

High-Performance Measure Details

Measure Name High Performance Building Envelope	Use Category Building Envelope
Effective Date June 15, 2025	Version 4
Measure Code LM424	Measure Stage Early Adoption & High Priority Data Collection

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Technology Summary

Building thermal enclosures for new construction and major renovation is required to meet thermal insulation and performance requirements for each building assembly: walls, windows, and roofs, as defined in the CA energy code. Buildings can exceed the energy code, utilizing high-performance enclosures through strategies such as increased insulation, enhanced windows, reduced window area, and others.

This measure requires buildings to be designed to exceed the building energy code for the thermal envelope through establishing whole building performance targets on either glazing area or overall insulation performance levels beyond Title 24, 2025 Part 6.

Alignment with CEDA Program Goals

The CEDA program supports the implementation of energy efficiency measures that support Code Readiness's Long Term Tactical Plan (LTTP) to drive the goals of electrification, decarbonization, and load reduction.

Projects must meet one of the CEDA Inducement Requirements identified in the next section to receive an inducement on the equipment and will be evaluated for level of interest in metering to support Code Readiness Objectives.

This measure meets the CEDA program goals as follows:

- **Building partnerships with market stakeholders** by consulting on innovative technologies and best practices in energy efficiency, which can lead to the development of more effective solutions and accelerate the adoption of new technologies. As teams adopt the measure, this increases the volume of engineers able to design the equipment, contractors capable of installing the equipment, and owners able to operate the equipment.
- **Increasing the supply of high-performance measures and all-electric buildings** by combining electrification with energy efficiency that can result in projects implementing measures to achieve greater energy savings, reduced emissions, and overall improved building performance. As more buildings specify and install high-performance envelopes, this helps to increase the overall supply of high-performance enclosures in the market for others to use, including beyond new construction.
- **Increasing the demand for high-performance measures and all-electric buildings** by pushing for electrification that drives the need for technological advancements, supporting economic growth opportunities through innovation, and raising awareness of the benefits of electrification to increase consumer adoption. As demand in the market increases for newer technologies, the long-term benefit is increased demand for manufacturers and suppliers to provide additional options available in the market.
- **Advancing new high-performance measure technology** by raising public awareness about new technologies and their benefits, helping build acceptance and demand through market support advocacy efforts that can influence stakeholder decisions that enable technological innovation.
- **Providing Codes & Standards with projects of interest** to collect metered data that will inform future California energy codes.

CEDA Inducement Requirements

The inducement requirements listed below are intended to support the adoption of the above code technologies in the current market. Projects receive inducements based on market impacts, savings, and influence.

Inducement Requirements

Whole building envelope thermal performance can be substantiated following one of two pathways for this energy measure to allow for flexibility. Either pathway represents a high-efficiency building envelope and is not considered an incremental improvement.

Projects must provide the required supporting documentation specified below and satisfy one of the two pathway design level requirements to be eligible for an inducement.

Essential Level Inducement

- **Pathway 1 Design Requirements:**
 - This measure applies to all buildings listed in Table 1 and the Appendix Table 2 with an area type to limit the amount of vertical glazing fenestration as a portion of the above-ground wall.
 - Buildings must meet or use less vertical fenestration as a percentage of gross above-grade-wall area defined in Table 1 or Table 2 for each building type.
 - The values used in Table 1 come from the ASHRAE 90.1 Table G3.1.1-1 Baseline Building Vertical Fenestration and represent a more aggressive approach to the window-wall ratio compared to the Title 24 baseline. This includes multifamily buildings as well as non-residential buildings.

