



TITLE 24, PART 6 **2025 CODE CYCLE**

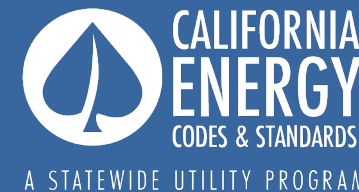
Opaque Envelope Assemblies

Codes and Standards Enhancement (CASE) Proposal
Nonresidential | Envelope



Maureen Guttman, Energy Solutions
May 22, 2023

Utility Sponsored Stakeholder Meeting, Round 2



Agenda

OPAQUE ASSEMBLIES

30 minutes

- Overview of Code Change Proposal
- Cost-effectiveness, Energy Savings and Statewide Impacts
- Data Gaps and Additional Feedback Requested

VESTIBULES

15 minutes

WINDOWS

15 minutes

NEXT STEPS





Code Change Proposal

Proposal Summary

This measure would consider **improvements to thermal performance and code simplification** for opaque assemblies in nonresidential buildings.

Description	Construction Type	Type of Change	Section(s) of Code Updated
Decrease U-factor for Roofs and Walls	New Construction	Mandatory	120.7(a), 120.7(b)
Decrease U-factor for Roofs and Walls	New Construction	Prescriptive	TABLE 140.3-B
Decrease U-factor for Roofs and Walls	Alterations	Mandatory	141.0(b)1
Hotel/Motel Guest Room	New Construction	Prescriptive	TABLE 140.3-B&C

Poll Request – ROUND 2 SLIDE

- **Measure Name: Opaque Assemblies**
- **Type of Poll:** Free Response
- **Question:** How is the Hotel/Motel Guest Room U-factor Table used in practice?
- **Answers:**
- **Placement:** After “Proposal Summary”
- **Broadcast results to attendees as they respond:** (Y)
- **Make poll public during presentation:** (Y)

Draft Code Change Language – New Construction/Additions

SECTION 120.7 – MANDATORY ~~INSULATION~~ THERMAL ENVELOPE REQUIREMENTS

Nonresidential and hotel/motel buildings shall comply with the applicable requirements in Sections 120.7(a) through 120.7~~(e)~~(e).

(a) Roof/Ceiling Insulation. The opaque portions of the roof/ceiling that separates conditioned spaces from unconditioned spaces or ambient air shall meet the applicable requirements of Items 1 through 3 below:

1. **Metal Building-** The weighted average U-factor of the roof assembly shall not exceed ~~0.098~~ 0.078.
2. **Wood Framed and Others-** The weighted average U-factor of the roof assembly shall not exceed ~~0.075~~ 0.060

Draft Code Change Language – New Construction/Additions

SECTION 120.7 – MANDATORY ~~INSULATION~~ THERMAL ENVELOPE REQUIREMENTS

(b) Wall Insulation.

The opaque portions of walls that separate conditioned spaces from unconditioned spaces or ambient air shall meet the applicable requirements of Items 1 through 7 below:

1. **Metal Building.** The weighted average U-factor of the wall assembly shall not exceed ~~0.113~~ 0.090.
2. **Metal Framed.** The weighted average U-factor of the wall assembly shall not exceed ~~0.151~~ 0.121.
3. **Light Mass Walls.** A 6 inch or greater Hollow Core Concrete Masonry Unit shall have a U-factor not to exceed ~~0.440~~ 0.352.
4. **Heavy Mass Walls.** An 8 inch or greater Hollow Core Concrete Masonry Unit shall have a U-factor not to exceed ~~0.690~~ 0.552.
5. **Wood Framed and Others.** The weighted average U-factor of the wall assembly shall not exceed ~~0.110~~ 0.088.

Draft Code Change Language – New Construction/Additions

SECTION 140.3 – PRESCRIPTIVE REQUIREMENTS FOR BUILDING ENVELOPES

- **Table 140.3-B** – All proposed U-factors represent an insulation increase of R-2
 - Metal-framed walls excluded, as this assembly was updated in the 2022 Energy Code
- **Table 140.3-C** – Hotel/Motel Guest Room Table deleted
 - Analyzing cost-effectiveness of using the U-factors in Table 140.3-C for all nonresidential applications

Discussion

Stakeholders: For opaque wall assemblies, is increasing frame sizing or adding continuous insulation the preferred method for achieving increased R-values?

