



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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March 17, 2026

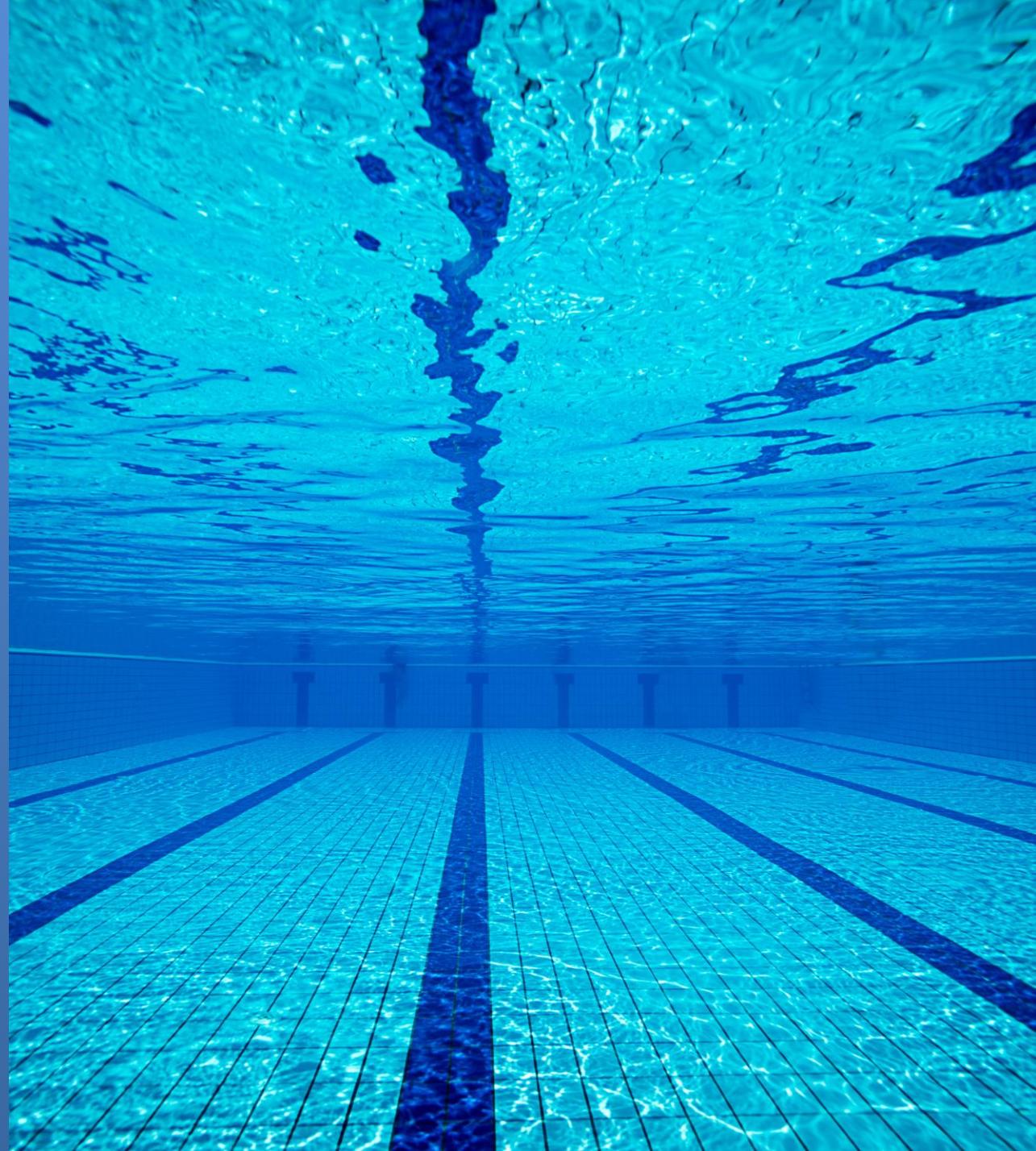
Agenda

- Background
- Recap of Proposal
- What's New?
- Proposed Code Changes
- Incremental Cost Framework
- Energy & Cost Impacts
- Statewide Impacts



Background

- Proposal Recap
- What's New?



Background Information

- Current (2025) T24 code applies to:
 - New pools with new heating systems
 - Existing pools adding a heating system for the first time
- Compliance Options:
 - Solar Heating Systems
 - 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)
- Exceptions:
 - Portable electric spas, solar only systems, and certain permanent spas



Proposed Change – as Presented at Last Stakeholder Meeting:

- Expand mandatory heating source requirements to existing **nonresidential** pools when replacing a heater
- Existing Residential and Hotel/motel pools are not in scope

