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CALIFORNIA ENERGY CODES & STANDARDS
A STATEWIDE UTILITY PROGRAM

Application of the 2022 Studies to the 2025 Energy Code:
Existing Single Family Building Upgrades

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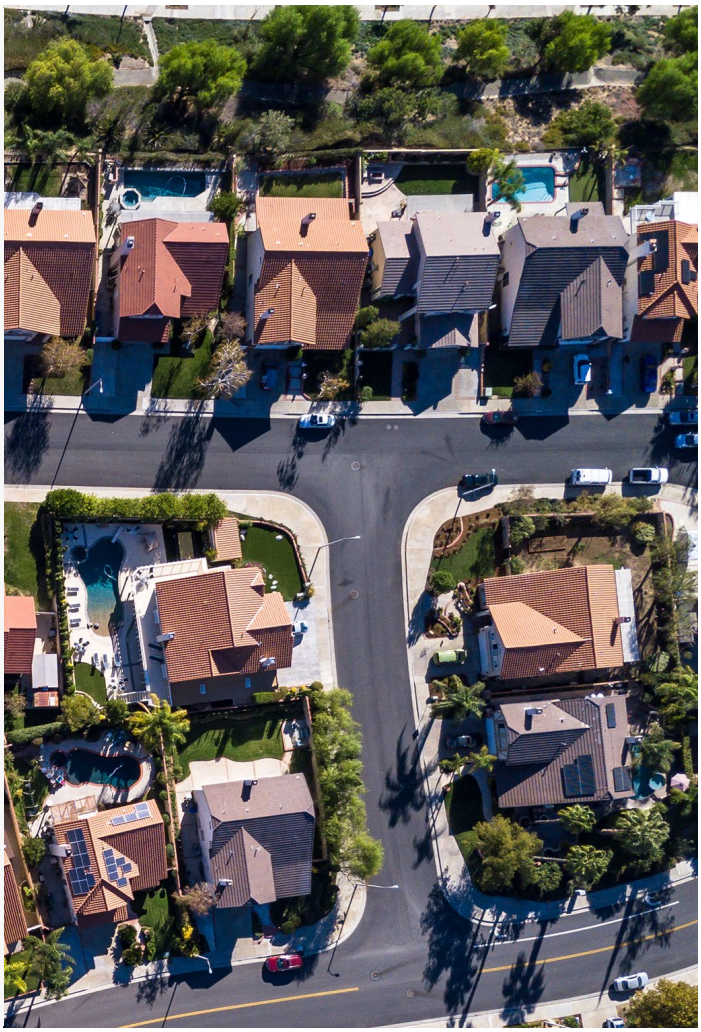

Table 1 Summary of Revisions

Date	Description	Reference (page or section)
8/15/2025	Original Release	N/A

Acronym List

B/C – Lifecycle Benefit-to-Cost Ratio

CASE – Codes and Standards Enhancement

CFL – Compact Fluorescent Lamps

CPAU – City of Palo Alto Utilities

CPUC – California Public Utilities Commission

CZ – California Climate Zone

kWh – Kilowatt Hour

NPV – Net Present Value

PG&E – Pacific Gas and Electric Company

PV – Photovoltaic

SCE – Southern California Edison

SDG&E – San Diego Gas and Electric

SMUD – Sacramento Municipal Utility District

SoCalGas – Southern California Gas Company

Therm – Unit for quantity of heat that equals 100,000 British thermal units

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1 Summary

The California Codes and Standards (C&S) Reach Codes program provides technical support to local governments considering adopting a local ordinance (reach code) intended to support meeting local and/or statewide energy efficiency and greenhouse gas reduction goals. The program facilitates adoption and implementation of the code when requested by local jurisdictions by providing resources such as cost-effectiveness studies, model language, sample findings, and other supporting documentation.

In April 2024, the Statewide Reach Codes Team published the 2022 Cost-Effectiveness Study: Existing Single Family Building Upgrades. This study focuses on existing single family buildings identifying cost-effective measures and measure package upgrades in all 16 California climate zones. The study was conducted to complement Part 6 of the California Building Code (the Energy Code) for the 2022 code cycle, effective January 1, 2023. In the 2019 code cycle the 2019 Cost-Effectiveness Study: Existing Single Family Residential Building Upgrades study included outdoor lighting and a water heater package that was discontinued in the 2022 study but has been brought back in this memo by request from jurisdictions. The studies document the estimated costs, benefits, energy impacts and greenhouse gas emission reductions that may result from implementing an ordinance to help local leadership, residents, and other stakeholders make informed policy decisions.

