Zones 1 and 2 to increase stringency. The SHGC indicates how much solar heating is absorbed through fenestration. The lower the SHGC, the less heat gain there is into a building through the windows. Requiring windows with a lower SHGC reduces the heat gain in a building space and reduces the need for cooling, saving energy. There are also likely to be comfort improvements as a result of less solar gain inside the space.

Energy Savings: An analysis of energy impact shows that savings from the improved SHGC in the proposal ranges from \$0.087 to \$0.141 per square foot of glazing area in medium-sized offices and mid-rise apartment buildings in Climate Zones 1 to 3. More details are found in the cost-effectiveness analysis referenced in the cost impact section.

The U.S. Department of Energy (DOE) develops its proposals through a public process to ensure transparency, objectivity and consistency in DOE-proposed code changes. Energy savings and cost impacts are assessed based on established methods and reported for each proposal, as applicable. More information on the process utilized to develop the DOE proposals for the 2018 IECC can be found at:

<https://www.energycodes.gov/development/2018IECC>.

Cost Impact: Lower SHGC adds a moderate cost to the building, ranging from \$1.40 to \$1.50 per square foot of glass area for the changes indicated in the proposal. In addition, there can be a reduction in peak cooling loads that may result in smaller cooling equipment, reducing costs—such HVAC cost reductions were not included in the cost-effectiveness analysis.

Cost-effectiveness: PNNL performed a cost-effectiveness analysis using the established DOE methodology.¹ Results of the cost-effectiveness analysis showed that in Climate Zones 1 and 2 the average savings-to-investment ratio (SIR) was 2.5 in medium-sized offices and 1.7 in mid-rise apartment buildings. A proposal is cost-effective when the SIR is greater than 1.0, indicating that the present value of savings is greater than the incremental cost. The complete cost-effectiveness analysis is available at:

<https://www.energycodes.gov/development/2018IECC>.

¹ Hart, R., and Liu, B. (2015). *Methodology for Evaluating Cost-effectiveness of Commercial Energy Code Changes*. Pacific Northwest National Laboratories for U.S. Department of Energy; Energy Efficiency & Renewable Energy. PNNL-23923 Rev1. <https://www.energycodes.gov/development/commercial/methodology>.