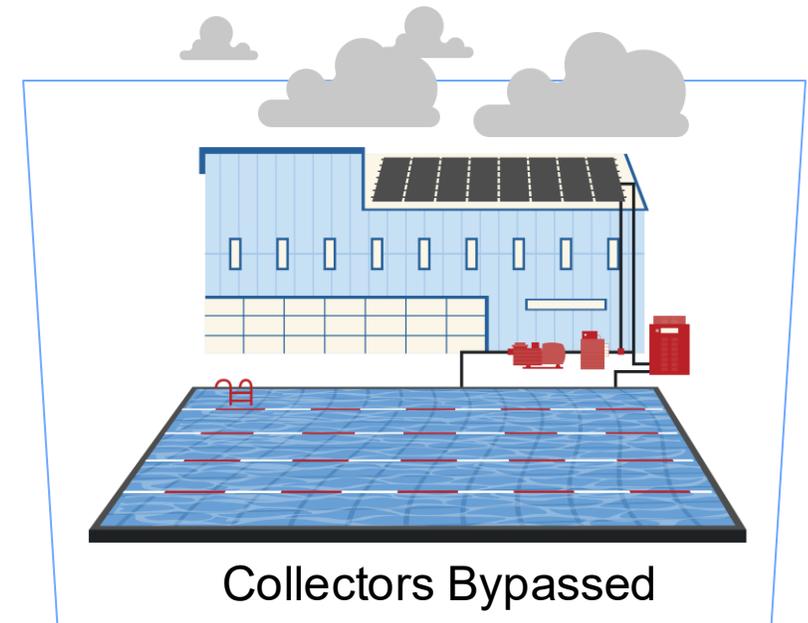
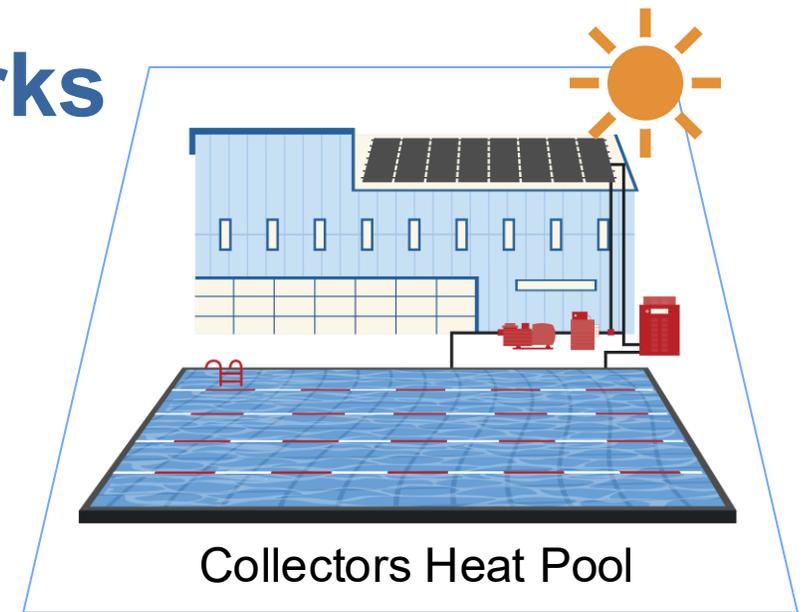
What's New Since Our Last Stakeholder Meeting?

| Summary of Comments Received | Actions Taken |
|---|--|
| 1. Request to study a larger commercial pool size | Analyzed a larger 60,000-gallon pool scenario |
| 2. Request to study pools with higher water temperature. Concerns that solar heating systems cannot reliably maintain pool temperatures | Added an indoor swim school pool scenario to analysis (heated at 90F) |
| 3. Facilities may lack the roof space for solar | Conducted a retrofit survey of municipal pools; lowered solar sizing requirements |
| 4. The upfront cost may be too high for some facilities | Proposing alternate compliance pathway (condensing gas) with lower incremental costs |
| 5. Solar collector lifetime shorter than CASE team assumption | Gathered research on material life and manufacturer warranty for solar collectors |



