Proposal Summary

Single-Family Windows and Walls

Updated: Thursday, May 18, 2023
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Introduction

The document summarizes proposed revisions to the California Energy Code (Title 24, Part 6) that will be discussed during a utility-sponsored stakeholder meeting on February 14, 2023. The Statewide Utility Codes and Standards Enhancement (CASE) Team is seeking input and feedback. To provide your comments, email info@title24stakeholders.com by February 28, 2023.

Measure Description

1. **High-performance windows:** This proposal for single-family homes has three components:
    - Reduce the prescriptive maximum U-factor requirement of window assemblies for all California climate zones to 0.28.
    - Reduce the mandatory U-factor requirement for all climate zones to 0.40.
    - Require that installed SHGC match (within ±0.01) the performance model.
2. **Mandatory R-value requirements for framed walls**: This measure proposes to reduce the mandatory U-factor of framed walls in single-family homes. For 2x4 framed walls the U-factor is reduced to 0.095, which can be met with R-15 cavity insulation in a wood framed wall. For 2x6 framed walls the U-factor is reduced to 0.069, which can be met with R-21 cavity insulation in a wood framed wall. There are proposed exceptions for altered wood-framed walls that allow for R-13 and R-20 cavity insulation in 2x4 and 2x6 assemblies, respectively.

Data Needs/Stakeholder Information Requests

Data needs may include:

- **Energy Savings**
    - Impact of solar heat gains on indoor climate, room-specific discomfort issues, need of venting, and potential benefits during heating season on overall heating demand.

- **Market Readiness**
  1. Are there market barriers for introducing more stringent code requirements for windows?
  2. How will an increase in demand of high-performance windows affect manufacturers production process?
- **Non-energy Benefits**
  1. What are the embodied carbon emissions associated with high-performance windows?
- **Costs** –
  - What are the additional material costs of high-performance windows, and will triple pane windows require more labor install?
- **Economic Impacts** – job creation, environment and social justice, equity

Data may be provided anonymously. To participate or provide information, please email Simon Pallin, spallin@frontierenergy.com directly and cc info@title24stakeholders.com.

Draft Code Language

The proposed changes to the Standards and Reference Appendices are provided below. Changes to the 2022 documents are marked with red underlining (new language) and ~~strikethroughs~~ (deletions).

Standards

Title 24, Part 6

SUBCHAPTER 7 SINGLE-FAMILY RESIDENTIAL BUILDINGS—MANDATORY FEATURES AND DEVICES

SECTION 150.0—MANDATORY FEATURES AND DEVICES

(c) **Wall insulation.** Opaque portions of above grade walls separating conditioned spaces from unconditioned spaces or ambient air shall meet the following requirements:

a. 2 × 4 inch framing shall have an overall assembly U-factor not exceeding U-0.095~~102~~. In wood framed assemblies, compliance with this U-factor may be demonstrated by installing insulation between framing members with an R-value of 15 or greater.

Exception 1 to Section 150.0(c)1a: Existing walls already insulated to a U-factor not exceeding U-0.110 or already insulated between framing members with insulation having an installed thermal resistance of R-11 or greater.

Exception 2 to Section 150.0(c)1a: Altered wood-framed walls where the existing siding is not being removed or replaced with insulation between framing members with an R-value of 13 or greater.

b. 2 × 6 inch or greater framing shall have an overall assembly U-factor not exceeding U-0.069~~071~~. In wood framed assemblies, compliance with this U-factor may be demonstrated by installing insulation between framing members with an R-value of 21 or greater.

Exception to Section 150.0(c)1b: Altered wood-framed walls where the existing siding is not being removed or replaced with insulation between framing members with an R-value of 20 or greater.

c. Opaque non-framed assemblies shall have an overall assembly U-factor not exceeding U-0.102.

d. Bay or bow window roofs and floors shall be insulated to meet the wall insulation requirements of Table 150.1-A.

e. Masonry walls shall be insulated to meet the wall insulation requirements of Table 150.1-A.