The Statewide Reach Codes Team reviewed the cost-effectiveness study for impacts of code changes implemented in the 2025 Energy Code. Measures that are now required by code may alter the results presented in the 2022 study. Below is a summary of the changes to the additions and alterations for residential buildings sections of the 2025 Energy Code.

- Mandatory wall insulation R-value has been increased from R-13 to R-15. [Section 150.2(a) of the Energy Code]
- Prescriptive window U-factor has decreased from 0.30 to 0.27 in Climate Zones 1-5, 11-14, and 16. [Section 150.2(b)1B of the Energy Code]

The wall insulation measure has been re-evaluated with R-15 instead of R-13. There is generally a slight increase in utility cost savings as expected with the increase in efficiency. However, there is not a substantial impact on the cost-effectiveness results.

For the prescriptive window U-factor, the original study modeled U-0.28 in all climate zones. This updated memo drops the U-factor from 0.28 to 0.27 in all climate zones. The SHGC is maintained at 0.23 for climate zone 2, 4, and 6-15 and 0.35 for CZ 1, 3, 5, 16. There is minimal impact on the cost-effectiveness results due to this update. However, there are two instances in the 1978-1991 vintage where cost-effectiveness flips from cost-effective to not cost-effective. Climate zone 4 in PGE territory utilizing standard rates and the modest gas escalation is no longer cost-effective on-bill by the smallest margin. Climate zone 10 in SDGE territory utilizing CARE rates and the modest gas escalation has also become no longer cost-effective on-bill.

The 2022 study included a whole building air sealing measure defined as a 30% reduction in air leakage. A new measure – air sealing of the ceiling floor, representing a 14% reduction in air leakage – is added in this memo. Further details and cost-effectiveness results are provided in Section 2.

Lighting measures were previously presented in the 2019 Cost-Effectiveness Study: Existing Single Family Residential Building Upgrades study but were not analyzed in the 2022 study. Updated cost-effectiveness analysis for this measure is presented in Section 3.

The water heating package measure was previously presented in 2019 Cost-Effectiveness Study: Existing Single Family Residential Building Upgrades study. Updated cost-effectiveness analysis for this measure is presented in Section 4.

The 3 kW PV measure from the 2022 study is revised here with an updated cost-effectiveness analysis that accounts for the elimination of the Federal Solar tax credit December 31, 2025. Additional details and analysis are provided in Section 5.

The 2022 report, 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.

2 Air Sealing at the Ceiling

Unlike full air sealing, which has previously been presented, air sealing of the ceiling floor may be an attractive measure for an attic remodel project. The whole building air sealing measure estimated a 30% reduction in air leakage, while air sealing at the ceiling measure results in a 14% reduction in air leakage.

Table 2 through Table 7 present the cost-effectiveness results for the air sealing at the ceiling plane measure. The estimated incremental cost for air sealing at the ceiling plane is $1,963 which is from the 2022 Residential Additions and Alterations CASE Report (Statewide CASE Team, 2020).

Table 2. [Pre-1978] Air Sealing at the Ceiling (Std)