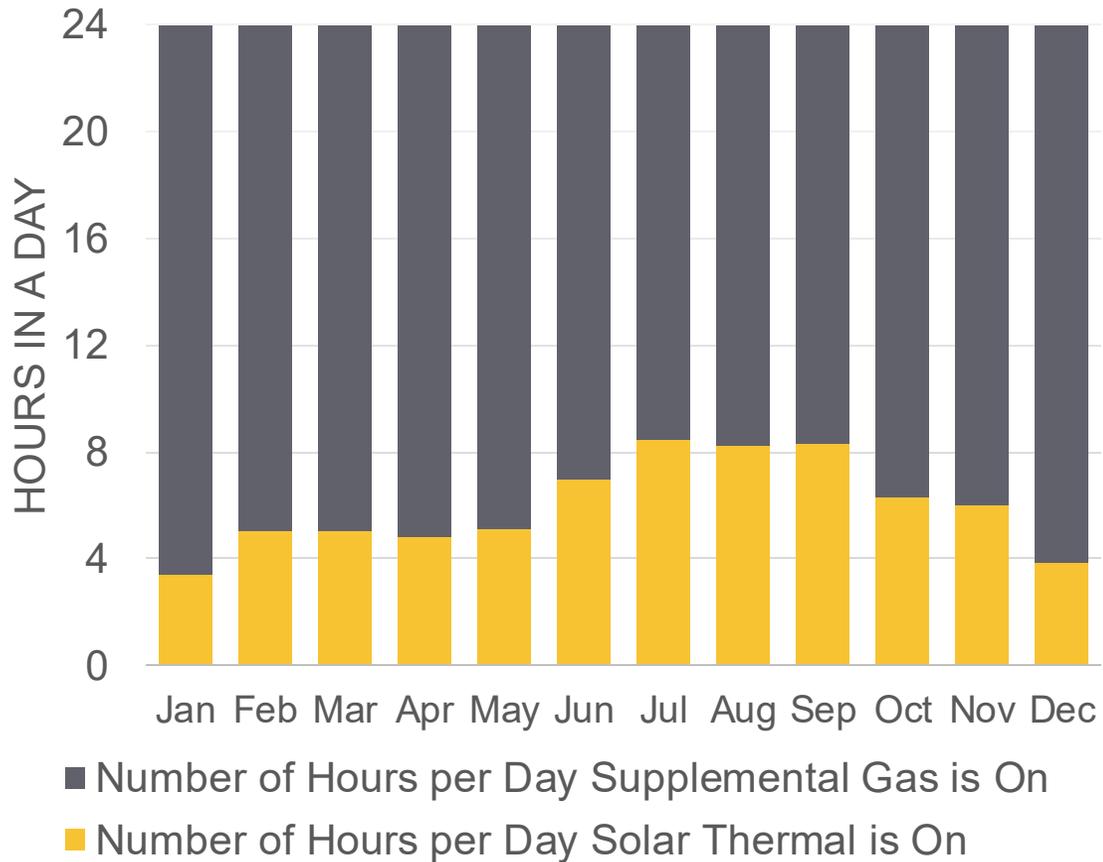
How Solar Thermal Pool Heating Works

- Solar runs when there's heat to collect
 - If collectors are hotter than pool, solar is ON and water gets pumped through collectors
 - If collectors are not warm enough, solar is BYPASSED and supplemental gas or HPPH is used
- Colder Climates = Shorter Solar Window
 - Winter sun warms panels for fewer hours (midday)
 - Outside that time, supplemental heater takes over

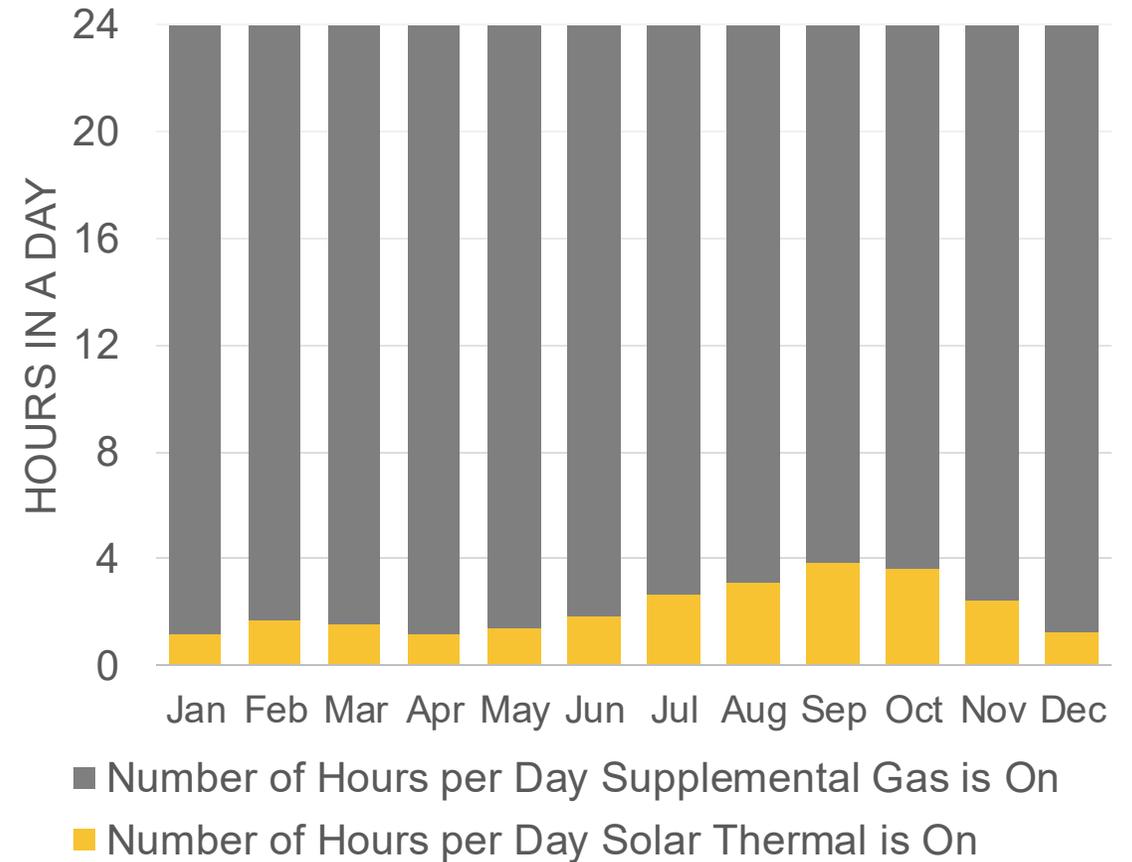


Solar Thermal Operation - Swim School Example (90°F)