~~f. In wood framed assemblies, compliance with U-factors may be demonstrated by installing wall insulation with an R-value of 13 in 2x4 assemblies, and 20 in 2x6 assemblies.~~

(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 0.4~~5~~0.

SUBCHAPTER 8 SINGLE-FAMILY RESIDENTIAL BUILDINGS - PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES

SECTION 150.1—PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES FOR SINGLE-FAMILY RESIDENTIAL BUILDINGS

(c) **Prescriptive standards/component packages.** Buildings that comply with the prescriptive standards shall be designed, constructed and equipped to meet all of the requirements for the appropriate climate zone shown in Table 150.1-A. In Table 150.1-A, NA (not allowed) means that feature is not permitted in a particular climate zone and NR (no requirement) means that there is no prescriptive requirement for that feature in a particular climate zone. Installed components shall meet the following requirements:

3. **Fenestration.**

A. Installed fenestration products, including glazed doors, shall have an area-weighted average U-factor and an area-weighted maximum Solar Heat Gain Coefficient (SHGC) meeting the applicable fenestration value in Table 150.1-A and shall be determined in accordance with Sections 110.6(a)2 and 110.6(a)3.

Exception 1 to Section 150.1(c)3A: For each dwelling unit, up to 3 square feet of ~~new~~ glazing area installed in doors and up to 3 square feet of ~~new~~ tubular skylights area with dual-pane diffusers shall not be required to meet the U-factor and SHGC requirements of Table 150.1-A.

Exception 2 to Section 150.1(c)3A: In Climate Zone 2, 4, and 6 through 15, f~~F~~or each dwelling unit up to 16 square feet of ~~new~~ skylight area with a maximum U-factor of 0.55 and a maximum SHGC of 0.30.

Exception 3 to Section 150.1(c)3A: In Climate Zone 1, 3, 5, and 16, for each dwelling unit up to 16 square feet of skylight area with a maximum U-factor of 0.55 and no SHGC requirement.

Exception 4 to Section 150.1(c)3A: New dwelling units with a conditioned floor area of 500 square feet or less in Climate Zones 6 through 10 and 16 may comply with a maximum U-factor of 0.3.

Exception ~~3~~5 to Section 150.1(c)3A For fenestration containing chromogenic type glazing:

i. The lower-rated labeled U-factor and SHGC shall be used with automatic controls to modulate the amount of solar gain and light transmitted into the space in multiple steps in response to daylight levels or solar intensity;
ii. Chromogenic glazing shall be considered separately from other fenestration; and
iii. Area-weighted averaging with other fenestration that is not chromatic shall not be permitted and shall be determined in accordance with Section 110.6(a).

EXCEPTION ~~4~~6 to Section 150.1(c)3A: For dwelling units containing unrated site-built fenestration that meets the maximum area restriction, the U-factor and SHGC can be determined in accordance with the Nonresidential Reference Appendix NA6 or use default values in Table 110.6-A and Table 110.6-B.

4. **Shading.** Where Table 150.1-A requires a maximum SHGC, the shading requirements shall be met by one of the following:

A. Complying with the required maximum SHGC pursuant to Section 150.1(c)3A; or

B. An exterior operable shading louver or other exterior shading device that meets the required maximum SHGC; or

C. A combination of Items A and B to achieve the same performance as achieved in Section 150.1(c)3A.

D. For south-facing glazing only, optimal overhangs shall be installed so that the south-facing glazing is fully shaded at solar noon on August 21 and substantially exposed to direct sunlight at solar noon on December 21.

E. Exterior shading devices must be permanently secured with attachments or fasteners that are not intended for removal.

Exception to Section 150.1(c)4E: Where the California Building Code (CBC) requires emergency egress or where compliance would conflict with health and safety regulations.