Table 4.3.1 – U-factors of Wood Framed Walls with 1/2-inch Gypsum Board

Spacing	Cavity Insulation	Nominal Framing Size	Rated R-value of Continuous Insulation ²						
			R-0 CZ3 Prescriptive	R-2 B	R-4 C	R-5 D	R-6 E		
16 in. OC	None	Any	1	0.356	0.209	0.146	0.127	0.113	
	R-11	2x4	2	0.110	0.088	0.074	0.068	0.064	
	R-13	2x4	3	0.102	0.082	0.069	0.064	0.060	
	R-15 ¹	2x4	4	0.095	0.077	0.065	0.060	0.056	
	R-19	2x6	5	0.074	0.063	0.055	0.051	0.049	
	R-20	2x6	6	0.071	0.060	0.052	0.049	0.047	
	R-21 ¹	2x6	7	0.069	0.059	0.051	0.048	0.046	
	R-22	2x6	8	0.072	0.062	0.054	0.051	0.048	
	R-23	2x6	9	0.067	0.057	0.049	0.047	0.044	
	R-25	2x6	10	0.065	0.055	0.048	0.045	0.043	
	R-19	2x8	11	0.065	0.057	0.051	0.048	0.045	
	R-22	2x8	12	0.061	0.053	0.047	0.045	0.043	
	R-25	2x8	13	0.057	0.050	0.044	0.042	0.040	
	R-30 ¹	2x8	14	0.056	0.049	0.044	0.041	0.040	

Poll Request – ROUND 2 SLIDE

- **Measure Name: Opaque Assemblies**
- **Type of Poll: Multiple Choice**
- **Question:** For the purposes of modeling savings, should the Statewide CASE Team assume additional R-2 cavity insulation, or additional R-2 continuous insulation?
- **Answers:** **Additional cavity insulation (consider costs to change framing members);**
Additional continuous insulation (consider costs to add/change anchors and trim)
- **Placement:** After “Discussion”
- **Broadcast results to attendees as they respond:** (Y)
- **Make poll public during presentation:** (Y)

Draft Code Change Language – Alterations

SECTION 141.0 – ALTERATIONS, AND REPAIRS TO EXISTING NONRESIDENTIAL...

(b) Alterations.

Alterations to components of existing nonresidential, hotel/motel, or relocatable public school buildings, including alterations made in conjunction with a change in building occupancy to a nonresidential, high-rise residential, or hotel/motel occupancy shall meet item 1, and either Item 2 or 3 below:

1. Mandatory Requirements.

Altered components in a nonresidential, or hotel/motel building shall meet the minimum requirements in this Section.

A. **Roof/Ceiling Insulation.** The opaque portions of the roof/ceiling that separate conditioned spaces from unconditioned spaces or ambient air shall meet the applicable requirements of Items 1 and 2 below: Section 141.0(b)2Biii.

1. Metal Building. A minimum of R-19 cavity + R-6 continuous insulation, or equivalent, or the area-weighted average U-factor of the roof assembly shall not exceed U-0.078.

2. Wood Framed and Others. A minimum of R-19 cavity + R-4 continuous insulation, or equivalent, or the area-weighted average U-factor of the roof assembly shall not exceed U-0.060.

Draft Code Change Language - Alterations

SECTION 141.0 – ALTERATIONS, AND REPAIRS TO EXISTING NONRESIDENTIAL...

(Mandatory continued)

- B. **Wall Insulation.** ~~For the~~ The altered opaque portion of walls separating conditioned spaces from unconditioned spaces or ambient air shall meet the applicable requirements of Items 1 through 4 below:
1. **Metal Building.** A minimum of R-13 cavity + R-2 continuous insulation, or equivalent ~~between framing members~~, or the area-weighted average U-factor of the wall assembly shall not exceed ~~U-0.113~~ U-0.092.
 2. **Metal Framed.** A minimum of R-13 cavity + R-2 continuous insulation, or equivalent ~~between framing members~~, or the area-weighted average U-factor of the wall assembly shall not exceed ~~U-0.217~~ U-0.151.
 3. **Wood Framed and Others.** A minimum of R-11 cavity + R-2 continuous insulation, or equivalent insulation ~~between framing members~~, or the area-weighted average U-factor of the wall assembly shall not exceed ~~U-0.110~~ U-0.088.