- Swim School, CZ09 (Pasadena)



- Swim School, CZ03 (San Francisco)



Retrofit Survey Los Angeles Municipal Pools

Satellite imagery of indoor and outdoor year-round pools
Compared nearby roof area to pool surface area for 32 pools

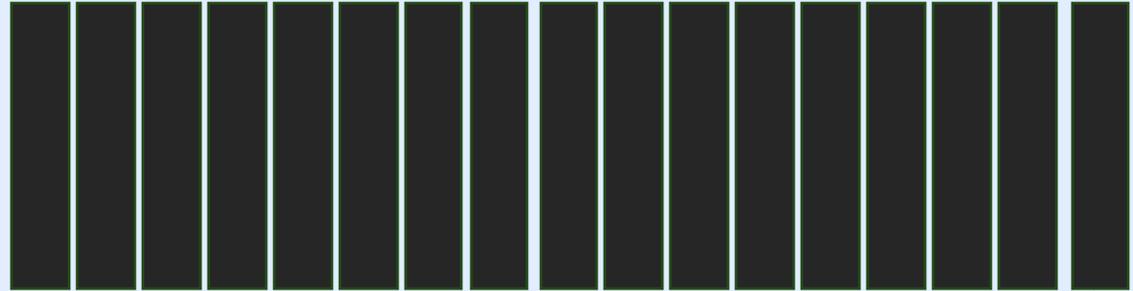


Proposed Solar Sizing Requirement

- Statewide CASE lowered solar collector sizing requirements from 65% to **40% of pool area** to match available roof space
- Reduces incremental first cost and monthly savings by 35%
- Remains cost-effective

2,000 sq. ft pool example

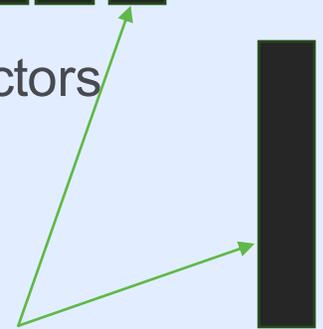
65% or Pool Area – 1,300 sq ft. or 17 collectors



40% of pool area – 800 sq. ft or 10 collectors



20'x4' solar collector



Condensing Gas Pool Heating

Context

- Condensing gas pool heaters are high-efficiency gas pool heaters designed to recover exhaust heat
- Typical condensing gas pool heater market efficiency is around 94%
- DOE requires non-condensing gas pool heaters to be 82% efficient today, with new 84% efficient starting in 2028

Overall Benefits

- Reduced natural gas usage compared to non-condensing gas heaters
- Lower incremental cost than solar thermal
- Similar installation and maintenance to non-condensing gas pool heaters

Proposal Description

Updates to Code Language



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:
 - Exception would apply *only* to group R occupancy buildings
 - Single family
 - Multifamily
 - Hotel/motel

Nonresidential Pools/Spas replacing existing heaters would need to comply with heating source requirements

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

- Permanent *spas* with inadequate SARA do not need to comply with requirements

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



For more information on SARA, see: [Nonresidential, Single-family, and Multifamily Pool and Spa Heating 2025 Factsheet](#)

Proposed Code Change – What’s New?

New Section in 141.0(b)1 – triggers Additions, Alteration and Repairs to Existing Nonresidential Buildings

- Add Section 141.0(b)1F
 - Triggers 110.4(a),(b) and (d)
 - Adds mandatory heating source sizing requirements to existing nonresidential pools when replacing a pool heater
 - Solar Thermal Systems Sized at **40% of Pool/Spa Surface Area**
 - HPPHs
 - On-site Renewable Energy / Site-Recovered Systems
 - **Condensing Gas Pool Heater ($\geq 94\%$ efficient)**
 - Combination Solar Thermal and HPPH
 - Pool Heating Systems approved by the CEC

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

Proposed Code Change – What’s New? (cont)

New Section in 141.0(b)1 – triggers Additions, Alteration and Repairs to Existing Nonresidential Buildings

Exceptions Added to 141.0(b)1Fii

- Similar to New Construction Section 110.4(c) Exceptions:
 - Portable electric spas
 - Solar only systems
 - Certain permanent spas

See Title24stakeholders.com
for proposal description,
justification, draft code
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Incremental Cost Framework

- Solar Thermal Cost Assumptions
- Condensing Gas Pool Heater Cost Assumptions



Solar Thermal – Retrofitting Cost Assumptions

- Collector Installation (Unglazed Systems)
- Plumbing Integration (e.g., trenching, roof penetration, insulation)
- Mechanical additions (new booster pump if existing pump lacks capacity for high-rise building)

| | Cost per Unit | Standard (60,000-gal) Pool Assumptions | Olympic-Sized Pool Assumptions |
|------------------------------|---------------------------|--|--------------------------------|
| Solar Collector Installation | \$20 per sq. ft. of panel | 802 sq. ft. collector | 5,382 sq. ft. collector |
| Additional Piping | \$20 per linear foot | 100 ft piping | 150 ft piping |
| Additional Pump | \$600 per pump | 1 pump | 3 pumps |