Climate Zone	Electric/ Gas Utility	First Incremental Cost	First-year Utility Savings	Lifecycle NPV Savings		
				2025 LSC NPV	On-Bill NPV Modest Gas Escalation	On-Bill NPV High Gas Escalation
CZ01	PGE	$1,963	$33	($465)	($997)	($432)
CZ02	PGE	$1,963	$18	($1,114)	($1,433)	($1,118)
CZ03	PGE	$1,963	$17	($1,180)	($1,463)	($1,171)
CZ04	PGE	$1,963	$25	($1,081)	($1,290)	($979)
CZ04	CPAU	$1,963	$21	($1,081)	($1,379)	($1,069)
CZ05	PGE	$1,963	$16	($1,230)	($1,500)	($1,235)
CZ05	PGE/SCG	$1,963	$14	($1,230)	($1,555)	($1,325)
CZ06	SCE/SCG	$1,963	($2)	($1,797)	($1,987)	($1,937)
CZ07	SDGE	$1,963	($3)	($1,813)	($2,008)	($1,934)
CZ08	SCE/SCG	$1,963	$7	($1,680)	($1,775)	($1,703)
CZ09	SCE/SCG	$1,963	$10	($1,597)	($1,693)	($1,592)
CZ10	SCE/SCG	$1,963	$17	($1,497)	($1,540)	($1,420)
CZ10	SDGE	$1,963	$23	($1,497)	($1,366)	($1,237)
CZ11	PGE	$1,963	$32	($1,014)	($1,120)	($816)
CZ12	PGE	$1,963	$22	($1,147)	($1,348)	($1,064)
CZ12	SMUD/PGE	$1,963	$17	($1,147)	($1,468)	($1,190)
CZ13	PGE	$1,963	$31	($1,114)	($1,162)	($918)
CZ14	SCE/SCG	$1,963	$32	($897)	($1,130)	($832)
CZ14	SDGE	$1,963	$42	($897)	($845)	($519)
CZ15	SCE/SCG	$1,963	$40	($1,297)	($1,041)	($946)
CZ16	PGE	$1,963	$30	($581)	($1,071)	($551)

Table 3. [1978-1991] Air Sealing at the Ceiling (Std)

Climate Zone	Electric/ Gas Utility	First Incremental Cost	First-year Utility Savings	Lifecycle NPV Savings		
				2025 LSC NPV	On-Bill NPV Modest Gas Escalation	On-Bill NPV High Gas Escalation
CZ01	PGE	$1,963	$23	($931)	($1,292)	($903)
CZ02	PGE	$1,963	$13	($1,364)	($1,570)	($1,341)
CZ03	PGE	$1,963	$10	($1,480)	($1,668)	($1,496)
CZ04	PGE	$1,963	$16	($1,330)	($1,522)	($1,292)
CZ04	CPAU	$1,963	$13	($1,330)	($1,575)	($1,356)
CZ05	PGE	$1,963	$11	($1,447)	($1,649)	($1,466)
CZ05	PGE/SCG	$1,963	$10	($1,447)	($1,684)	($1,522)
CZ06	SCE/SCG	$1,963	($1)	($1,830)	($1,967)	($1,934)
CZ07	SDGE	$1,963	($4)	($1,896)	($2,040)	($1,991)
CZ08	SCE/SCG	$1,963	$4	($1,797)	($1,860)	($1,813)
CZ09	SCE/SCG	$1,963	$5	($1,747)	($1,823)	($1,764)
CZ10	SCE/SCG	$1,963	$10	($1,663)	($1,722)	($1,652)
CZ10	SDGE	$1,963	$14	($1,663)	($1,603)	($1,517)
CZ11	PGE	$1,963	$25	($1,264)	($1,320)	($1,096)
CZ12	PGE	$1,963	$16	($1,380)	($1,520)	($1,314)
CZ12	SMUD/PGE	$1,963	$12	($1,380)	($1,604)	($1,402)
CZ13	PGE	$1,963	$23	($1,364)	($1,373)	($1,199)
CZ14	SCE/SCG	$1,963	$22	($1,230)	($1,397)	($1,182)
CZ14	SDGE	$1,963	$28	($1,230)	($1,212)	($974)
CZ15	SCE/SCG	$1,963	$32	($1,463)	($1,225)	($1,154)
CZ16	PGE	$1,963	$21	($1,014)	($1,357)	($1,001)

Table 4. [1992-2010] Air Sealing at the Ceiling (Std)