Cost Effectiveness and Energy Savings

Methodology and Assumptions

- Energy Savings Methodology and Results
- Cost Impacts Methodology and Results
 - Incremental costs
 - Energy cost savings



2026 Construction Forecast – Opaque Assembly Impacts

Construction Forecast Building Type	Roof Assemblies Impacted (%)		Wall Assemblies Impacted (% of floorspace)			
	Metal Building	Wood & Other	Metal Building	Mass Light	Mass Heavy	Wood & Other
Large Office	0%	100%	0%	10%	0%	90%
Medium Office	2%	98%	2%	10%	5%	83%
Small Office	2%	98%	2%	10%	5%	83%
Large Retail	0%	100%	0%	40%	0%	60%
Medium Retail	2%	98%	2%	20%	0%	78%
Strip Mall	0%	100%	0%	10%	10%	80%
Mixed-use Retail	2%	98%	2%	10%	10%	78%
Large School	0%	100%	0%	10%	5%	85%
Small School	0%	100%	0%	10%	5%	85%
Non-refrigerated Warehouse	80%	20%	80%	5%	0%	15%
Hotel	0%	100%	0%	10%	5%	85%
Assembly	5%	95%	5%	10%	10%	75%
Hospital	0%	100%	0%	5%	5%	90%
Laboratory	0%	100%	0%	5%	5%	90%
Restaurant	2%	98%	2%	10%	5%	83%

Preliminary Energy Savings Estimates/SF- New Construction & Additions – Wood Framed Roof

Savings	Office Medium	Office Large	Retail Medium	Retail Large	School Small
Annual Electricity Savings (kWh/yr)	-0.003 – 0.004	0.000 – 0.002	0.005 – 0.058	-0.010 – 0.036	0.003 – 0.020
Annual Natural Gas Savings (therms/yr)	-0.123 – 0.137	0.004 – 0.050	0.000 – 0.221	0.000 – 0.238	0.000 – 0.182
Peak Demand Reduction (kW)	-0.001 – 0.001	-0.002 – 0.001	0.000 – 0.003	0.000 – 0.003	0.002 – 0.005
Annual Life Cycle Energy Cost Savings (\$2026 PV)	0.09 – 0.11	0.01 – 0.04	-0.03 – 0.38	-0.04 – 0.18	0.04 – 0.150
Annual Source Energy Savings (kBtu/yr)	-0.110 – 0.123	0.003 – 0.045	0.000 – 0.104	0.000 – 0.215	0.000 – 0.164

Incremental Cost/Square Foot - Prescriptive

Over 30-Year Period of Analysis

Incremental First Cost	
Add'l R-2 Insulation	\$0.10
Installation	N/A
Commissioning	N/A
Other	N/A
Total	\$0.10

- Labor & maintenance costs will be the same for baseline & proposed cases.
- Material cost is averaged out through California, including the Inflation Index per Bureau of Labor Statistics.
- The CASE team presumes there will not be any extra hardware cost for additional R2 insulation.

Cost Data Sources

- Interview with general contractor
- Verified cost data from big box improvement stores.

Can you help us verify incremental costs for this measure?

Poll Request – ROUND 2 SLIDE

- **Measure Name: Opaque Assemblies**
- **Type of Poll: Free Response**
- **Question:** What values should be used as incremental costs for adding R-2 to each assembly?
- **Answers:**
- **Placement:** After “Incremental Cost”
- **Broadcast results to attendees as they respond:** (Y)
- **Make poll public during presentation:** (Y)

Cost Effectiveness

Wood-framed roof, New
Construction and Additions

Climate Zone	Benefits LSC Savings + Other PV Savings (2026 PV\$)	Costs Total Incremental PV Costs (2026 PV\$)	Benefit-to- Cost Ratio
1	0.08	0.07	1.13
2	0.07	0.07	0.98
3	0.03	0.04	0.66
4	0.06	0.04	1.47
5	0.04	0.06	0.63
6	0.02	0.05	0.37
7	-0.01	0.05	-0.14
8	0.12	0.05	2.55
9	0.03	0.04	0.75
10	0.07	0.06	1.16
11	0.05	0.07	0.81
12	0.05	0.06	0.88
13	0.08	0.07	1.13
14	0.10	0.06	1.85
15	0.11	0.07	1.68
16	0.11	0.06	1.79