Table 1: ASRHAE 90.1 Table G2.1.1-1 Baseline Building Vertical Fenestration

Building Area Type	Maximum Window Area % of Wall
Multifamily High-rise	30%
Multifamily Low-rise	20%
Grocery Store	7%
Healthcare	21%
Hospital	27%
Hotel/motel (<=75 rooms)	24%
Hotel/motel (> 75 rooms)	34%
Office <5k sf	19%
Office 5k to <50k sf	31%
Office >50k sf	40%
Restaurant (quick service)	34%
Restaurant (full service)	24%
Retail (stand-alone)	11%
Retail (strip mall)	20%
School	22%
Warehouse	6%

Note: When using the performance compliance pathway under any version of the California Title 24 energy code (e.g., 2019, 2022, or 2025), the effective thermal performance of each building envelope assembly may not fall below 85% of the prescriptive requirement for that specific assembly type. For instance, if the prescriptive requirement for a wall assembly is R-16.1, the proposed design must achieve a minimum effective R-value of R-13.7. This threshold can be applied on a per-assembly basis for simplicity or evaluated across all applicable assemblies using an area-weighted average method.

- **Pathway 1 Supporting Documentation Requirements:**
 - Provide engineered, stamped, and permitted construction plans demonstrating that the project design complies with state and local jurisdiction requirements and regulations.
 - Project design documentation must also provide the following:
 - Window-to-wall ratio calculations
 - Assembly thermal performance values
 - Insulation level of each assembly type
 - Baseline insulation level and assembly type per Title 24 Part 6

Premium Level Inducement

- **Pathway 2 Design Requirements:**
 - Buildings must exceed the overall level of insulation required prescriptively on an area-weighted average by 10% from the requirements defined in Title 24, 2025, Part 6, based on evaluating the thermal envelope at the winter design condition for the location.
 - This assessment must be completed compared to the 2025 energy code, even for projects permitted under previous code vintages (such as 2022, 2019, and 2016). This pathway allows for any amount of glazing area so long as it meets the energy efficiency code in the permitting process.
- **Pathway 2 Supporting Documentation Requirements:**
 - Provide engineered, stamped, and permitted construction plans demonstrating that the project design complies with state and local jurisdiction requirements and regulations.
 - Project design documentation must also provide the following:
 - Area of envelope enclosure by assembly type
 - Insulation level of each assembly type
 - Calculations documenting the project exceeds the prescriptive insulation by 10% on an area-weighted basis
 - Building fenestration, window-to-wall ratio, as a percentage of above-ground vertical fenestration versus wall area

Code Readiness Objectives

The performance pathway of the energy code allows for envelope trade-offs in thermal efficiency with active systems such as HVAC and lighting. This presents a risk to the long-term persistence of energy efficiency, relying more on active systems and controls rather than passive systems such as insulation and window frames. A method to limit the trade-offs with systems such as the thermal envelope is to define limits and performance targets that bound buildings to only take so many credits against the thermal performance.

This measure seeks to define a limit to envelope tradeoffs allowed through adopting a glazing area limit by building type in the prescriptive and performance compliance pathway, leveraging the limits established by building type in ASHRAE 90.1 2022 Appendix G and expanding them to include a larger set of building types in Pathway 1.

Pathway 2 provides an alternative pathway for buildings where window area cannot be reduced to exceed the thermal performance of the envelope insulation overall. This has been found to be achievable in high-performance envelopes and provides a means to achieve this measure.

The information would help to specifically inform energy codes to:

- Support code backstops for window area by building type in the performance compliance pathway of Title 24 Part 6.
- Support Market Transformation: Provide envelope examples to help update building energy codes based on building type.
- For projects that exceed the thermal performance of the prescriptive code, information on the level of increased performance and cost effectiveness of those measures.

To support future code cycles, Code Readiness seeks to capture the following information:

- Typical glazing area by building type and type in CA.
- Insulation thermal performance by assembly and overall by building for each building type and CA climate zone.

Site Metering Prerequisite

- This measure does not include a metering component.

Data Benefits

- Data will be used to identify the potential opportunity for these code requirements to be further researched. Current data sets on new construction do not account for this granularity on window area and thermal performance of the overall building envelope.

Eligible Climate Zones and Building Types

Eligible Climate Zones

This measure is applicable in all California climate zones.

