TITLE 24, PART 6 | 2025 CODE CYCLE

Cool Roof

Codes and Standards Enhancement (CASE) Proposal
Multifamily | Envelope

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CALIFORNIA ENERGY CODES & STANDARDS
A STATEWIDE UTILITY PROGRAM

Multifamily - Proposed Code Change

- Change the cool roof requirements in Table 170.2-A to increase the number of climate zones where the cool roof requirements apply.
- Make a minor increase to the aged solar reflectivity (ASR) of some steep slope roof condition requirements.
- Make a minor increase to the thermal emittance (TE) of some steep slope roof condition requirements.

Multifamily - Proposed Code Change

Description of change:

- **Steep-sloped roofs, Option B**
  - Increase ASR in CZs 10-15 from 0.2 to 0.25, TE from 0.75 to 0.8, and SRI from 16 to 23.
  - Extend cool roof requirements to CZs 4, 7-9. Set ASR to 0.25, TE to 0.8, and SRI to 23.
- **Low-sloped roofs, Option D**
  - Extend cool roof requirements of ASR 0.63, TE 0.75, and SRI 75 to CZs 2, 4, 6-8, and 12.
- Clarify code exceptions language related to building integrated PV. Add a pretext - “Roof area covered by” for building integrated photovoltaic panels exception.

Current Code Requirements

2022 T24 has cool roof requirements in select CZs (Table 170.2-A)

Steep-sloped roofs, Option B

		Climate Zone															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
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
	Solar Reflectance Index (SRI)	NR	NR	NR	NR	NR	NR	NR	NR	NR	16	16	16	16	16	16	NR

Low-sloped roofs, Option D (Non-Attic)

		Climate Zone															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Low-sloped	Aged Solar Reflectance	NR	NR	NR	NR	NR	NR	NR	NR	0.63	0.63	0.63	NR	0.63	0.63	0.63	NR
	Thermal Emittance	NR	NR	NR	NR	NR	NR	NR	NR	0.75	0.75	0.75	NR	0.75	0.75	0.75	NR
	Solar Reflectance Index (SRI)	NR	NR	NR	NR	NR	NR	NR	NR	75	75	75	NR	75	75	75	NR

*Aged Solar Reflectance (ASR); Thermal Emittance (TE); Solar Reflectance Index (SRI)

= Proposed New Cool Roof Reqt. = Minor increase in existing cool roof reqt.

2022 Building Energy Efficiency Standards; Title 24, Part 6: Section 170.2 – Prescriptive Approach. https://www.energy.ca.gov/sites/default/files/2022-12/CEC-400-2022-010_CMF.pdf

Context and History

Why are we proposing this measure?

- Higher reflectance would **reduce cooling load, reduce peak temperatures, and increase energy savings** in cooling dominant regions.
- This is a very **low-cost change** for most roof types.
- **Reduces urban heat island effect**.