Statewide Impacts

Methodology and Assumptions

- Statewide Energy Impacts
Methodology and Results



Statewide Economic Impacts Methodology

The Statewide CASE Team estimates annual statewide impacts by multiplying **A x B x C**:

- A. per-unit energy impacts (discussed in previous section)
- B. number of units of new construction/additions/alterations of each applicable building type
- C. portion of affected units in each climate zone

Example:

Per Unit Impacts

Savings type	Savings per square foot
Electricity	[X] kWh
Peak demand	[X] Watts
Natural gas	[X] Therms
GHG emissions	[X] Tons CO ₂ e



Affected New Construction

Climate Zone	Large Office sq ft	Assembly sq ft
1	100	20
2	1,000	1,500
...		
16	5,000	3,000



Statewide Energy Impacts

Climate Zone	Elec Savings (GWh)	...	GHG savings (MT CO ₂ e)
1	20		1,500
2	50		3,000
...			
16	100		2,000

Statewide Energy Impacts – Opaque Assemblies

	Statewide Impacts During First Year	
Prescriptive – Wood-framed Roof and Others New Construction and Additions	Electricity Savings (GWh)	0.37
	Peak Electrical Demand Reduction (MW)	0.03
	Natural Gas Savings (Million Therms)	0.01
	Source Energy Savings (Million kBtu)	0.67
	LSC Electricity Savings (Million 2026 PV\$)	2.21
	LSC Gas Savings (Million 2026 PV\$)	0.43
	Total LSC Savings (Million 2026 PV\$)	2.63
	Avoided GHG Emissions (Metric Tons CO ₂ e)	75.59
	Monetary Value of Avoided GHG Emissions (\$2026)	9,309
	On-site Indoor Water Savings (Gallons)	N/A
On-site Outdoor Water Savings (Gallons)	N/A	
Embedded Electricity in Water Savings (kWh)	N/A	



Data Gaps and Additional Feedback Requested

- Additional Data Needs
- Feedback Requested

Data Gaps – Opaque Assemblies

- **In a hotel or motel building, are the guest room U-factors actually used adjacent to non-guest room spaces that use the nonresidential U-factors?**
- **Do the percent values in the 2026 Construction Forecast (see previous slide) look reasonable?**
- **If new U-factor values involve changes beyond increasing the rated R-value of insulation, (stud depth, exterior insulation, etc), what are the costs associated with those elements?**



TITLE 24, PART 6

2025 CODE CYCLE



Reduced Air Leakage - Vestibules

Codes and Standards Enhancement (CASE) Proposal
Nonresidential | Envelope



Maureen Guttman
May 22, 2023



Utility Sponsored Stakeholder Meeting – Round 2

Agenda

OPAQUE ASSEMBLIES

30 minutes

VESTIBULES

15 minutes

- Overview of Code Change Proposal
 - Cost-effectiveness, Energy Savings and Statewide Impacts
 - Data Gaps and Additional Feedback Requested
-

WINDOWS

15 minutes

NEXT STEPS





Code Change Proposal

Proposal Summary

The proposed code change would establish a new mandatory vestibule requirement with continuous air barriers in nonresidential buildings with high-traffic main entrances (shopping malls, healthcare facilities, hotels, etc.). This is also applicable for additions with main entrances.

Building Type	Construction Type	Type of Change	Section(s) of Code Updated	Software Updates Required
Nonresidential	New Construction	Mandatory	120.7(e) new section*	Minimum
Nonresidential	Addition	Mandatory	141.0	Minimum

*NOTE: We also propose changing the title of Section 120.7 from MANDATORY INSULATION REQUIREMENTS to MANDATORY THERMAL ENVELOPE REQUIREMENTS

Draft Code Change Language

SECTION 120.7 – MANDATORY ~~INSULATION~~ THERMAL ENVELOPE REQUIREMENTS

Nonresidential and hotel/motel buildings shall comply with the applicable requirements in Sections 120.7(a) through 120.7~~(c)~~(e).

