



TITLE 24, PART 6

2028 CODE CYCLE

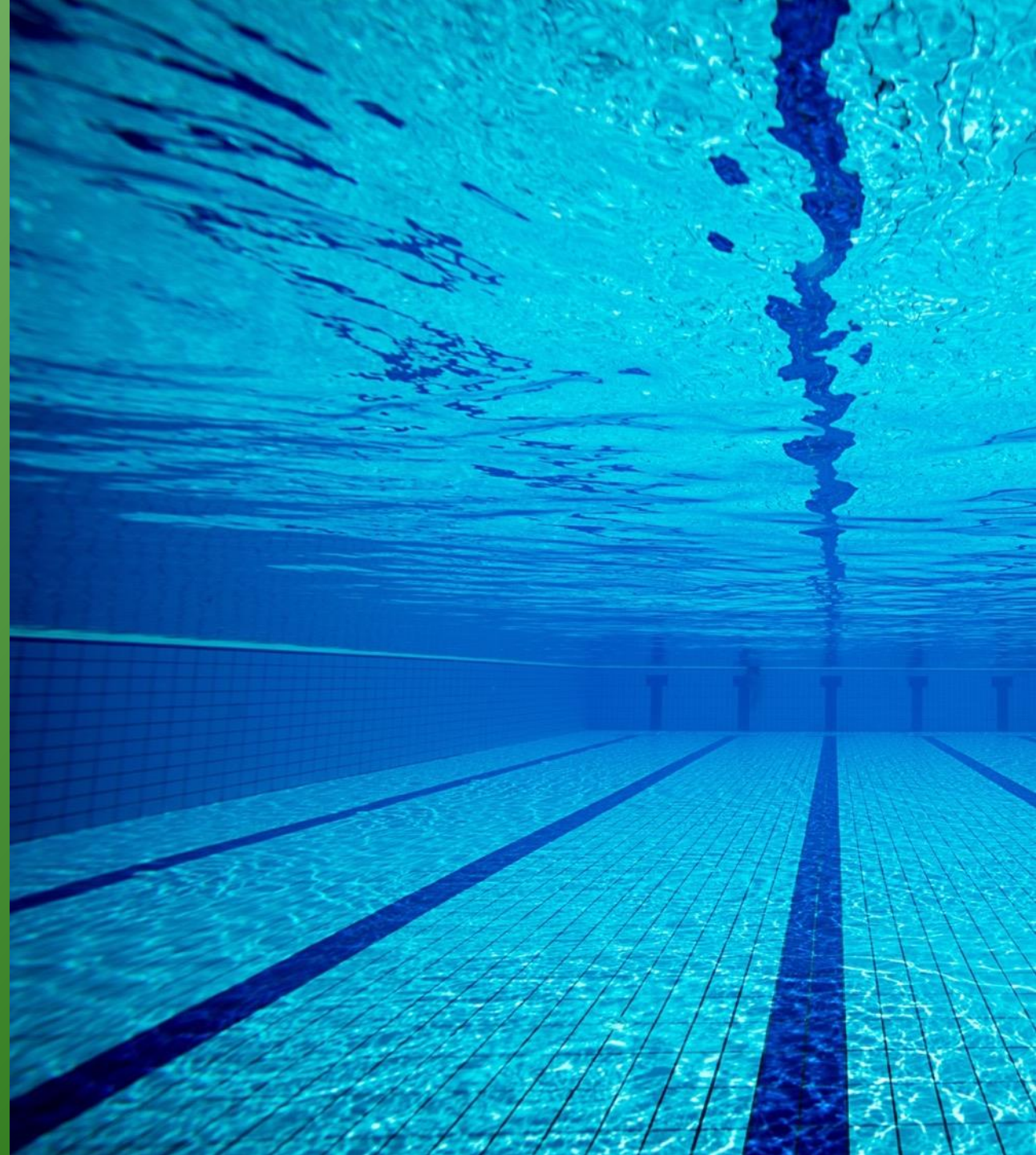
Solar Heating for an Existing Pool and Spa

Codes and Standards Enhancement (CASE) Proposal

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September 30, 2025

Proposal Description

- Background Information
- Code Change Proposal
- Benefits



Background Information

- California has one of the largest pool markets in the country, with many commercial pools heated year-round.
- Current code requirements for pool heating systems apply to new construction:
 - New pools being built with a new heating system
 - Existing pools adding a heating system for the first time

Background Information

- Primary Pool Heating System must be one of the following types:
 - Solar Thermal Systems for Pool and Spa Heating (excluding portable electric spas)
 - Heat Pump Pool Heaters (HPPH)
 - On-site Renewable Energy / Site-Recovered Systems
 - Combination Solar Thermal and HPPH
 - Pool Heating Systems approved by the California Energy Commission (CEC) that use an equivalent amount of energy as other compliant systems
- This proposal expands mandatory heating source requirements to existing nonresidential pools when replacing a pool heater.

