TITLE 24, PART 6 | 2028 CODE CYCLE

Traction Elevators

Codes and Standards Enhancement (CASE) Proposal

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CALIFORNIA ENERGY CODES & STANDARDS
A STATEWIDE UTILITY PROGRAM

Proposal Description

- Code Change Proposal
- Benefits
- Background Information

Proposed Code Change

Update Title 24, Part 6, 120.6(f) to add mandatory requirements for elevators in new construction, additions, and alterations for non-residential buildings:

120.6(f)1. All new traction elevators with a rated capacity of 2,000 pounds or greater, a rated speed of 150 feet per minute or greater, and a total rise of 20 feet or greater, shall have a regenerative drive that recovers energy released during motion and supplies electrical energy to the building electrical system.

Braking resistors or resistive load bank shall be permitted to absorb regenerated energy only during emergency generator operation.

Drives must meet or exceed a 90 percent total power factor.

Exception 1 to Section 120.6(f)1. Stand-alone parking garages, where the calculated total building electrical load under normal operation is less than the load needed to absorb regenerated power from the elevator system.

No other changes to 120.6(f) will be made.

See Title24stakeholders.com for proposal description, justification, draft code language, and requested data

Benefits of the Proposed Change

Energy Savings

- Adding regenerative drives to traction elevators can reduce energy consumption by 20%-35% on average.
  - Offers additional energy savings in the form of reducing the cooling load on the building by reducing the heat rejected in the elevator machine room.

Cost-Effective

- Cost is small to negligible due to the industry practice of commonly installing traction elevators with regenerative drives.

National Coordination

- Allows California to be coordinated with industry trends as well as ASHRAE 189.1 and IECC Commercial current national model code efforts.

Background Information

The Statewide CASE Team introduced a mandatory measure for traction elevators during the 2025 code cycle.

- The proposed measure required installing a regenerative drive on traction elevators during controller replacement with an exception for hospitals.
- The CEC requested further data gathering and additional energy use analysis to be completed before moving forward.
- The Statewide CASE Team maintains that the proposed measure remains feasible and cost-effective for many non-residential buildings.

Regenerative drives recapture energy that is usually lost as heat and return it to the electric system, resulting in 30-40% annual energy savings.

- There are additional savings from reducing the cooling load.

Background Information – Other Codes

- **IECC Commercial Consensus Committee** has approved a traction elevator proposal that aligns with the Title 24 proposal.
- The **National Elevator Industry (NEII)** is incorporating regenerative drive as a requirement in ASME A17.1.
- Already a code requirement in at least **21 State Energy Codes and 9 local codes.**
- **CALGreen** has a measure to encourage the installation of regenerative drives in traction elevators.
- **An ASHRAE 189.1 Committee** is considering a traction elevator proposal that aligns with the Title 24 proposal.

Marked-up Code Language

See Title24stakeholders.com for marked-up code language

Title 24, Part 1	Title 24, Part 6	Reference Appendices
▪ No Changes	▪ Update Section 120.6(f)	▪ Update Appendix NA7.14

Market and Technical Considerations

- Current Conditions and Trends
- Potential Barriers and Solutions
- Technical feasibility

Current Market Conditions

Based on CalOSHA data, of the **114,389** passenger conveyances in California, roughly **36,000 (32%)** are **traction** elevators.

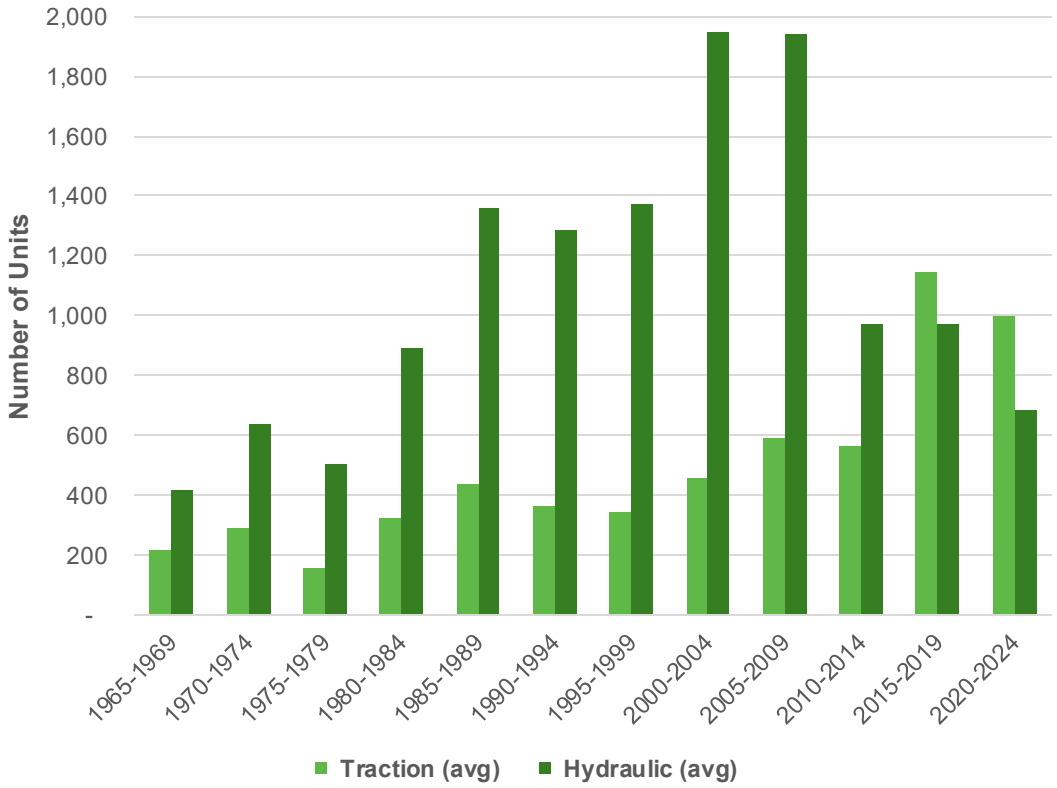
- Approximately **1,000** traction elevators are installed each year (when averaging last 10 years).