(e) **Vestibules.** Building entrances shall be protected with an enclosed vestibule meeting the applicable requirements of Items 1 and 2 below:

1. All doors opening into and out of the vestibule shall be equipped with self-closing devices. Vestibules shall be designed so that in passing through the vestibule it is not necessary for the interior and exterior doors to open at the same time. The installation of one or more revolving doors in the building entrance shall not eliminate the requirement that a vestibule be provided on any doors adjacent to revolving doors.
2. Where provided, the heating system for heated vestibules and air curtains with integral heating shall be provided with controls configured to shut off the source of heating when the outdoor air temperature is greater than 45°F. Vestibule heating and cooling systems shall be controlled by a thermostat located in the vestibule configured to limit heating to a temperature not greater than 60°F and cooling to a temperature not less than 85°F.

Draft Code Change Language – cont'd

EXCEPTIONS to Section 120.7(e): Vestibules are not required for the following:

1. Doors not intended to be used by the public, such as doors to mechanical or electrical equipment rooms, or intended solely for employee use.
2. Doors opening directly from a sleeping unit or dwelling unit.
3. Doors that open directly from a space less than 3,000 square feet in area.
4. Revolving doors.
5. Doors used primarily to facilitate vehicular movement or material handling and adjacent personnel doors.
6. Doors that have an air curtain with a velocity of not less than 6.56 feet per second at the floor that have been tested in accordance with ANSI/AMCA 220 and installed in accordance with the manufacturer's instructions. Manual or automatic controls shall be provided that operate the air curtain with the opening and closing of the door.

Poll Request – ROUND 2 SLIDE

- **Measure Name:** Vestibules
- **Type of Poll:** Free Response
- **Question:** Should we limit the requirement to buildings with high-traffic entrances? If yes, how do we identify those building types?
- **Answers:**
- **Placement:** After “Draft Code Change Language – cont'd”
- **Broadcast results to attendees as they respond:** (Y)
- **Make poll public during presentation:** (Y)

Cost Effectiveness and Energy Savings

Methodology and Assumptions

- Energy Savings Methodology and Results
- Cost Impacts Methodology and Results
 - Incremental costs
 - Energy cost savings



Preliminary Energy Savings Estimates Per sq ft - Vestibules

Savings	Office Medium	Office Large	Retail Medium	Retail Large	School Small
Annual Electricity Savings (kWh/yr)	0.21 - 0.32	0.19 - 0.25	0.00 - 0.83	0.33 - 0.80	0.03 - 0.36
Annual Natural Gas Savings (therms/yr)	0.10 - 0.60	0.10 - 0.58	0.00	0.00 - 0.29	-0.07 - 1.29
Peak Demand Reduction (kW)	0.00	0.00	0.00 - 0.02	0.00 - 0.02	0.00 - 0.01
Annual Life Cycle Energy Cost Savings (\$2026 PV)	1.24 - 1.60	1.10 - 1.34	0.49 - 5.22	1.89 - 5.01	0.99 - 3.11
Annual Source Energy Savings (kBtu/yr)	0.08 - 0.56	0.09 - 0.52	0.00 - 0.08	0.00 - 0.26	-0.07 - 1.16

Poll Request – ROUND 2 SLIDE

- **Measure Name:** Vestibules
- **Type of Poll:** Free Response
- **Question:** ASHRAE 90.1 language regarding vestibule size says:
 - *The floor area of each vestibule shall not exceed the greater of 50 ft² or 2% of the gross conditioned floor area for that level of the building.*

Should the Statewide CASE Team assume a minimum vestibule area or a maximum vestibule area for estimating energy savings and costs?

- **Answers:**
- **Placement:** After “Preliminary Energy Savings”
- **Broadcast results to attendees as they respond:** (Y)
- **Make poll public during presentation:** (Y)

2026 Construction Forecast – Vestibule Impacts

Construction Forecast Building Type		Newly Constructed Floorspace Impacted (%)
Nonresidential	Large Office	80%
	Medium Office	80%
	Small Office	80%
	Large Retail	80%
	Medium Retail	80%
	Strip Mall	80%
	Mixed-use Retail	80%
	Large School	80%
	Small School	80%
	Non-refrigerated Warehouse	80%
	Hotel	80%
	Assembly	80%
	Hospital	80%
	Laboratory	80%
	Restaurant	80%

Do these estimates look reasonable?