Solar Thermal – Incremental Cost Framework



| Prototype | Incremental First Cost (Equipment, Pump, Plumbing + Installation) |
|----------------------------|---|
| Standard (60,000-gal) Pool | \$19,640 |
| Olympic-Sized Pool | \$113,940 |

Assumptions

- Incremental maintenance cost → 1% of First Cost
- Equipment Replacement Assumptions
 - Solar Thermal: Once in 30-year CASE Period (25-year lifetime)
 - Pump: 4x in 30-year CASE Period (7-year lifetime)

~35% reduction in incremental first costs by lowering solar collector sizing requirements from 65% to 40% of pool surface area

Solar Collector Lifetime

Comments received that assumed lifetime of 25 years is too long

- Statewide CASE Team performed additional research
- Surveyed collector manufacturer warranty information
- Warranties ranged from 10 to 18 years with 12.5-year average

Title 24 requires solar collectors to meet standards of the Solar Rating and Certification Corporation (SRCC) OG-100

- Certification requires safety, durability, and performance testing
- Solar collector listing available on SRCC website

Statewide CASE Team requests information on specific experience for solar collector product lifetime

Condensing Gas Heater - Retrofitting Cost Assumptions

Installation Cost Assumptions

- Standard 60,000-gal Pools - Derived from Department of Energy's (DOE) Technical Support Document for Consumer Pool Heaters
 - Scaled to appropriate heater size needed per Prototypical Pool
- Olympic Swimming Pools - Derived from City of Sacramento Public Reports - Replacement Pool Heater Project Costs

Incremental Installation Cost Assumptions:

- Condensate drain piping
- PVC venting (indoor pools)
- Assumed 10% incremental installation cost

Condensing Heater - Incremental Cost Framework

|  | |  | |
|---|---|---|-----------------------|
| Prototype | Incremental First Cost (Equipment + Installation) | Number of Heaters | Heater Capacity (BTU) |
| Standard (60,000-gal) Pool | \$16,636 | 1 | 700,000 |
| Olympic-Sized Pool - Outdoor | \$67,132 | 3 | 4,800,000 |
| Olympic-Sized Pool - Indoor | \$24,866 | 1 | 1,500,000 |

Assumptions

- Incremental maintenance cost (checking condensate removal system and condensate neutralizer):
 - \$11 per heater
- Equipment Replacement assumed to happen twice in 30-year CASE Period (11-year lifetime)

Incremental First Cost of Condensing Gas Pool Heater is Lower than the Solar Pool Heating System

Poll

What has been your experience with a condensing gas pool heater?

Cost Effectiveness and Energy Savings

Methodology and Assumptions

- Energy Savings Methodology and Results
- Cost Impacts Methodology and Results
 - Incremental Costs
 - Energy Cost Savings



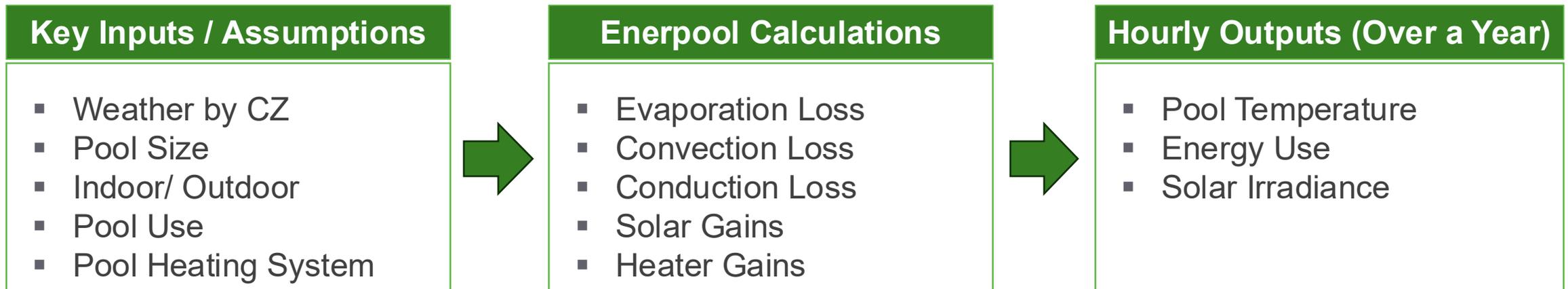
Energy and Energy Cost Savings Methodology

- Seven representative use cases across commercial sectors:
 - Outdoor and indoor pools cooling rates differ due to ambient temperature and wind conditions
 - Outdoor pools heat from sun directly while indoor pools do not
 - Analysis of two common sizes 60,000 gal and Olympic-sized 660,000 gal pools
- Analysis assumes all indoor pools heated year-round and operated daily
- Analysis studied outdoor pools open seasonally and year-round