Elevators are an **established market**.

No incentives in California.

- ComEd offers custom incentives for commercial and multifamily buildings.

The industry is moving toward machine-room-less (MRL) and traction elevators.



Cal/OSHA Elevator

ComEd Elevator Incentives

Market Barrers and Solutions

Market Barriers	Potential Solutions
1. Not all buildings can absorb the regenerated load. 2. Some building types are not a good fit due to consistent low load. 3. Buildings with emergency generators must consider whether the regenerated energy during an emergency power outage will overload the installed generator.	1. Exclude buildings where the total building electrical load is less than the load needed to absorb regenerated power. 2. Exclude building types with average building electrical load less than load that can be regenerated from elevator.

Current Market Share

Market share: percentage of buildings that already use the proposed technology or design practice (at or above the proposed stringency level)

Current Market Share

New Construction and Additions	**90%**	▪ Buildings with traction elevators
Alterations	**90%**	▪ Buildings retrofitting traction elevators

Poll

What is the current market share for <u>new construction?</u> That is, what percentage of annual new construction in California currently use regenerative drives with traction elevators?

a. 1% – 10%
b. 11% – 20%
c. 21% – 30%
d. 31% – 40%
e. 41% - 50%
f. 51% - 60%
g. 61% - 70%
h. 71% - 80%
i. 81% - 90%
j. 91% - 100%

Poll

What is the current market share for alterations? That is, what percentage of annual retrofits in California currently use regenerative drives with traction elevators?

a. 1% – 10%
b. 11% – 20%
c. 21% – 30%
d. 31% – 40%
e. 41% - 50%
f. 51% - 60%
g. 61% - 70%
h. 71% - 80%
i. 81% - 90%
j. 91% - 100%

Technical Considerations

- Need to gather more information on total power factor for regenerative drives.
  - What is a typical vs. max efficient value for regenerative drives?
- Regenerated electricity incompatibility with existing equipment or back-up generators.
- Under what circumstance is regenerative drives too high a burden on building owner?

Technical Barrers and Solutions

Technical Barriers	Potential Solutions
1. Existing buildings with emergency generators connected to elevators and insufficient electrical load	1. Add braking resistors that are enabled during emergency generation or a resistive load bank that is adjacent to the emergency generator serving the transfer switch containing the elevator load

Poll

What else should we know? Are there market or technical barriers or solutions we should consider?

Open ended response

Per Unit Energy and Cost Impacts

Methodology and Assumptions

- Energy and Energy Cost Savings
- Incremental Costs

Energy and Energy Cost Savings Methodology

- Began with selecting building prototypes.
- Identified the number of elevators and specifications for those elevators for the different building types in CA using a combination of CBECC prototype assumptions, real-world knowledge, and expert opinion. Required input parameters include:
  - Elevator type
  - Floor elevation (1st floor and all other floors)
  - Population on each floor
  - Number of elevators
  - Speed of elevators
  - Capacity of elevators
  - Door size and type of door
  - Acceleration rate of elevators (feet per minute)
- The assumed inputs where then shared with a diverse group of experts for input.

Energy and Energy Cost Savings Methodology

Using the agreed-upon modeling parameters, the Research Team used Elevate™ to simulate energy consumption based on velocity, acceleration rate, jerk rate, empty car mass, and load in the car.

- Cumulative energy consumption, average electrical load, peak electrical load, and heat rejection were output in 5-minute increments to an Excel file for a 24-hour period

This 24-hour period was expanded to an 8,760 format for energy consumption and heat rejection by applying the following assumptions:

- Elevator use is assumed only on weekdays for all non-residential building types. The 24-hour period output was used for all weekdays, while weekends are assumed to have zero elevator use.