Statewide Energy Impacts – Vestibules

Category	Metric	New Construction & Additions
Statewide Impacts During First Year	Electricity Savings (GWh)	18.61
	Peak Electrical Demand Reduction (MW)	0.33
	Natural Gas Savings (Million Therms)	0.08
	Source Energy Savings (Million kBtu)	6.99
	LSC Electricity Savings (Million 2026 PV\$)	\$111.58
	LSC Gas Savings (Million 2026 PV\$)	\$4.61
	Total LSC Savings (Million 2026 PV\$)	\$116.20
	Avoided GHG Emissions (Metric Tons CO ₂ e)	1793.71
	Monetary Value of Avoided GHG Emissions (\$2026)	\$220,891

Poll Request – ROUND 2 SLIDE

- **Measure Name:** Vestibules
- **Type of Poll:** Free Response
- **Question:** What is a good cost/sf for an unconditioned vestibule?
- **Answers:**
- **Placement:** After “Incremental Per Square Foot Cost”
- **Broadcast results to attendees as they respond:** (Y)
- **Make poll public during presentation:** (Y)



Data Gaps and Additional Feedback Requested

- Additional Data Needs
- Feedback Requested

Data Gaps - Vestibules

- **How should we identify buildings with high-traffic entrances? (trigger?)**
- **What size vestibule should we assume?**
- **We need realistic estimates of cost per square foot for an unconditioned vestibule**
- **Do the percent values in the 2026 Construction Forecast (see previous slide) look reasonable?**



TITLE 24, PART 6 **2025 CODE CYCLE**



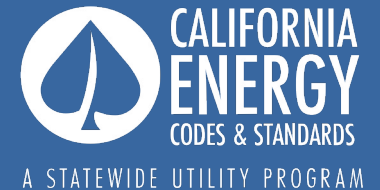
Windows

Codes and Standards Enhancement (CASE) Proposal
Nonresidential | Envelope



Maureen Guttman, Energy Solutions
May 22, 2023

Utility Sponsored Stakeholder Meeting, Round 2



Agenda

OPAQUE ASSEMBLIES

30 minutes

VESTIBULES

15 minutes

WINDOWS

15 minutes

- Overview of Code Change Proposal
 - Cost-effectiveness, Energy Savings and Statewide Impacts
 - Data Gaps and Additional Feedback Requested
-

NEXT STEPS





Code Change Proposal

Proposal Summary

- This measure would consider improvements to thermal performance factors for windows in nonresidential buildings.

Building Type	Construction Type	Type of Change	Section(s) of Code Updated	Software Updates Required
Nonresidential	New Construction And Additions	Mandatory	120.7 new section	Minimum
Nonresidential	Alterations	Mandatory	141.0(b) new section	Minimum

- New Mandatory U-factor** – introduce a mandatory U-factor requirement for vertical fenestration assemblies in new construction/additions and alterations.

Draft Code Change Language – New Con. & Additions

SECTION 120.7 – MANDATORY ~~INSULATION~~ THERMAL ENVELOPE REQUIREMENTS

d) Exterior Windows. Vertical fenestration assemblies shall:

1. Have an area-weighted average U-factor no greater than 0.47

2. Have an area-weighted average Relative Solar Heat Gain Coefficient no greater than 0.41.

Draft Code Change Language – Alterations

SECTION 141.0 – ADDITIONS, ALTERATIONS, AND REPAIRS TO EXISTING NONRESIDENTIAL, AND HOTEL/MOTEL BUILDINGS, TO EXISTING OUTDOOR LIGHTING, AND TO INTERNALLY AND EXTERNALLY ILLUMINATED SIGNS

1. Mandatory Requirements.

Altered components in a nonresidential, or hotel/motel building shall meet the minimum requirements in this Section.

E. Exterior Windows. Fenestration alterations other than repair shall meet the requirements below:

1. Vertical fenestration alterations. Where over 150 square feet of the entire building's vertical fenestration is replaced, the maximum U-factor of the replaced units shall not exceed U-0.58 and the maximum Relative Solar Heat Gain Coefficient, RSHGC, excluding the effects of interior shading, shall not exceed 0.49.

NOTE: Glass replaced in an existing sash and frame or sashes replaced in an existing frame are considered repairs. In these cases, Section 141.0(c) requires that the replacement be at least equivalent to the original in performance.

