All-Electric and Solar Thermal Pool Heating

Building Energy Efficiency Standards: January 1, 2023

Complete Report

This report documents the assumptions and cost-effectiveness analysis comparing an all-electric heat pump pool heater (HPPH) or a combination of HPPH with solar power heating systems to a base case of a gas-fired pool heater. The report also compares the use of all-electric HPPH to gas-fired pool heating for single family and multifamily swimming pools and inground spas.

This report presents measures or measure packages that local jurisdictions may consider adopting to achieve energy savings and emissions reductions beyond what will be accomplished by enforcing minimum state requirements, namely the 2022 Building Energy Efficiency Standards (Title 24, Part 6), effective January 1, 2023. The analysis demonstrates the cost-effectiveness of electric pool heating options, which allow jurisdictions to develop, adopt, and implement all-electric ordinances.

The 2022 version of Title 24, Part 6 does not allow electric resistance pool heating unless 60 percent of annual demand is met by site-solar or recovered energy (Section 110.4(a)4). Additionally, if a pool is heated by a heat pump or gas pool heater, a pool cover is required (Section 110.4(b)2).

Prototypes:

For this analysis, the Reach Codes team designed three prototypes:

1. Pool associated with a single-family house.
2. Pool and spa associated with a single-family house.
3. Pool and spa at a location with multifamily housing.

See Table 1 on page two for a complete overview of prototype characteristics and measure packages in this analysis.

Climate Zones: All 16

Table 1. Pool and Spa Prototype Characteristics and Measure Packages

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Prototype Name	Single Family Pool	Single Family Pool and Spa	Single Family Pool and Spa	Multifamily Pool and Spa	Multifamily Pool and Spa
Measure Package Description	All-Electric Pool Heating Package – Without Electric Resistance	All-Electric Pool Heating Package – With Electric Resistance	All-Electric and Solar Thermal Pool Heating Package	All-Electric Pool Heating Package	All-Electric and Solar Thermal Pool Heating Package
Pool Volume	30,000 gal	30,000 gal	30,000 gal	30,000 gal	30,000 gal
Pool Surface Area	660 ft²	660 ft²	660 ft²	660 ft²	660 ft²
Spa Volume	N/A	1,000 gal	1,000 gal	1,000 gal	1,000 gal
Spa Surface Area	N/A	64 ft²	64 ft²	64 ft²	64 ft²
Pool Water Temp Weekday (setback for single family scenarios)	70 °F (gas) / 75 °F (HPPH)	70 °F (gas) / 75 °F (HPPH)	70 °F (gas) / 75 °F (HPPH)	80 °F	80 °F
Pool Water Temp Weekend	80 °F	80 °F	80 °F	80 °F	80 °F
Spa Water Temp Weekday	N/A	70 °F (gas) / 85 °F (HPPH)	70 °F (gas) / 85 °F (HPPH)	102 °F	102 °F
Spa Water Temp Weekend	N/A	102 °F	102 °F	102 °F	102 °F
Pool Swim Season	Part-year	Part-year	Part-year	Year-round	Year-round
Spa Swim Season	N/A	Year-round	Year-round	Year-round	Year-round
Pool and Spa Use	Weekends	Weekends	Weekends	Daily	Daily
Cover Use	Covered when not in use	Covered when not in use	Covered when not in use	Covered when not in use	Covered when not in use
Baseline Auxiliary Heater	Gas-Fired Pool Heater	Gas-Fired Pool Heater	Gas-Fired Pool Heater	Gas-Fired Pool Heater	Gas-Fired Pool Heater
Measure Auxiliary Heater	HPPH	Electric Resistance and HPPH	Electric Resistance and HPPH	Electric Resistance and HPPH	Electric Resistance and HPPH
Solar Collector Type and Size	None	None	Unglazed 450 ft²	None	Unglazed 825 ft²

Study Results

Tables 2 and 3 present the results of the cost effectiveness analysis of all-electric pool heating options in each California climate zone relative to gas-fired pool heating. Table 2 presents the benefit-to-cost ratios using the TDV metric, and Table 3 presents results using an On-Bill metric. When the benefit-to-cost ratio is equal to or greater than one, the measure is cost effective. The options that are cost effective are highlighted in green.

Looking at the TDV metric results, the all-electric option of a HPPH alone without resistance heating or solar thermal is cost effective in all climate zones if used to heat a pool only. If using a heat pump to heat a single family pool and spa, the all-electric option of a HPPH with electric resistance and solar thermal is cost effective in all climate zones except 15 and 16. If heating a multifamily pool and spa, the option of HPPH with resistance backup and solar thermal is cost effective in all climate zones except 1, 15 and 16. All-electric pool heating is not as cost effective when using the On-Bill metric, as shown in Table 3.