Proposed Code Change

Updates to Exception 2 of Section 110.4(c) – Replacing Existing Pool Heaters

- Current exception applies to *all* existing pools replacing their heating systems.
- Proposed Change:
 - Would continue to apply to single family, multifamily and hotel/motel pools.
 - No longer would apply to nonresidential pools and spas — they would now need to comply with the mandatory requirements when replacing existing heaters.

[See Title24stakeholders.com](https://Title24stakeholders.com)
for proposal description,
justification, draft code
language, and requested data

Updates to Exception 5 of Section 110.4(c) – Inadequate Solar Access Roof Area (SARA)

- Current exception applies only to permanent *spas* with inadequate SARA
- Proposed Expansion:
 - Would also apply to **pools** at any building type.
 - Pools and permanent spas without sufficient SARA or nearby roof space would qualify for the exception.

Benefits of the Proposed Change

- **Energy Savings:**
 - Solar thermal is a highly efficient way to heat pools, reducing energy use, greenhouse gas emissions, and utility operating costs—while supporting California’s decarbonization goals.
- **Cost-Effective:**
 - Prior analysis by the CASE Team confirms that solar pool heating is a cost-effective solution to heat a pool or spa, especially in California’s climate.
- **Flexible, Targeted Exceptions:**
 - Single-family homeowners, multifamily buildings and hotel/motels replacing existing heaters may continue using their current technology.
 - Pools also qualify for an exception if there is inadequate solar access roof area, ensuring flexibility where solar is not feasible.

Marked-up Code Language

See Title24stakeholders.com for marked-up code language

Title 24, Part 1
▪ N/A

Title 24, Part 6
▪ Exception 2 to Section 110.4(c) ▪ Exception 5 to Section 110.4(c)

Reference Appendices
▪ N/A



Market and Technical Considerations

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

Current Market Conditions

Solar Thermal Pool Heating

- A well-established technology with decades of use in California.
- Becoming more common in both new and retrofit applications.
- Systems can meet most or all pool heating needs with a gas or electric backup only when needed.
- 25-year solar thermal useful life supported by National Renewable Energy Laboratory (NREL) data.

Current Market Conditions

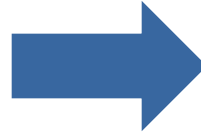
Heat Pump Pool Heaters

- “Unitary” HPPHs (standalone systems) are widely available and increasingly common in both residential and commercial markets
- “Applied” HPPHs (field-assembled systems) are less common, typically used in large commercial pools
- Performance can vary by climate; proper sizing and installation are essential for reliable heating
- Typical useful life of ~11 years, depending on maintenance and conditions

Market Barriers and Solutions

Market Barriers

1. Higher upfront costs for solar thermal systems, HPPH and recovered energy
2. Perception that solar thermal heating systems and HPPHs do not provide same level of convenience, immediate responsiveness, or on-demand heating as gas pool heaters



Potential Solutions

1. Studies and calculators to predict payback periods for the more efficient systems
2. Consumer education / showing data that solar thermal can meet all heating needs in California

Current Market Share

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

Current Market Share



NOMAD assumptions derived and calculated from the following sources:
U.S. Commercial Swimming Pool Market Report (YE 2022), 2023 P.K. Data, Inc.
SEIA U.S. Solar Market Insight | 2010 Year in Review Executive Summary

Poll

What is the current market share for alterations? That is, how many existing commercial pools would replace their current systems to solar, a HPPH, or heat recovery in the absence of this proposed requirement?

- a. 1% – 5%
- b. 5% – 10%
- c. 11% – 15%
- d. 16% – 20%
- e. 21% - 25%

Technical Considerations – Solar Thermal

- Site Suitability: Solar thermal requires sufficient and unshaded roof space with good solar orientation
- System Sizing: Collector area must be 65% of the pool surface area
- Environmental Conditions: Output varies seasonally; most climate zones need backup heat in winter

Technical Considerations – HPPHs

- Site Suitability: HPPH require open space for air circulation and equipment clearance
- System Sizing: Selection must account for climate zone, pool volume, and typical heating demand
- Environmental Conditions: Performance drops in colder temps
- Energy Inputs: Requires substantial electrical power (~50 amps/unit)
- Heat-Up Time: Heats slower than gas heaters but can maintain desired temperatures with proper sizing
- Noise Levels: Sound output is comparable to moderate rainfall or a casual conversation (~50–65 dB); typically placed near other mechanical equipment
- HPPH Type: Unitary systems suit most installations; applied systems are field-assembled and used in custom applications

When are applied systems appropriate over unitary models?