To estimate the potential energy saved from not having to remove the heat rejected by the elevator, the Research Team divided the heat rejection in kW by an assumed coefficient of performance (COP) of 3.5 which is meant to represent the efficiency of HVAC units currently installed in commercial buildings across CA.

Elevate™ is the energy modeling software used for analysis presented in the 2023 CASE report.

Energy and Energy Cost Savings Methodology

Heat rejection was assumed to require removal by a cooling system.

To estimate the potential energy saved from not having to remove the heat rejected by the elevator, the Research Team divided the heat rejection in kW by an assumed coefficient of performance (COP) of 3.5 which is meant to represent the efficiency of HVAC units currently installed in commercial buildings across CA.

A 3.5 COP is the equivalent of 12.7 SEER2.

The coefficient of performance is defined as the heat rejected (kW) divided by the work into the heat rejection system.

Energy Modeling Assumptions

Prototypical Buildings

- Large Office
- Medium Office
- Parking Garage
- Secondary School (new)

Climate Zones

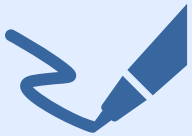
- Not applicable

Key Modeling Assumptions

Prototypes: All

Standard Design

Elevator without regenerative drive and is minimally compliant with 2025 code.



Proposed Design

Elevator with a regenerative drive with a 90% or greater power factor.

Key Modeling Assumptions – Range of Values

Building Prototype	Floors	# of elevators	Elevator population	Speed (fpm)	Capacity (lb)	1st floor height (ft)	All other floor heights (ft)	Traffic Handling	Door Width and Opening (ft)
Large Office building	11-17	10-16	914-1526	500	4000	16	14	<20/30 sec	4' Center
Medium Office Building	3-9	2-4	180-720	150-350	3500-4000	16	14	<20/30 sec	3.5' Side-4’ Side
Parking Structure	4	2	465	200	3500	12	12	<20 sec	3.5' Side
Secondary School	2	1	62	100	4000	15		9.1-36.1 sec	4' Center

Incremental Cost Framework

Prototype(s): All

Baseline

First Cost

Elevator without regenerative drive and is minimally compliant with 2025 code.

30-Year Maintenance Costs

Regular Maintenance

Proposed

First Cost

Elevator with a regenerative drive with a 90% or greater power factor.

30-Year Maintenance Costs

Regular Maintenance

Approach for Gathering Costs

- Additional costs will be collected through stakeholder outreach with elevator engineers to confirm current first cost and maintenance cost assumptions.
- **Confirm assumptions for regenerative drives through stakeholder outreach with elevator engineers**

Compliance Verification

- Key Aspects of Compliance Verification
- Barriers and Solutions
- Revisions to Compliance Software

Key Aspects of Compliance Verification

1. Design Phase: Designer understands latest code

2. Permit Application Phase: Reviewers need to understand new requirements

3. Construction Phase: Contractors should understand code requirements and programming elevators.

4. Inspection Phase: Inspectors should verify that elevator includes a regenerative drive & verify that controls work properly.

Compliance Barriers and Solutions

Compliance Verification Barriers	Potential Solutions
1. Building permits are not currently being pulled for elevator modernizations. 2. Building officials may not know where to look to verify. 3. Elevator designer/contractor is not aware of the Energy Code requirements.	1. Engage with AHJ building official stakeholders early in the process. 2. Control type is included in Cal/OSHA data. 3. Engage with elevator designers/contractors to increase awareness of Energy Code.

Compliance Software Updates

No software updates are needed.

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More information on
CEC's 2028 proceeding website.

We want to hear from you!

CALIFORNIA ENERGY CODES & STANDARDS
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Key Modeling Assumptions

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Building Prototype	Floors	# of elevators	Elevator population	Speed (fpm)	Capacity	1st floor height	All other floor heights	Traffic Handling	Door Width and Opening
Large Office building	11	10	914	350	4000	16	14	<20/30 sec	4' Center
Large Office building	13	12	1118	500	4000	16	14	<20/30 sec	4' Center
Large Office building	17	16	1526	500	4000	16	14	<20/30 sec	4' Center
Medium Office Building	3	2	180	150	3500	16	14	<20/30 sec	3.5' Side
Medium Office Building	6	3	450	200	3500	16	14	<20/30 sec	4' Center
Medium Office Building	9	4	720	350	4000	16	14	<20/30 sec	4' Center
Parking Structure	4	2	465	200	3500	12	12	<20 sec	3.5' Side
Secondary School	2	1	62	100	4000	15		9.1-36.1 sec	4' Center

Cost Effectiveness Results

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Climate Zone	Benefits *30-year Energy Cost Savings + Other PV Savings* (2029 PV$)	Costs *Total Incremental PV Costs* (2029 PV$)	Benefit-to-Cost Ratio
1	$#,### – $#,###	$#,### – $#,###	#.# – #.#
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			

Results vary by prototypical building

134.79

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