Climate Zone	Electric/ Gas Utility	First Incremental Cost	First-year Utility Savings	Lifecycle NPV Savings		
				2025 LSC NPV	On-Bill NPV Modest Gas Escalation	On-Bill NPV High Gas Escalation
CZ01	PGE	$1,963	$14	($1,314)	($1,550)	($1,309)
CZ02	PGE	$1,963	$9	($1,530)	($1,687)	($1,529)
CZ03	PGE	$1,963	$7	($1,613)	($1,744)	($1,618)
CZ04	PGE	$1,963	$11	($1,530)	($1,653)	($1,501)
CZ04	CPAU	$1,963	$9	($1,530)	($1,701)	($1,557)
CZ05	PGE	$1,963	$7	($1,613)	($1,759)	($1,637)
CZ05	PGE/SCG	$1,963	$6	($1,613)	($1,788)	($1,686)
CZ06	SCE/SCG	$1,963	$1	($1,863)	($1,936)	($1,911)
CZ07	SDGE	$1,963	$0	($1,896)	($1,944)	($1,911)
CZ08	SCE/SCG	$1,963	$3	($1,830)	($1,885)	($1,851)
CZ09	SCE/SCG	$1,963	$3	($1,780)	($1,892)	($1,853)
CZ10	SCE/SCG	$1,963	$6	($1,763)	($1,814)	($1,767)
CZ10	SDGE	$1,963	$8	($1,763)	($1,741)	($1,681)
CZ11	PGE	$1,963	$14	($1,530)	($1,581)	($1,437)
CZ12	PGE	$1,963	$10	($1,580)	($1,693)	($1,560)
CZ12	SMUD/PGE	$1,963	$8	($1,580)	($1,737)	($1,606)
CZ13	PGE	$1,963	$12	($1,580)	($1,643)	($1,531)
CZ14	SCE/SCG	$1,963	$12	($1,530)	($1,639)	($1,503)
CZ14	SDGE	$1,963	$16	($1,530)	($1,537)	($1,382)
CZ15	SCE/SCG	$1,963	$17	($1,680)	($1,572)	($1,532)
CZ16	PGE	$1,963	$14	($1,314)	($1,556)	($1,314)

Table 5. [Pre-1978] Air Sealing at the Ceiling (CARE)

Climate Zone	Electric/ Gas Utility	First Incremental Cost	First-year Utility Savings	Lifecycle NPV Savings		
				2025 LSC NPV	On-Bill NPV Modest Gas Escalation	On-Bill NPV High Gas Escalation
CZ01	PGE	$1,963	$26	($465)	($1,212)	($766)
CZ02	PGE	$1,963	$14	($1,114)	($1,550)	($1,302)
CZ03	PGE	$1,963	$13	($1,180)	($1,574)	($1,343)
CZ04	PGE	$1,963	$18	($1,081)	($1,459)	($1,216)
CZ04	CPAU	$1,963	$0	($1,081)	($1,963)	($1,963)
CZ05	PGE	$1,963	$12	($1,230)	($1,604)	($1,395)
CZ05	PGE/SCG	$1,963	$11	($1,230)	($1,648)	($1,467)
CZ06	SCE/SCG	$1,963	($1)	($1,797)	($1,969)	($1,928)
CZ07	SDGE	$1,963	($1)	($1,813)	($1,976)	($1,918)
CZ08	SCE/SCG	$1,963	$5	($1,680)	($1,824)	($1,768)
CZ09	SCE/SCG	$1,963	$8	($1,597)	($1,764)	($1,686)
CZ10	SCE/SCG	$1,963	$12	($1,497)	($1,659)	($1,566)
CZ10	SDGE	$1,963	$16	($1,497)	($1,546)	($1,443)
CZ11	PGE	$1,963	$23	($1,014)	($1,353)	($1,116)
CZ12	PGE	$1,963	$17	($1,147)	($1,503)	($1,279)
CZ12	SMUD/PGE	$1,963	$11	($1,147)	($1,623)	($1,406)
CZ13	PGE	$1,963	$22	($1,114)	($1,394)	($1,205)
CZ14	SCE/SCG	$1,963	$23	($897)	($1,352)	($1,120)
CZ14	SDGE	$1,963	$30	($897)	($1,163)	($905)
CZ15	SCE/SCG	$1,963	$27	($1,297)	($1,334)	($1,266)
CZ16	PGE	$1,963	$24	($581)	($1,270)	($859)

Table 6. [1978-1991] Air Sealing at the Ceiling (CARE)