Eligible Building Types

This measure applies to all building types listed in Tables 1 and 2 that are not shown as N/A.

Measure Exclusions

This high-performance measure excludes the following:

- Any building type not listed in Table 1 or shown as N/A in Table 2.

Appendix

Table 2: Detailed Building Types for Pathway 1 Fenestration WWR

No.	Building Area Type	Portfolio Manager Types	Portfolio Manager
1	Multifamily Highrise	Multifamily Highrise >= 4 stories	Multifamily Highrise
2	Multifamily Lowrise	Multifamily Lowrise <= 3 stories	Multifamily Lowrise
3	Office 5k to <50ksf	Banking/financial services	Bank Branch
4	Office 5k to <50ksf	Banking/financial services	Financial Office
5	School	Education	Adult Education
6	School	Education	College/University
7	School	Education	K-12 School (Elementary/middle school)
8	School	Education	K-12 School (High school)
9	School	Education	Preschool/Daycare
10	School	Education	Vocational School
11	School	Education	Other - Education
12	N/A	Entertainment/public assembly	Aquarium
13	N/A	Entertainment/public assembly	Bar/Nightclub - Entertainment/public assembly
14	N/A	Entertainment/public assembly	Bowling Alley
15	N/A	Entertainment/public assembly	Casino
16	Office 5k to <50ksf	Entertainment/public assembly	Convention Center
17	Office 5k to <50ksf	Entertainment/public assembly	Fitness Center/Health Club/Gym
18	N/A	Entertainment/public assembly	Ice/Curling Rink
19	N/A	Entertainment/public assembly	Indoor Arena
20	N/A	Entertainment/public assembly	Movie Theater
21	Office 5k to <50ksf	Entertainment/public assembly	Museum
22	Office 5k to <50ksf	Entertainment/public assembly	Performing Arts
23	N/A	Entertainment/public assembly	Race Track
24	N/A	Entertainment/public assembly	Roller Rink
25	Office 5k to <50ksf	Entertainment/public assembly	Social/Meeting Hall
26	N/A	Entertainment/public assembly	Stadium (Closed)
27	N/A	Entertainment/public assembly	Stadium (Open)
28	N/A	Entertainment/public assembly	Swimming Pool
29	N/A	Entertainment/public assembly	Zoo
30	Office 5k to <50ksf	Entertainment/public assembly	Other - Entertainment/Public Assembly (Entertainment/culture)
31	Office 5k to <50ksf	Entertainment/public assembly	Other - Entertainment/Public Assembly Library (Entertainment/culture)
32	Office 5k to <50ksf	Entertainment/public assembly	Other - Entertainment/Public Assembly (Other public assembly)
33	Office 5k to <50ksf	Entertainment/public assembly	Other - Entertainment/Public Assembly (Recreation)
34	Office 5k to <50ksf	Entertainment/public assembly	Other - Entertainment/Public Assembly (Social/meeting)
35	N/A	Entertainment/public assembly	Other - Recreation
36	N/A	Entertainment/public assembly	Other - Stadium
37	N/A	Food sales and service	Bar/Nightclub - Food sales and service
38	Restaurant (quick service)	Food sales and service	Convenience Store with Gas Station
39	Restaurant (quick service)	Food sales and service	Convenience Store without Gas Station
40	Restaurant (quick service)	Food sales and service	Fast Food Restaurant