Table 2. TDV Benefit-to-Cost Ratio (Cost Effectiveness) of All Electric Pool and Spa

Climate Zone	Electric Utility	Single Family Pool	Single Family Pool and Spa		Multifamily Pool and Spa	
		All Electric (HPPH)	All Electric (HPPH + Electric Resistance)	All Electric + Solar (Solar + HPPH + Electric Resistance)	All Electric (HPPH + Electric Resistance)	All Electric + Solar (Solar + HPPH + Electric Resistance)
CZ01	PG&E	5.8	0.0	1.4	0.0	0.0
CZ02	PG&E	8.5	0.7	3.6	0.0	2.8
CZ03	PG&E	8.0	0.6	2.2	0.0	2.6
CZ04	PG&E	5.1	0.0	2.6	0.1	2.9
CZ04-2	CPAU	5.1	0.0	2.6	0.1	2.9
CZ05	PG&E	5.9	0.0	2.5	0.0	1.5
CZ05-2	PG&E SoCalGas	5.9	0.0	2.5	0.0	1.5
CZ06	SCE	5.1	0.0	2.3	0.0	2.1
CZ07	SDG&E	3.3	0.0	1.5	0.0	1.7
CZ08	SCE	4.2	0.0	2.0	0.0	1.3
CZ09	SCE	4.1	0.0	1.7	0.0	1.8
CZ10	SCE	7.1	0.4	2.5	0.0	1.2
CZ10-2	SDG&E	7.1	0.4	2.5	0.0	1.2
CZ11	PG&E	5.8	0.0	1.7	0.0	1.2
CZ12	PG&E	5.9	0.1	2.4	0.0	2.0
CZ12-2	SMUD	5.9	0.1	2.4	0.0	2.0
CZ13	PG&E	6.4	0.2	2.1	0.0	1.0
CZ14	SCE	10.3	1.0	2.9	0.6	3.0
CZ14-2	SDG&E	10.3	1.0	2.9	0.6	3.0
CZ15	SCE	3.7	0.0	0.9	0.0	0.2
CZ16	PG&E	3.6	0.0	0.3	0.0	0.0

Table 3. On-Bill Benefit-to-Cost Ratio (Cost Effectiveness) of All Electric Pool and Spa

Climate Zone	Electric Utility	Single Family Pool	Single Family Pool and Spa		Multifamily Pool and Spa	
		All Electric (HPPH)	All Electric (HPPH + Electric Resistance)	All Electric + Solar (Solar + HPPH + Electric Resistance)	All Electric (HPPH + Electric Resistance)	All Electric + Solar (Solar + HPPH + Electric Resistance)
CZ01	PG&E	0.0	0.0	0.0	0.0	0.0
CZ02	PG&E	1.5	0.0	2.2	0.0	0.0
CZ03	PG&E	3.0	0.0	0.6	0.0	0.0
CZ04	PG&E	2.0	0.0	1.4	0.0	0.0
CZ04-2	CPAU	7.7	0.7	3.1	5.2	5.5
CZ05	PG&E	0.4	0.0	1.2	0.0	0.0
CZ05-2	PG&E SoCalGas	0.0	0.0	0.0	0.0	0.0
CZ06	SCE	1.1	0.0	0.4	0.0	0.0
CZ07	SDG&E	0.4	0.0	0.0	0.0	0.0
CZ08	SCE	0.7	0.0	0.3	0.0	0.0
CZ09	SCE	1.5	0.0	0.0	0.0	0.0
CZ10	SCE	0.2	0.0	0.0	0.0	0.0
CZ10	SDG&E	1.2	0.0	0.3	0.0	0.0
CZ11	PG&E	3.5	0.0	0.4	0.0	0.0
CZ12	PG&E	2.6	0.0	1.3	0.0	0.0
CZ12-2	SMUD	10.7	2.9	4.3	17.3	11.8
CZ13	PG&E	2.6	0.0	0.8	0.0	0.0
CZ14	SCE	0.9	0.0	0.0	0.0	0.0
CZ14-2	SDG&E	2.2	0.0	0.1	0.0	0.0
CZ15	SCE	0.7	0.0	0.0	0.0	0.0
CZ16	PG&E	0.0	0.0	0.0	0.0	0.0

Local jurisdictions may also adopt ordinances that amend different Parts of the California Building Standards Code or may elect to amend other state or municipal codes. The decision regarding which code to amend will determine the specific requirements that must be followed for an ordinance to be legally enforceable. Reach codes that amend Part 6 of the CA Building Code and require energy performance beyond state code minimums must demonstrate the proposed changes are cost-effective and obtain approval from the CEC.

Model ordinance language and other resources are posted on the C&S Reach Codes Program website at LocalEnergyCodes.com. Local jurisdictions that are considering adopting an ordinance may contact the program for further technical support at info@localenergycodes.com.

Get in touch

Get in touch with the Reach Code Team

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Contact info@localenergycodes.com for no-charge assistance from expert Reach Code advisors

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