Are they more space-efficient or capacity-driven?

Technical Considerations - HPPHs

- Heating Load: Most pools up to 40 thousand gallons require only one HPPH to meet heating needs when properly sized.

Pool Volume	140kBTU/hr Units	Pad Size for Unitary HPPH (LxW)	Noise Level*	Typical Applications
≤ 40k gal	1	5' x 5'	55-65 dB	Hotels
40-60k gal	2	12' x 5'	58-68 dB	Health Clubs
60-90k gal	3	19' x 5'	60-70 dB	Schools, Community
90-160k gal	4	26' x 5'	61-71 dB	Municipal, YMCAs
160k+ gal	5+	Custom	62-72 dB	Waterparks

*Measured at 3ft; ambient noise typically 50-55 dB

- Noise impact: Single unit equivalent sound to light rain or conversation volume; multiple units equivalent sound to shower running or dishwasher

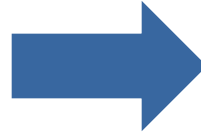
Technical Considerations - HPPHs

- Electrical Load. The electrical load for pools with HPPH may be 50-200 amps for pools found at many facilities.
- National Electric Code calculations for panelboards require that the continuous load not exceed 80% of the panelboard's rating.
 - If the panelboard is rated to 200 amps, the continuous load cannot exceed 160 amps.
- Much larger pools with much larger electric loads due to large pool pumps may be served by switchboards or switchgear.
- What assumptions for available electrical service should be made for locations with:
 - Panelboards
 - Switchgear

Technical Barriers and Solutions (Solar Thermal)

Technical Barriers

1. Roof space or limited sunlight for solar thermal to be effective
2. Shading, orientation, and structural limitations can reduce available SARA, especially in urban or multifamily settings.
3. Unfamiliarity of SARA and how to apply it



Potential Solutions

1. Implementation of the SARA exception
2. Engage with stakeholders on existing compliance documents

Technical Barriers and Solutions (HPPHs)

Technical Barriers

1. Performance Drops in Cold Weather/ HPPH does not provide sufficient heating
2. System Capacity Concerns - Belief that HPPHs cannot match gas heater output
 - Space and Clearance Requirements- Multiple units need significant pad space and airflow
 - High Electrical Demand - Each unit may require 50 amps with some pools requiring multiple HPPH



Potential Solutions

1. Gas back-up heating for coldest conditions once HPPH sizing requirement is satisfied
2. Evaluate compatibility of applied vs. unitary HPPH systems for fit within existing spaces
3. Evaluate capacity of existing panelboard or switchgear in the pool pump room for load capacity

Poll

What has been the biggest challenge when upgrading an existing gas pool heater to a solar thermal, HPPH, or heat recovery system?

Per Unit Energy and Cost Impacts

Methodology and Assumptions

- Energy and Energy Cost Savings
- Energy Modeling Assumptions
- Incremental Costs