No.	Building Area Type	Portfolio Manager Types	Portfolio Manager
41	Grocery Store	Food sales and service	Food Sales (Grocery/food market)
42	Grocery Store	Food sales and service	Food Sales (Convenience store with gas)
43	Grocery Store	Food sales and service	Food Sales (Convenience store)
44	Restaurant (quick service)	Food sales and service	Food Sales (Other food sales)
45	Restaurant (quick service)	Food sales and service	Food Service (Fast food)
46	Restaurant (quick service)	Food sales and service	Food Service (Restaurant/cafeteria)
47	Restaurant (quick service)	Food sales and service	Food Service (Other food service)
48	Restaurant (full service)	Food sales and service	Restaurant
49	Grocery Store	Food sales and service	Supermarket/Grocery Store
50	Grocery Store	Food sales and service	Wholesale Club/Supercenter
51	Restaurant (quick service)	Food sales and service	Other - Restaurant/Bar
52	Healthcare (outpatient)	Healthcare	Ambulatory Surgical Center
53	Healthcare (outpatient)	Healthcare	Hospital (General Medical & Surgical)*
54	Healthcare (outpatient)	Healthcare	Medical Office - Healthcare
55	Healthcare (outpatient)	Healthcare	Outpatient Rehabilitation/Physical Therapy
56	Healthcare (outpatient)	Healthcare	Residential Care Facility
57	Healthcare (outpatient)	Healthcare	Senior Care Community
58	Healthcare (outpatient)	Healthcare	Urgent Care/Clinic/Other Outpatient
59	Healthcare (outpatient)	Healthcare	Other - Specialty Hospital
60	Hotel/motel (avg)	Lodging/residential	Barracks
61	Hotel/motel (avg)	Lodging/residential	Hotel
62	Hotel/motel (avg)	Lodging/residential	Hotel (Motel or inn)
63	Hotel/motel (avg)	Lodging/residential	Multifamily Housing
64	Hotel/motel (avg)	Lodging/residential	Prison/Incarceration
65	Hotel/motel (avg)	Lodging/residential	Residence Hall/Dormitory
66	Hotel/motel (avg)	Lodging/residential	Residential Care Facility
67	Hotel/motel (avg)	Lodging/residential	Senior Care Community
68	Hotel/motel (avg)	Lodging/residential	Other - Lodging/Residential
69	Office 5k to <50ksf	Mixed use	Mixed Use Property
70	Office 5k to <50ksf	Office	Medical Office - Office
71	Office 5k to <50ksf	Office	Office (Admin/professional office)
72	Office 5k to <50ksf	Office	Office (Bank/other financial)
73	Office 5k to <50ksf	Office	Office (Government office)
74	Office 5k to <50ksf	Office	Office (Medical office (diagnostic))
75	Office 5k to <50ksf	Office	Office (Other office)
76	Office 5k to <50ksf	Office	Veterinary Office
77	Office 5k to <50ksf	Office	Other - Office
78	Office 5k to <50ksf	Public services	Courthouse
79	Office 5k to <50ksf	Public services	Fire Station
80	Office 5k to <50ksf	Public services	Library
81	Office 5k to <50ksf	Public services	Mailing Center/Post Office
82	Office 5k to <50ksf	Public services	Police Station
83	Office 5k to <50ksf	Public services	Prison/Incarceration
84	Office 5k to <50ksf	Public services	Social/Meeting Hall
85	Office 5k to <50ksf	Public services	Transportation Terminal/Station
86	Office 5k to <50ksf	Public services	Other - Public Service
87	Office 5k to <50ksf	Religious worship	Worship Facility
88	Retail (strip mall)	Retail	Automobile Dealership