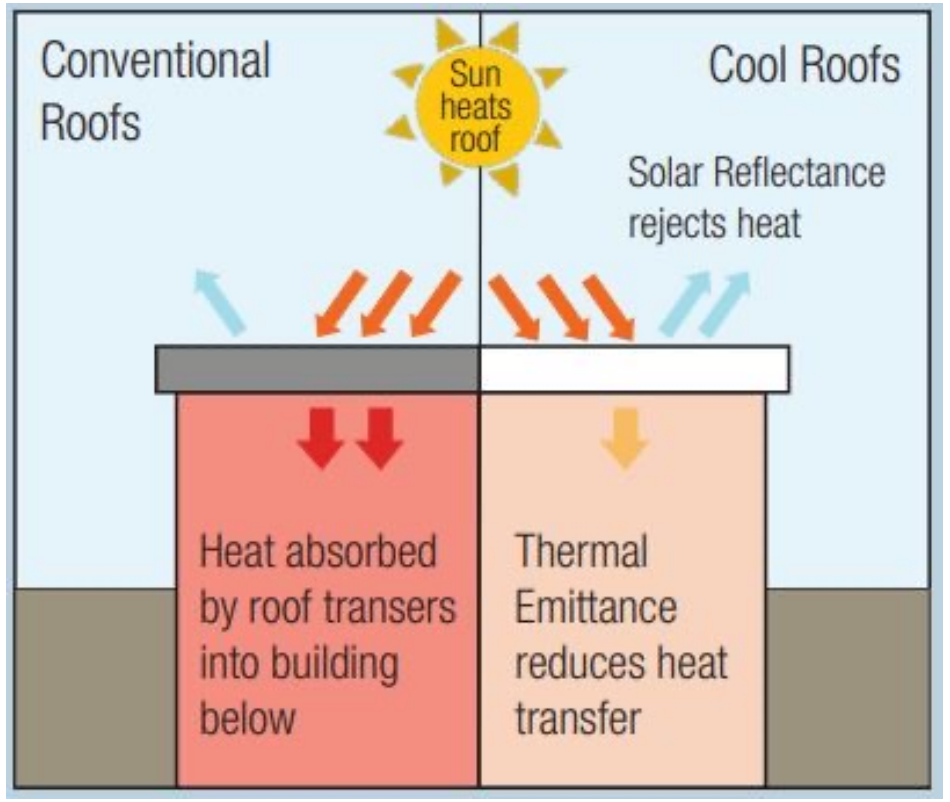

Image Source: California Energy Commission: Energy Efficient Cool Roofs Nonresidential Buildings, High-Rise Residential, Hotels and Motels. https://www.energy.ca.gov/sites/default/files/2020-02/Nonres_High-rise_Cool_Roof_ADA_2020-02-21.pdf

Market Overview

Market Overview and Analysis

Current Market

- Cool roof market is already well-established with many product offerings available.
- In many cases, cool roof products have very low or no added cost compared to a similar baseline product.

Market Trends

- Most MF buildings are built using the performance method
- 41% of steep-slope and 94% of low-slope MF projects meet or exceed the T24 2022 prescriptive cool roof requirement (*Dodge Database Survey (33 projects)*)

Cool Roof Rating Council Products Directory. 12/6/2022. https://coolroofs.org/directory/roof
Dodge Database. 10/20/22

Market Overview and Analysis

Market Barriers

- **Aesthetic**: Cool roof product options in a desired color or material can be limited and incur increased costs for steep slope
  - *ASR of 0.25 still provides many aesthetic options to comply with proposed prescriptive method.*
- **Moisture accumulation:** Low slope roofing materials may have issues with moisture accumulation below the membrane as ASR increases above 0.63.

Do you agree with this description? What else should we know?

Technical Considerations

Technical Considerations

Steep-slope reflective granules can reach high reflectance values for asphalt but may limit the color options above ASR 0.25.

- Similar related energy savings can alternatively be met by additional roof insulation or radiant barrier when using Performance Method.

Energy and Cost Impacts Per Dwelling Unit

Methodology and Assumptions

Methodology for Energy Impacts Analysis

- 2026 Long-Term System Cost (LSC) factors
- 2022 T24 prescriptive requirements assumed as the base case.

Building prototypes built in CBECC software:

- **Steep-sloped roofs:**
  - Low-rise garden prototype
- **Low-sloped roofs:**
  - Low-rise loaded corridor
  - Mid-rise mixed-use
  - High-rise mixed-use prototypes

Assumptions for Standard and Proposed Designs

Option B (attic) steep-sloped roof

Standard Design

- Minimally compliant with 2022 Code for all building systems (meets the prescriptive code requirements)
- Exterior roof performance:
  - CZs 10-15: ASR 0.20, TE 0.75
  - Other CZs: ASR 0.10, TE 0.85 (default)

Proposed Design

- Minimally compliant with 2022 Code for all building systems except those listed below:
- Exterior roof performance
  - CZs 4, 7-15: ASR 0.25, TE 0.80

Assumptions for Standard and Proposed Designs

Option D (non-attic) low-sloped roof

Standard Design

- Minimally compliant with 2022 Code for all building systems (meets the prescriptive code requirements).
- Exterior roof performance:
  - CZs 9-11, 13-15: ASR 0.63, TE 0.75, SRI 75
  - Other CZs: ASR 0.10 TE 0.85 (default)

Proposed Design

- Minimally compliant with 2022 Code for all building systems other than the changes below:
- Exterior roof performance:
  - CZs 2, 4, 6-8, 12: ASR 0.63, TE 0.75, SRI 75

Preliminary Energy Savings Estimates Per Dwelling Unit

Weighted average of four prototypes: **LowRiseGarden-steep-sloped, Others-low-sloped**