Energy Modeling Assumptions



- Enerpool Pro 3.0 Pool Heater Simulation Software
- Developed by Canadian Government Agency, Natural Resources Canada
- Baseline is 84% thermal efficient gas heater
- Solar thermal, heat pump pool heater, and condensing gas systems studied



Pool Scenario Assumptions

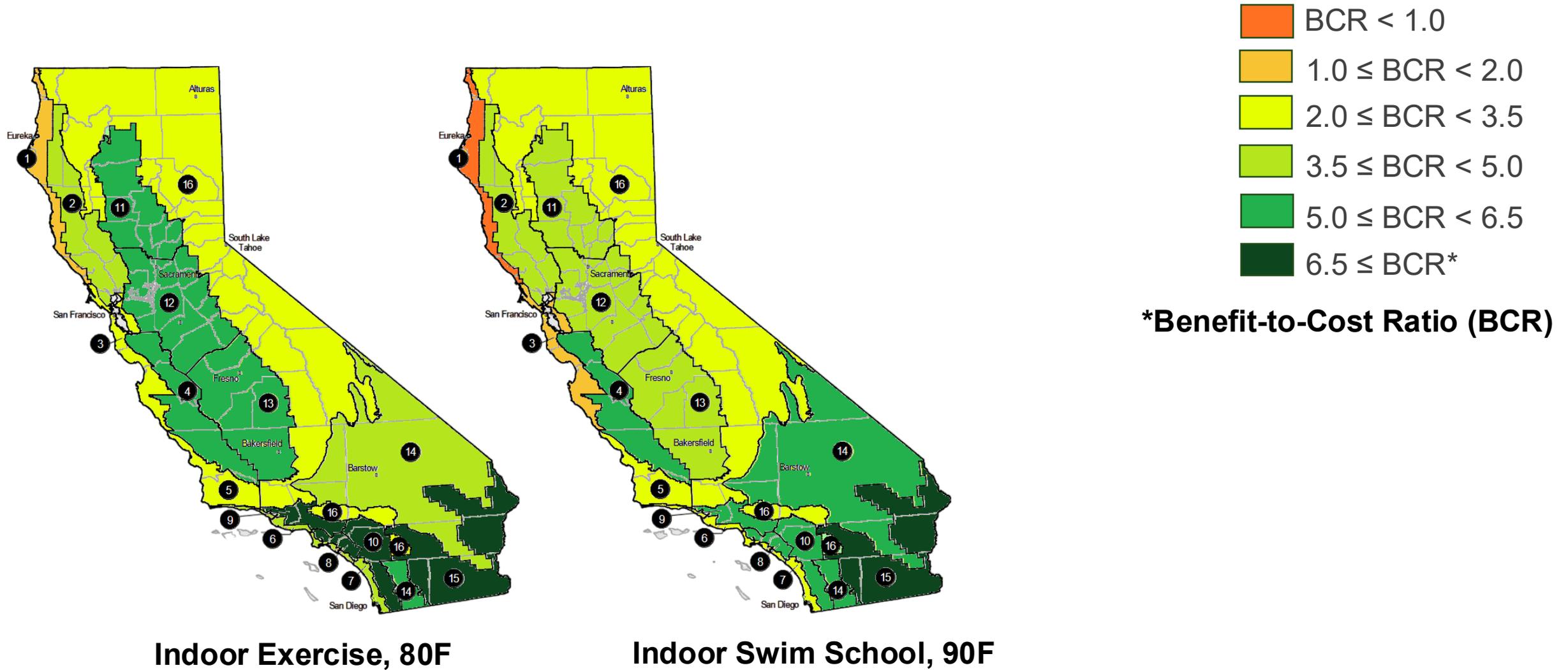
| | Outdoor Exercise Year-round | Outdoor Exercise (Seasonal) | Indoor Exercise | Olympic Outdoor Year-round | Olympic Outdoor (Seasonal) | Olympic Indoor |
|-----------------------------------|-----------------------------|-----------------------------|-----------------------|----------------------------|----------------------------|------------------------|
| Pool Volume (gal) | 60,000 | 60,000 | 60,000 | 660,000 | 660,000 | 660,000 |
| Pool Surface Area | 2,005 ft ² | 2,005 ft ² | 2,005 ft ² | 13,455 ft ² | 13,455 ft ² | 13,455 ft ² |
| Pool Depth | 4 ft | 4 ft | 4 ft | 6.6 ft | 6.6 ft | 6.6 ft |
| Pool Water Temp | 80°F | 80°F | 80°F | 80°F | 80°F | 80°F |
| Indoor Air Temp | N/A | N/A | 82°F | N/A | N/A | 82°F |
| Pool Swim Season | Year round | Varies by Climate | Year round | Year round | Varies by Climate | Year round |
| Pool Use (Daily) | 6am to 8pm | 6am to 8pm | 6am to 9pm | 6am to 9pm | 7am to 8pm | 5am to 9pm |
| Solar Collector Size @ 40% | 802 ft ² | 802 ft ² | 802 ft ² | 5,382 ft ² | 5,382 ft ² | 5,382 ft ² |
| Solar Collector Type | Unglazed | Unglazed | Unglazed | Unglazed | Unglazed | Unglazed |