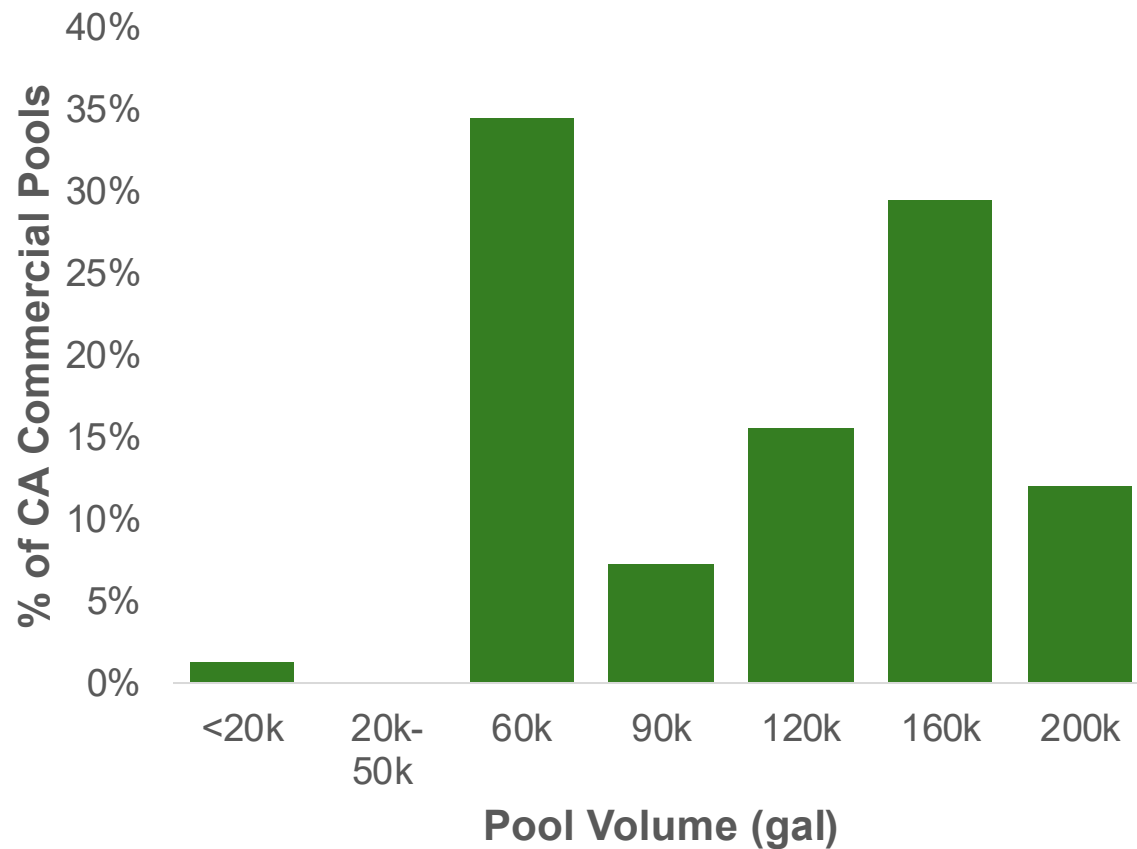
Energy and Energy Cost Savings Methodology

- Four representative use cases across commercial sectors:
 - Outdoor and indoor pools differ by climate and solar insulation
 - Standard (~20,000 gal)* and Olympic-sized (~660,000 gal) pools

**Additional commercial pools sizes may be studied based on stakeholder input*
- All pools assumed to be heated year-round and operated daily
- Unglazed solar collectors modeled for all scenarios (typical market condition)

Poll

Distribution of Commercial Pools by Pool Size (Pk Data 2022)



What size pool would stakeholders like to see analyzed for energy savings and cost-effectiveness?

- a) 60,000 gallon
- b) 90,000 gallon
- c) 120,000 gallon
- d) 160,000 gallon
- e) 200,000 gallon

Energy Modeling Assumptions



National Resources
Canada



- Simulating energy savings Enerpool Pro 3.0 Pool Heater Simulation Software – Developed by Canadian Government Agency, Natural Resources Canada
 - Use of Title 24 2028 weather files as input
 - User defined pool size, heater and solar collector, use of cover, and description of pool activity
 - Calculates losses from evaporation, convection, conduction, and radiation
 - Calculates heating from gas, heat pump, solar collector or combinations solar and heater
 - Hourly calculation of energy loads and pool temperature
- Simulating using the following prototypical pools and climate zones

Prototypical Pools

- Commercial Outdoor Pool
- Commercial Indoor Pool
- Commercial Indoor Olympic Pool
- Commercial Outdoor Olympic Pool

Climate Zones

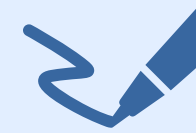
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Key Modeling Assumptions



Standard Commercial Pools*

- Pool Volume: 20,000 gallons
- Pool Surface area: 440 ft²
- Pool Water Temperature: 80 °F
- Pool Swim Season: Year-round
- Pool Use: Daily 10 am to 8 pm
- Gas Heater Capacity: 110 kBtu/h
- Solar Collector Size: 286 ft² (nonresidential)
- Solar Collector Type: Unglazed



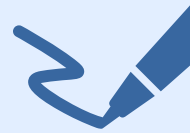
Olympic-Sized Pools

- Pool Volume: 660,000 gallons
- Pool Surface Area: 13,450 ft²
- Pool Water Temperature: 80 °F
- Pool Swim Season: Year-round
- Pool Use: Daily 10 am to 8 pm
- Solar Collector Size: 8,800 ft²
- Solar Collector Type: Unglazed

**Additional commercial pools sizes may be studied based on stakeholder input*

Incremental Cost Framework

Prototype(s): Commercial Pool (20,000-gallon capacity)



Proposed (Solar Thermal)