Energy and Energy Cost Impacts - New Construction & Additions					
Climate Zone	First-Year Electricity Savings (kWh)	First-Year Peak Electrical Demand Reduction (W)	First-Year Natural Gas Savings (therms)	First-Year Source Energy Savings (kBtu)	30-Year Present Valued Energy Cost Savings (2026 PV$)
CZ02	15.08	7.69	0.00	5.37	76.06
CZ04	21.43	8.82	0.00	1.53	134.59
CZ06	11.82	9.10	0.00	9.89	80.13
CZ07	31.16	13.74	0.00	29.12	217.90
CZ08	37.78	19.13	0.00	33.27	232.12
CZ09	0.60	0.35	0.00	0.32	3.74
CZ10	0.43	0.20	0.00	0.14	2.51
CZ11	0.46	0.19	0.00	0.24	2.85
CZ12	34.48	15.50	0.00	26.29	221.76
CZ13	0.50	0.21	0.00	0.31	3.24
CZ14	0.26	0.10	0.00	(0.21)	1.28
CZ15	0.96	0.27	0.00	0.89	6.00

Incremental Cost Information

We collected costs of base case technology and proposed technology from:

- Distributors, 2022 Title24 Nonresidential CASE report, TRC studies
- Interviews with manufacturers, contractors, SMEs to validate the high-level estimates
- **Material costs only, no incremental labor costs.**

Measure Category	Climate Zones	Baseline (ASR/TE)	Proposed (ASR/TE)	Incremental First Cost* ($/roof area sqft)	Notes
Steep-slope	CZs 10-15	0.2/0.75	0.25/0.8	~$0.06	Reflective asphalt shingles
	CZs 4,7-9	0.1/0.85	0.25/0.8	~$0.06	Reflective asphalt shingles
Low-slope	CZs 2,4,6-8,12	0.1/0.85	0.63/0.75	~$0.33	Baseline-modified bitumen, Proposed-TPO

Incremental Cost Per Dwelling Unit

Incremental Cost			
Equipment (First Cost)	Steep-slope	LowRiseGarden, CZs 10-15	**$32.03**
		LowRiseGarden, CZs 4, 7-9	**$32.03**
	Low-slope	LoadedCorridor, CZs 2,4,6-8,12	**$120.3**
		MixedUseMidRise, CZs 2,4,6-8,12	**$84.83**
		MixedUseHighRise, CZs 2,4,6-8,12	**$35.45**

Cost data resources:

- 2022 T24 NR CASE Report
- Designers
- Distributors
- Manufacturers

Cost Effectiveness

- Weighted average of four prototypes (*LowRiseGarden-steep-sloped, Others-low-sloped measure)*
- Assuming 2022 forecast proportions across the four prototypes, until construction forecast is available.

Climate Zone	Benefits *Life Cycle Energy Cost Savings + Other PV Savings* (2026 PV$)	Costs *Total Incremental PV Costs* (2026 PV$)	Benefit-to-Cost Ratio
2	76.06	65.79	1.16
4	134.59	65.79	2.05
6	80.13	65.79	1.22
7	217.90	65.79	3.31
8	232.12	65.79	3.53
9	93.42	32.03	2.92
10	62.68	32.03	1.96
11	71.19	32.03	2.23
12	221.76	65.79	3.37
13	81.07	32.03	2.53
14	32.03	32.03	1.00
15	149.88	32.03	4.69

Compliance and Enforcement

Compliance and Verification Process

1. Design Phase

- Architect/Designer decide roof area layout and roof construction materials.
- Fill LMCC/NRCC compliance forms.

2. Permit Application Phase

- Building owner/designer/energy consultant submit documentation to building department.
- Plan examiner/building inspector reviews construction plans and compliance documentation.

3. Construction Phase

- Roofing contractor procures specified roof materials and performs installation.
- Complete LMCI/NRCI installation certificates.

4. Inspection Phase

- Building owner/designer to submit all compliance forms to building department
- Building inspector conducts on-site verification.

Compliance and Verification

- No change in standard compliance and verification practices.
- Climate zones that do not currently have a cool roof requirement will need to implement cool roof compliance and verification practices.
- Climate zones that currently have a cool roof requirement will have no change to compliance and verification process.