2. Added vertical fenestration. Where over 50 square feet of vertical fenestration is added, it shall meet the requirements of Section 120.7(d). Where 50 square feet or less of vertical fenestration is added, this requirement shall not apply.

Poll Request – ROUND 2 SLIDE

- **Measure Name:** Windows
- **Type of Poll:** Free Response
- **Question:** How often are the mandatory requirements used for alterations (how often is the performance path used)?
- **Answers:**
- **Placement:** After “Draft Code Language - Alterations”
- **Broadcast results to attendees as they respond:** (Y)
- **Make poll public during presentation:** (Y)

Poll Request – ROUND 2 SLIDE

- **Measure Name: Windows**
- **Type of Poll:** Multiple Choice – multiple answers
- **Question:** Should the Statewide CASE Team consider lowering the existing prescriptive in addition to the proposed mandatory values for window alterations?
- **Answers: BOTH, NEITHER, ONLY ADD MANDATORY REQUIREMENT, CHANGE ONLY PRESCRIPTIVE VALUES**
- **Placement:** After question about frequency of mandatory provisions in alterations
- **Broadcast results to attendees as they respond:** (Y)
- **Make poll public during presentation:** (Y)

Cost Effectiveness and Energy Savings

Methodology and Assumptions

- Energy Savings Methodology and Results
- Cost Impacts Methodology and Results
 - Incremental costs
 - Energy cost savings



Preliminary Energy Savings Estimates/SF New Construction & Additions

Savings	Office Medium	Office Large	Retail Medium	Retail Large	School Small
Annual Electricity Savings (kWh/yr)	0.05 – 0.21	0.05 – 0.21	-0.01 – 0.10	0.00 – 0.06	-0.03 – 0.29
Annual Natural Gas Savings (therms/yr)	0.05 – 0.38	0.03 – 0.49	-0.03 – 0.00	0.00	0.00 – 0.34
Peak Demand Reduction (kW)	0.00	0.00	0.00	0.00	0.00 – 0.02
Annual Life Cycle Energy Cost Savings (\$2026 PV)	0.42 – 1.06	0.38 – 0.62	-0.11 – 0.46	0.01 – 0.30	-0.12 – 1.10
Annual Source Energy Savings (kBtu/yr)	0.05 – 0.35	0.03 – 0.44	-0.03 – 0.00	0.00	0.00 – 0.30

Preliminary Energy Savings Estimates/SF Alterations

Savings	Office Medium	Office Large	Retail Medium	Retail Large	School Small
Annual Electricity Savings (kWh/yr)	0.11 – 0.55	0.11 – 0.55	0.01 – 0.25	0.00 – 0.12	0.10 – 0.80
Annual Natural Gas Savings (therms/yr)	0.11 – 0.81	0.31 – 1.07	-0.06 – 0.00	-0.03 – 0.02	0.00 – 0.11
Peak Demand Reduction (kW)	0.00 – 0.01	0.00 – 0.01	0.00	0.00	0.00 – 0.04
Annual Life Cycle Energy Cost Savings (\$2026 PV)	0.77 – 2.76	0.87 – 1.59	0.01 – 1.31	0.00 – 0.61	-0.44 – 3.99
Annual Source Energy Savings (kBtu/yr)	0.10 – 0.73	0.28 – 0.96	-0.09 – 0.00	- 0.02	0.00

Incremental Per Square Foot Cost

Over 30 Year Period of Analysis

Incremental First Cost	
Equipment*	\$6.00
Installation	NA
Commissioning	NA
Other	NA
Total	\$6.00

- Per SF Cost of standard double pane unit with metal frame (U-0.47) vs single pane metal frame unit (U-0.57)
- Labor & maintenance costs will be the same for baseline & proposed cases.
- Material cost is averaged out through California; labor costs change by region

Cost data came from:

- Manufacturers (SAGE, Nippon Sheet Glass)
- Glazing Consultant
- NFRC's CMAST software/database