First Cost

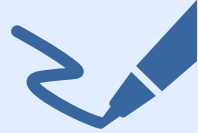
1. Solar Equipment and Installation: \$5,250

30-Year Maintenance Costs (\$PV)

1. Equipment Replacement: \$2,434 (at 25-year)
2. Regular Maintenance: \$1,029 (1% of the first cost of the system)

Incremental Cost Framework

Prototype(s): Olympic Pool (660,000-gallon capacity)



Proposed (Solar Thermal + Gas Back-Up)

First Cost

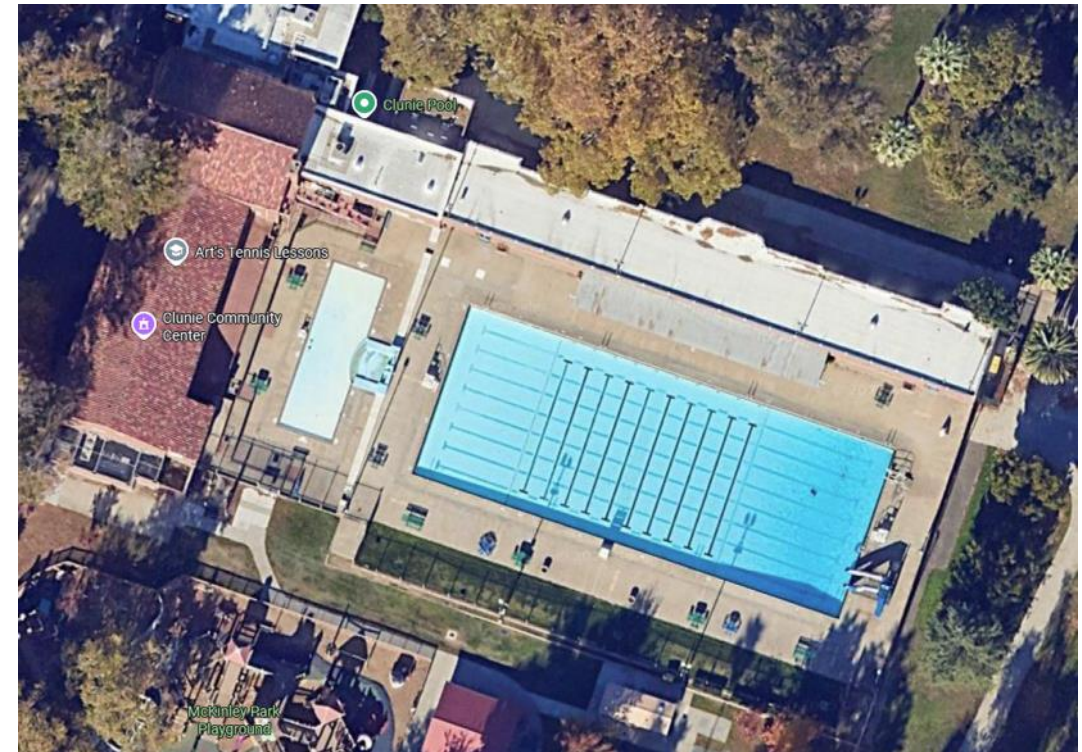
1. Solar Equipment and Installation: \$139,214

30-Year Maintenance Costs (\$PV)

1. Solar Equipment Replacement: \$64,553
2. Solar Regular Maintenance: \$27,287

Approach for Gathering Costs

- California Pool Solar Thermal Rebate Program contains over one thousand commercial pool solar thermal projects
- RS Means – constructions costs for adapting existing pool heating systems to meet proposed requirements.
- Stakeholder outreach and comments
- **What retrofit costs and scenarios should we consider?**
 - Alteration to buildings for additional equipment?
 - Trenching to connect pool pump pad to solar thermal collector location?
 - Increases for electrical capacity?
- What are some examples of retrofit projects?
High School Pool in Walnut Creek, CA
Beverly Hot Springs Spa in LA, CA



Clunie Community Pool, Sacramento, CA



Compliance Verification

- Key Aspects of Compliance Verification
- Revisions to Compliance Software

Compliance and Verification Process



- 1. Design Phase – requirement triggered for:**
 - Upgrades to update the heat source of an existing pool.



- 2. Permit Application Phase**
 - Permit is obtained by installer, and plans and compliance forms may be reviewed by a building inspector.



- 3. Construction Phase**
 - Equipment is installed per the design.



- 4. Inspection Phase**
 - Verify that equipment installed matches the design.

Compliance Software Updates

There are no compliance software updates.

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More information on
[CEC's 2028 proceeding website.](#)

We want to hear from you!