Swim School Pool Scenario Assumptions

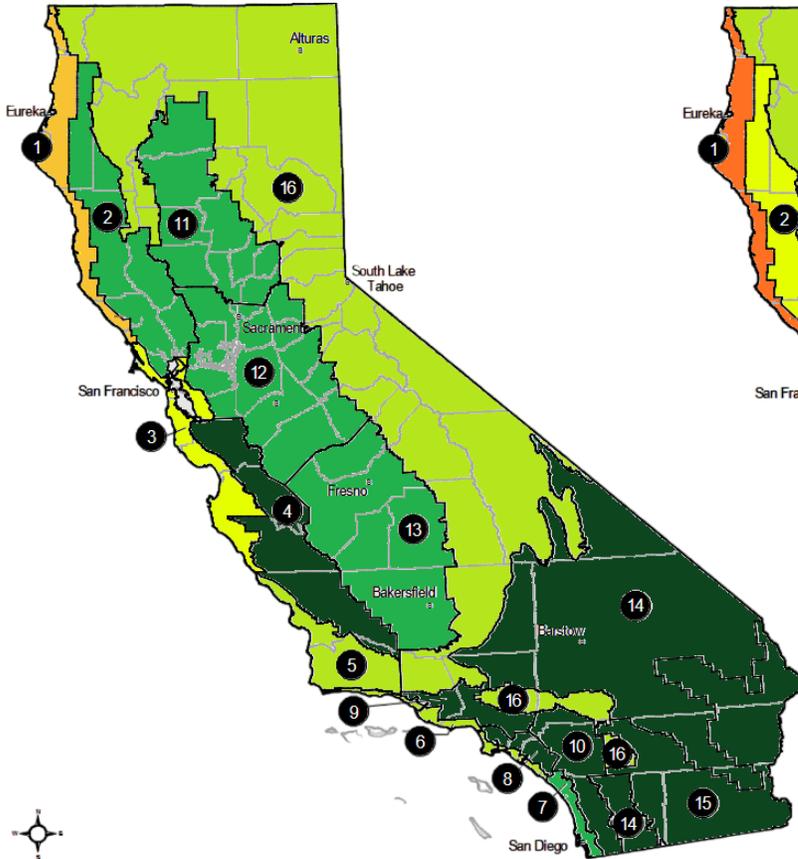
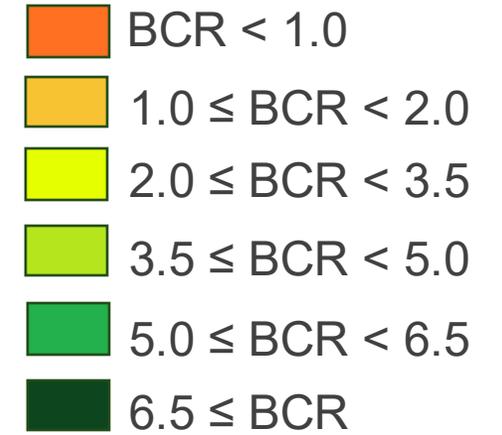
| Dimensions and Use | Indoor Swim School |
|----------------------------|-----------------------|
| Pool Volume | 60,000 gal |
| Pool Surface Area | 2,005 ft ² |
| Pool Depth | 4 ft |
| Pool Water Temp | 90°F |
| Indoor Air Temp | 85°F |
| Pool Swim Season | Year round |
| Pool Use | Daily 7 am to 8 pm |
| Solar Collector Size @ 40% | 802 ft ² |
| Solar Collector Type | Unglazed |