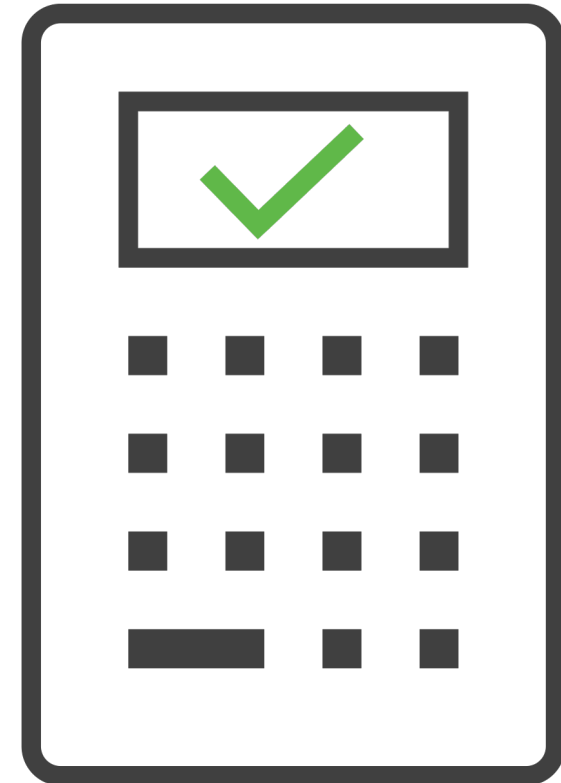
2023 Estimated incremental cost for a standard double-glazed, argon-filled unit w/ metal frame (~ U-value of 0.47)

Cost Effectiveness

The proposed measure is Mandatory and is less stringent than the existing prescriptive requirements.

Because the prescriptive requirements have already been shown to be cost-effective the new Mandatory provisions are also cost-effective.

No cost-effective analysis is required for this measure.



Statewide Impacts

Methodology and Assumptions

- Statewide Energy Impacts
Methodology and Results



Statewide Energy Impacts - Windows

Statewide Impacts During First Year	Metric	New Construction & Additions	Alterations
	Electricity Savings (GWh)	0.50	3.47
	Peak Electrical Demand Reduction (MW)	0.01	0.08
	Natural Gas Savings (Million Therms)	0.01	0.04
	Source Energy Savings (Million kBtu)	0.57	3.98
	LSC Electricity Savings (Million 2026 PV\$)	\$2.48	\$17.15
	LSC Gas Savings (Million 2026 PV\$)	\$0.37	\$2.59
	Total LSC Savings (Million 2026 PV\$)	\$2.85	\$19.74
	Avoided GHG Emissions (Metric Tons CO2e)	57.56	400.13
	Monetary Value of Avoided GHG Emissions (\$2026)	\$7,089	\$49,275

2026 Construction Forecast – Window Impacts

Construction Forecast Building Type		Newly Constructed Floorspace Impacted (%)	Existing Floorspace Impacted (%)
Nonresidential	Large Office	13%	1.5%
	Medium Office	13%	1.5%
	Small Office	*13%	*1.5%
	Large Retail	13%	1.5%
	Medium Retail	13%	*1.5%
	Strip Mall	*13%	*1.5%
	Mixed-use Retail	*13%	*1.5%
	Large School	*13%	*1.5%
	Small School	13%	1.5%
	Hotel	*13%	*1.5%
	Assembly	*13%	*1.5%
	Hospital	*13%	*1.5%
	Laboratory	*13%	*1.5%
	Restaurant	*13%	*1.5%
Grocery	*13%	*1.5%	

Do these estimates look reasonable?

**Energy modeling will be conducted for the Final CASE Report. Impacted floorspace would remain the same for all building types.*



Data Gaps and Additional Feedback Requested

- Additional Data Needs
- Feedback Requested

Data Gaps - Windows

- **Should the Statewide CASE Team consider lowering the existing prescriptive in addition to the proposed mandatory values for window alterations?**
- **What incremental cost should we use for an upgraded mandatory value of U-0.47? Can we reach out to you for cost information??**
- **Do the percent values in the 2026 Construction Forecast (see previous slide) look reasonable?**



Discussion and Next Steps

We want to hear from you!

- Provide **any last comments or feedback** on this presentation now verbally or over the GoTo Webinar Questions Pane
- 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>
- **Take our survey:**
https://evergreenecon.co1.qualtrics.com/jfe/form/SV_9zWNlvx9K6yDzeK

Comments on this measure are due by **June 5, 2023.** Please send comments to info@title24stakeholders.com and copy CASE Authors (see contact info on following slide).

Thank You

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