TABLE 150.1-A COMPONENT PACKAGE—Single- Family Standard Building Design

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			Climate Zone															
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Building Envelope	Floors	Slab Perimeter	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	U-0.58 R-7.0
		Raised	U- 0.037 R-19	U- 0.037 R-19	U- 0.037 R-19	U- 0.037 R-19	U- 0.037 R-19	U- 0.037 R-19	U- 0.037 R-19	U-0.037 R-19	U- 0.037 R-19	U- 0.037 R-19	U- 0.037 R-19	U- 0.037 R-19	U-0.037 R-19	U-0.037 R-19	U-0.037 R-19	U- 0.037 R-19
		Concrete Raised	U 0.092 R-8.0	U 0.092 R-8.0	U 0.269 R-0	U 0.269 R-0	U 0.269 R-0	U 0.269 R-0	U 0.269 R-0	U 0.269 R-0	U 0.269 R-0	U 0.269 R-0	U 0.092 R-8.0	U 0.138 R-4.0	U 0.092 R-8.0	U 0.092 R-8.0	U 0.138 R-4.0	U 0.092 R-8.0
	Quality Insulation Installation (QII)		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Roofing Product	Low-Sloped	Aged Solar Reflectance	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.63	NR	0.63	NR
			Thermal Emittance	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.75	NR	0.75	NR
		Steep-Sloped	Aged Solar Reflectance	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.20	0.20	0.20	0.20	0.20	0.20	NR
			Thermal Emittance	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.75	0.75	0.75	0.75	0.75	0.75	NR
	Fenestration	Maximum U-factor	0.~~30~~28	0.~~30~~28	0.~~30~~28	0.~~30~~28	0.~~30~~28	0.~~30~~28	0.~~30~~28	0.~~30~~28	0.~~30~~28	0.~~30~~28	0.~~30~~28	0.~~30~~28	0.~~30~~28	0.~~30~~28	0.~~30~~28	0.~~30~~28
		Maximum SHGC	NR	0.23	NR	0.23	NR	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	NR
		Maximum Total Area	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
		Maximum West Facing Area	NR	5%	NR	5%	NR	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	NR
	Door	Maximum U-factor	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20

SUBCHAPTER 9 SINGLE-FAMILY RESIDENTIAL BUILDINGS - ADDITIONS AND ALTERATIONS TO EXISTING RESIDENTIAL BUILDINGS

SECTION 150.2—ENERGY EFFICIENCY STANDARDS FOR ADDITIONS AND ALTERATIONS TO EXISTING SINGLE-FAMILY RESIDENTIAL BUILDINGS

(a) **Additions.** Additions to existing single-family residential buildings shall meet the requirements of Sections 110.0 through 110.9, Sections 150.0(a) through (n), (p), (q), and either Section 150.2(a)1 or 2.

1. **Prescriptive approach.** Additions to existing buildings shall meet the following additional requirements:
   A. Additions that are greater than 700 square feet shall meet the requirements of Section 150.1(c), with the following modifications:
      i. Extensions of existing wood-framed walls may retain the dimensions of the existing walls and shall install cavity insulation of R-15 in a 2x4 framing and R-21 in a 2x6 framing.
      ii. The maximum allowed fenestration area shall be the greater of 175 square feet or 20 percent of the addition floor area, and the maximum allowed west-facing fenestration area shall be the greater of 70 square feet or the requirements of Section 150.1(c).
      iii. When existing siding of a wood-framed wall is not being removed or replaced, cavity insulation of R-15 in a 2x4 framing and R-21 in a 2x6 framing shall be installed and continuous insulation is not required.
      iv. Additions that consist of the conversion of existing spaces from unconditioned to conditioned space shall not be required to perform the following as part of QII:
         a. Existing window and door headers shall not be required to be insulated.
         b. Air sealing shall not be required when the existing air barrier is not being removed or replaced.
   B. Additions that are 700 square feet or less shall meet the requirements of Section 150.1(c), with the following modifications:
      i. Roof and ceiling insulation in a ventilated attic shall meet one of the following requirements:
         a. In Climate Zones 1, 2, 4, and 8 through 16, achieve an overall assembly U-factor not exceeding 0.025. In wood framed assemblies, compliance with U-factors may be demonstrated by installing insulation with an R-value of R-38 or greater.
         b. In Climate Zones 3, and 5 through 7, achieve an overall assembly U-factor not exceeding 0.031. In wood framed assemblies, compliance with U-factors may be demonstrated by installing insulation with an R-value of R-30 or greater.
      ii. Radiant barriers shall be installed in climate zones 2-15.
      iii. Extensions of existing wood-framed walls may retain the dimensions of the existing walls and shall install cavity insulation of R-15 in a 2×4 framing and R-21 in a 2×6 framing.