No.	Building Area Type	Portfolio Manager Types	Portfolio Manager
89	Retail (strip mall)	Retail	Convenience Store with Gas Station
90	Retail (strip mall)	Retail	Convenience Store without Gas Station
91	Retail (strip mall)	Retail	Enclosed Mall
92	Retail (strip mall)	Retail	Lifestyle Center (Enclosed mall)
93	Retail (strip mall)	Retail	Lifestyle Center (Other retail)
94	Retail (strip mall)	Retail	Lifestyle Center (Retail store)
95	Retail (strip mall)	Retail	Lifestyle Center
96	Retail (stand-alone)	Retail	Retail Store
97	Retail (strip mall)	Retail	Strip Mall
98	Grocery Store	Retail	Supermarket/Grocery Store
99	Retail (stand-alone)	Retail	Wholesale Club/Supercenter
100	Retail (stand-alone)	Retail	Other - Retail/Mall (Enclosed mall)
101	Retail (stand-alone)	Retail	Other - Retail/Mall
102	Office 5k to <50ksf	Technology/science	Data Center
103	Office 5k to <50ksf	Technology/science	Laboratory
104	Office 5k to <50ksf	Technology/science	Other - Technology/Science (Other service)
105	Retail (strip mall)	Services	Personal Services (Health/Beauty, Dry Cleaning, etc.)
106	Retail (strip mall)	Services	Repair Services (Repair shop)
107	N/A	Services	Repair Services (Vehicle service/repair shop)
108	N/A	Services	Repair Services (Vehicle storage/maintenance.)
109	Retail (strip mall)	Services	Other - Services
110	N/A	Utility	Energy/Power Station
111	N/A	Utility	Other - Utility
112	Warehouse	Warehouse/storage	Self-Storage Facility
113	Warehouse	Warehouse/storage	Distribution Center
114	Warehouse	Warehouse/storage	Nonrefrigerated Warehouse
115	Warehouse	Warehouse/storage	Refrigerated Warehouse

Reviewer Checklist

HPM Review Checklist: LM424 – High Performance Building Envelope – V4

Checklist Description: This checklist captures the elements that must be present in the project design to be eligible for the high-performance measure inducement or consideration for additional site metering.

Project Name: _____ **Review Date:** _____

Assessment: _____ **Notes:** _____

- Approved
- Not approved

Reviewer: _____ **Signature:** _____

Essential Level - Pathway 1 Inducement Requirements	Comments
<input type="checkbox"/> Is this project in alignment with one of the listed building types as shown in Table 1 or Table 2?	
<input type="checkbox"/> Does the building meet or use less vertical fenestration as a percentage of gross above-grade-wall area defined in Table 1 or Table 2 for each building type?	
<input type="checkbox"/> Did the project satisfy the Pathway 1 compliance calculation per 2025-04-04_Calculation_PGE_CR_CEDA_HPM Envelope.xlsx workbook?	
<input type="checkbox"/> Were engineered, stamped, and permitted construction plans demonstrating that the project design complies with state and local jurisdiction requirements and regulations provided?	
<input type="checkbox"/> Did the project design documentation provide the following: <ul style="list-style-type: none"> ○ Window-to-wall ratio calculations ○ Assembly thermal performance values ○ Insulation level of each assembly type ○ Baseline insulation level and assembly type per Title 24 Part 6 	

Premium Level - Pathway 2 Inducement Requirements	Comments
<input type="checkbox"/> Did the project satisfy the Pathway 2 compliance calculation per 2025-04-04_Calculation_PGE_CR_CEDA_HPM Envelope.xlsx workbook?	
<input type="checkbox"/> Did the project exceed the overall level of insulation required prescriptively on an area-weighted average by 10% from the requirements defined in Title 24, 2025, Part 6, based on evaluating the thermal envelope at the winter design condition for the location?	
<input type="checkbox"/> Were engineered, stamped, and permitted construction plans demonstrating that the project design complies with state and local jurisdiction requirements and regulations provided? <ul style="list-style-type: none"> ○ Area of envelope enclosure by assembly type ○ Insulation level of each assembly type ○ Calculations documenting the project exceeds the prescriptive insulation by 10% on an area-weighted basis ○ Building fenestration, window-to-wall ratio, as a percentage of above-ground vertical fenestration versus wall area 	

Version History Log

Version	Effective Date	End Date	Change Description
1	April 26, 2023	January 4, 2024	N/A
2	January 5, 2024	June 25, 2024	Data benefits, format changes
3	June 26, 2024	June 14, 2025	Prescriptive and performance pathways
4	June 15, 2025	Active	Updated format, tier-level requirements, checklist

The version identified as 'Active' is the current published version and remains in effect until superseded by a subsequent published version. CEDA may update, replace, or retire High-Performance Measures without prior notice. End dates are assigned to prior versions once superseded.