Market Actors

Market actors involved in implementing this measure include:

- Manufacturers/distributors
- Designers/consultants/architects/builders
- Plan examiners
- Building contractors
- Regulatory Agency
- Building Inspector
- Trade/Industry Organization

We anticipate the proposed changes will have a minimal impact on all market actors.

Software Updates

- Compliance software will be updated to reflect the proposed changes in the standard design.
- No other software changes are required to implement the proposed changes.

Review of Code Language Markup

Photo Credit: 2025 Building Energy Efficiency Standards

Draft Code Change Language

- **Prescriptive Approach. Section 170.2 (a)**

  1. Exterior roofs and ceilings.

  Exterior roofs and ceilings shall comply with each of the applicable requirements in this subsection:

  A. Roofing Products. All roofing products shall meet the requirements of Section 110.8 and the applicable minimum aged solar reflectance and thermal emittance requirements of TABLE 170.2-A.

  EXCEPTION 1 to Section 170.2(a)1A: Roof area covered with ~~B~~building integrated photovoltaic panels and building integrated solar thermal panels are exempt from the minimum requirements for solar reflectance and thermal emittance or SRI.

Draft Code Change Language

- **Section 170.2 – Prescriptive Approach. Section 170.2 (a) 1. TABLE 170.2-A**

MultiFamily				Climate Zone														
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Roof/ Ceiling	Option B (meets §170.2(a) 1Bii)	Steep-sloped	Aged Solar Reflectance	NR	NR	NR	~~NR~~ 0.25	NR	NR	~~NR~~ 0.25	~~NR~~ 0.25	~~NR~~ 0.25	~~0.2~~ 0.25	~~0.2~~ 0.25	~~0.2~~ 0.25	~~0.2~~ 0.25	~~0.2~~ 0.25	~~0.2~~ 0.25	NR
			Thermal Emittance	NR	NR	NR	~~NR~~ 0.8	NR	NR	~~NR~~ 0.8	~~NR~~ 0.8	~~NR~~ 0.8	~~0.75~~ 0.8	~~0.75~~ 0.8	~~0.75~~ 0.8	~~0.75~~ 0.8	~~0.75~~ 0.8	~~0.75~~ 0.8	NR
			Solar Reflectance Index (SRI)	NR	NR	NR	~~NR~~ 23	NR	NR	~~NR~~ 23	~~NR~~ 23	~~NR~~ 23	~~16~~ 23	~~16~~ 23	~~16~~ 23	~~16~~ 23	~~16~~ 23	~~16~~ 23	NR
	Option D (Non Attic Roof)	Low-sloped	Aged Solar Reflectance	NR	~~NR~~ 0.63	NR	~~NR~~ 0.63	NR	~~NR~~ 0.63	~~NR~~ 0.63	~~NR~~ 0.63	0.63	0.63	0.63	~~NR~~ 0.63	0.63	0.63	0.63	NR
			Thermal Emittance	NR	~~NR~~ 0.75	NR	~~NR~~ 0.75	NR	~~NR~~ 0.75	~~NR~~ 0.75	~~NR~~ 0.75	0.75	0.75	0.75	~~NR~~ 0.75	0.75	0.75	0.75	NR
			Solar Reflectance Index (SRI)	NR	~~NR~~ 75	NR	~~NR~~ 75	NR	~~NR~~ 75	~~NR~~ 75	~~NR~~ 75	75	75	75	~~NR~~ 75	75	75	75	NR

- **Option B: Steep-Slope:**
  - **Climate Zones 4, 7-9: ASR: NR to 0.25; TE: NR to 0.8; SRI: NR to 23**
  - **Climate Zones 10-15: ASR: 0.2 to 0.25; TE: 0.75 to 0.8; SRI: 16 to 23**

- **Option D Low-Slope**
  - **Climate Zones 2, 4, 6-8, 12: ASR: NR to 0.63; TE: NR to 0.75; SRI: NR to 75**

Discussion and Next Steps

We want to hear from you!

- Provide **any last comments or feedback** on this presentation now verbally or over the chat
- More information on pre-rulemaking for the 2025 Energy Code at https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/2025-building-energy-efficiency

Comments on this measure are due by February 28. Please send comments to info@title24stakeholders.com and copy CASE Authors (see contact info on following slide).

Thank You

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