Cost Effectiveness – 60,000-gallon Indoor Pool



Cost Effectiveness – 60,000-gallon Outdoor Pool

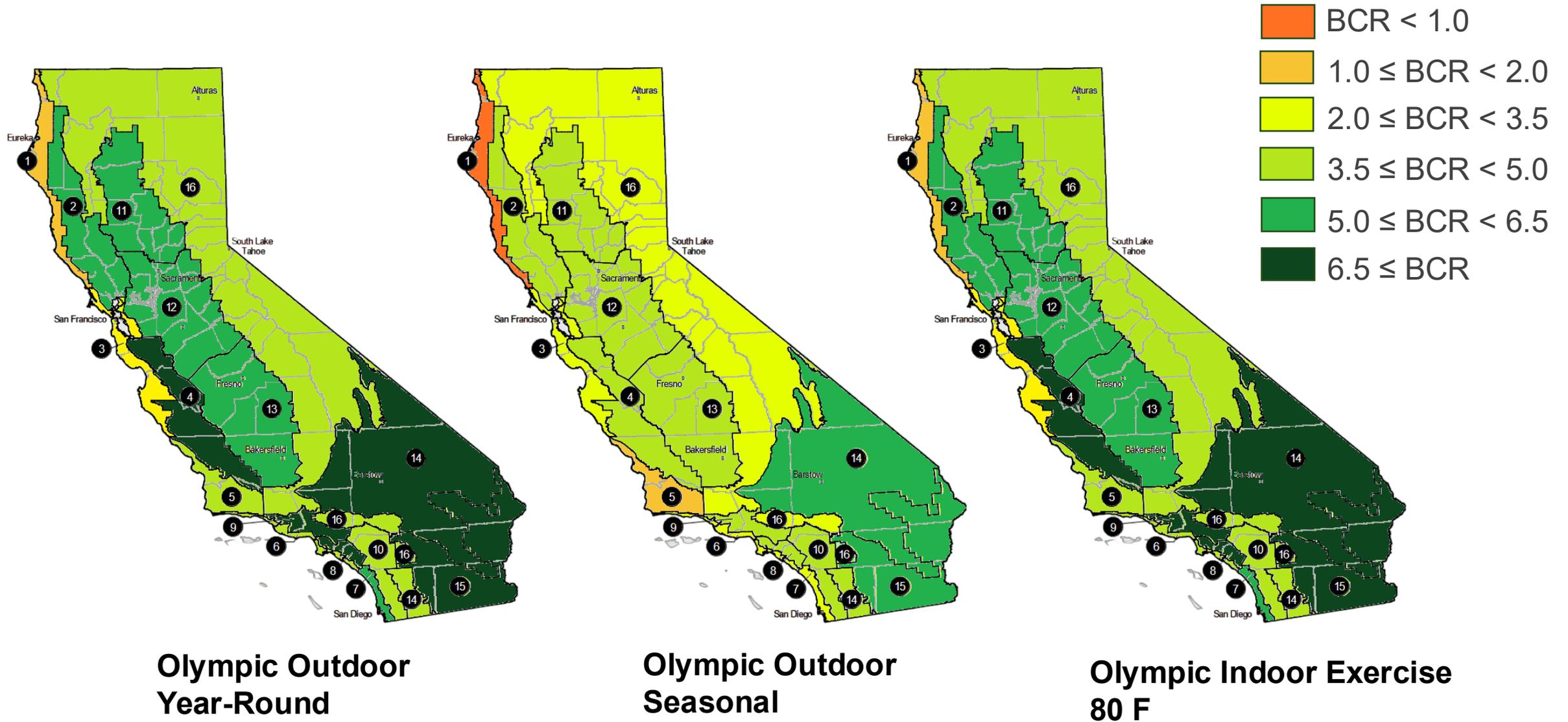


Outdoor Year-Round



Outdoor Seasonal

Cost Effectiveness – 660,000-gallon Olympic Pool



Statewide Impacts

Methodology and Assumptions

- Statewide Energy Impacts
Methodology
- 2029 Pool Forecast



Statewide Energy Impacts Methodology

The Statewide CASE Team estimates annual statewide impacts by multiplying $A \times B \times C$:

- A. per pool energy impacts (discussed in previous section)
- B. number of pool of each applicable pool prototype
- C. number of heated pool in each climate zone

2029 Pool Forecast – Updates

In-scope pools

- Private clubs, health clubs, YMCA/gym, medical facilities, water parks, schools, and municipal pools.

Assumptions

- 9% of all pools expected to need heater replacement (11-year lifecycle)
- Outdoor Pools (78% of market)
 - 70% are seasonal, of which 25% are heated
 - Remaining Outdoor pools operate with year-round heating
- Indoor Pools (22% of market)
 - 39% assumed to be swim schools
 - 61% used as exercise pools (80F)

| Prototypical Pool | 2029 Impacted Pools |
|---|---------------------|
| Standard Outdoor Year-Round Exercise Pool | 235 |
| Standard Outdoor Seasonal Exercise Pool | 137 |
| Standard Indoor Exercise Pool | 135 |
| Standard Indoor Swim School Pool | 86 |
| Olympic Outdoor Year-Round Exercise Pool | 40 |
| Olympic Outdoor Seasonal Exercise Pool | 23 |
| Olympic Indoor Exercise Pool | 38 |
| Total Existing Pools Impacted | 695 |

Preliminary Statewide Energy Savings

| First-Year Statewide Savings | 60,000-gallon Commercial Pool | Olympic-Sized Pool | Measure Total |
|--|-------------------------------|--------------------|--------------------|
| Electricity Savings (GWh) | -- | -- | -- |
| Peak Electrical Demand Reduction (MW) | -- | -- | -- |
| Natural Gas Savings (million therms) | 1.14 | 1.31 | 2.45 |
| Source Energy Savings (million kBtu) | 97.9 | 112.3 | 210.2 |
| LSC* Electricity Savings (million 2029 PV\$) | -- | -- | -- |
| LSC Gas Savings (million 2029 PV\$) | \$91.9 | \$104.7 | \$196.6 |
| Avoided GHG Emissions (Metric Tons CO2e) | 5,970 | 6,850 | 12,820 |
| Monetary Value of Avoided GHG Emissions (\$) | \$735,000 | \$843,000 | \$1,578,000 |

**Long-term Systemwide Costs (LSC)*

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

We want to hear from you!