iv. In Climate Zones 2, 4 and 6- through 15; the maximum allowed west-facing fenestration area shall not be greater than 60 square feet; and shall also comply with either a or b below:

a. For additions that are 700 square feet or less but greater than 400 square feet, the maximum allowed fenestration area limit is the greater of 120 square feet or 25 percent of the conditioned floor area of the addition; or

b. For additions that are 400 square feet or less, the maximum allowed fenestration area is the greater of 75 square feet or 30 percent of the conditioned floor area of the addition.

v. Quality Insulation Installation (QII) requirements of Section 150.1(c)1E do not apply.

vi. When existing siding of a wood-framed wall is not being removed or replaced, cavity insulation of R-15 in a 2×4 framing and R-21 in a 2×6 framing shall be installed and continuous insulation is not required.

Exception to Section 150.2(a)1B: Insulation in an enclosed rafter ceiling shall meet the requirements of Section 150.0.

(b) **Alterations.** Alterations to existing single-family residential buildings or alterations in conjunction with a change in building occupancy to a single-family residential occupancy shall meet either Item 1 or 2 below.

1. **Prescriptive approach.** The altered component and any newly installed equipment serving the alteration shall meet the applicable requirements of Sections 110.0 through 110.9 and all applicable requirements of Sections 150.0(a) through (l), 150.0(m)1 through 150.0 (m)10, and 150.0(p) through (q); and

A. **Added fenestration**. Alterations that add vertical fenestration and skylight area shall meet the total fenestration area and west facing fenestration area, U-factor, and Solar Heat Gain Coefficient requirements of Section 150.1(c) and TABLE 150.1-A.

~~**Exception 1 to Section 150.2(b)1A:** Alterations that add fenestration area of up to 75 square feet shall not be required to meet the total fenestration area and west-facing fenestration area requirements of Sections 150.1(c)3B and C.~~

Exception 2 to Section 150.2(b)1A: Alterations that add up to 16 square feet of new fenestration or skylight area ~~with a maximum U-factor of 0.55 and a maximum SHGC of 0.30 area~~ shall not be required to meet the total fenestration area and west-facing fenestration area requirements of Sections 150.1(c)3B and C.

B. **Replacement fenestration.** New manufactured fenestration products installed to replace existing fenestration products of the same total area shall meet the U-factor and Solar Heat Gain Coefficient requirements of Sections 150.1(c)3.A, and 150.1(c)4.

Exception 1 to Section 150.2(b)1B: Replacement of vertical fenestration no greater than ~~75~~16 square feet with a U-factor no greater than 0.40 in Climate Zones 1-16, and a SHGC value no greater than 0.35 in Climate Zones 2, 4, and 6 through -15.

~~**Exception 2 to Section 150.2(b)1B:** Replaced skylights must meet a U-factor no greater than 0.55, and a SHGC value no greater than 0.30.~~

NOTE: Glass replaced in an existing sash and frame or sashes replaced in an existing frame are considered repairs, provided that the replacement is at least