Climate Zone	Electric/ Gas Utility	First Incremental Cost	First-year Utility Savings	Lifecycle NPV Savings		
				2025 LSC NPV	On-Bill NPV Modest Gas Escalation	On-Bill NPV High Gas Escalation
CZ01	PGE	$1,963	$18	($931)	($1,442)	($1,135)
CZ02	PGE	$1,963	$10	($1,364)	($1,658)	($1,477)
CZ03	PGE	$1,963	$8	($1,480)	($1,734)	($1,598)
CZ04	PGE	$1,963	$12	($1,330)	($1,627)	($1,446)
CZ04	CPAU	$1,963	$0	($1,330)	($1,963)	($1,963)
CZ05	PGE	$1,963	$8	($1,447)	($1,719)	($1,575)
CZ05	PGE/SCG	$1,963	$7	($1,447)	($1,746)	($1,619)
CZ06	SCE/SCG	$1,963	($0)	($1,830)	($1,959)	($1,933)
CZ07	SDGE	$1,963	($2)	($1,896)	($2,003)	($1,964)
CZ08	SCE/SCG	$1,963	$3	($1,797)	($1,886)	($1,848)
CZ09	SCE/SCG	$1,963	$4	($1,747)	($1,859)	($1,813)
CZ10	SCE/SCG	$1,963	$7	($1,663)	($1,790)	($1,736)
CZ10	SDGE	$1,963	$10	($1,663)	($1,710)	($1,641)
CZ11	PGE	$1,963	$18	($1,264)	($1,500)	($1,325)
CZ12	PGE	$1,963	$12	($1,380)	($1,631)	($1,469)
CZ12	SMUD/PGE	$1,963	$8	($1,380)	($1,716)	($1,558)
CZ13	PGE	$1,963	$16	($1,364)	($1,545)	($1,411)
CZ14	SCE/SCG	$1,963	$16	($1,230)	($1,545)	($1,378)
CZ14	SDGE	$1,963	$20	($1,230)	($1,422)	($1,233)
CZ15	SCE/SCG	$1,963	$22	($1,463)	($1,460)	($1,410)
CZ16	PGE	$1,963	$16	($1,014)	($1,491)	($1,211)

Table 7. [1991-2010] Air Sealing at the Ceiling (CARE)

Climate Zone	Electric/ Gas Utility	First Incremental Cost	First-year Utility Savings	Lifecycle NPV Savings		
				2025 LSC NPV	On-Bill NPV Modest Gas Escalation	On-Bill NPV High Gas Escalation
CZ01	PGE	$1,963	$11	($1,314)	($1,642)	($1,452)
CZ02	PGE	$1,963	$7	($1,530)	($1,749)	($1,625)
CZ03	PGE	$1,963	$6	($1,613)	($1,793)	($1,693)
CZ04	PGE	$1,963	$8	($1,530)	($1,729)	($1,609)
CZ04	CPAU	$1,963	$0	($1,530)	($1,963)	($1,963)
CZ05	PGE	$1,963	$5	($1,613)	($1,804)	($1,708)
CZ05	PGE/SCG	$1,963	$5	($1,613)	($1,827)	($1,747)
CZ06	SCE/SCG	$1,963	$1	($1,863)	($1,940)	($1,920)
CZ07	SDGE	$1,963	$0	($1,896)	($1,944)	($1,918)
CZ08	SCE/SCG	$1,963	$2	($1,830)	($1,905)	($1,879)
CZ09	SCE/SCG	$1,963	$2	($1,780)	($1,908)	($1,878)
CZ10	SCE/SCG	$1,963	$4	($1,763)	($1,855)	($1,819)
CZ10	SDGE	$1,963	$6	($1,763)	($1,805)	($1,758)
CZ11	PGE	$1,963	$10	($1,530)	($1,685)	($1,572)
CZ12	PGE	$1,963	$7	($1,580)	($1,759)	($1,654)
CZ12	SMUD/PGE	$1,963	$5	($1,580)	($1,802)	($1,700)
CZ13	PGE	$1,963	$9	($1,580)	($1,732)	($1,644)
CZ14	SCE/SCG	$1,963	$9	($1,530)	($1,722)	($1,615)
CZ14	SDGE	$1,963	$11	($1,530)	($1,652)	($1,529)
CZ15	SCE/SCG	$1,963	$12	($1,680)	($1,696)	($1,667)
CZ16	PGE	$1,963	$11	($1,314)	($1,645)	($1,454)

3 Lighting Measures

LED lighting and exterior lighting control measures were previously evaluated in the 2019 Cost-Effectiveness Study: Existing Single Family Residential Building Upgrades study. These measures are not included in the 2022 Cost-Effectiveness Study: Existing Single Family Building Upgrades study, but have been re-evaluated and included in this memo. The updated analysis follows the same methodology as the 2019 study, but with updated costs for equipment and updated utility rates.

The three measures evaluated are LED lighting, exterior photosensor, and LED lighting plus photosensor. Table 8 through Table 10 show the results for the different lighting measures evaluated. Each measure is explained in more detail below.

LED Lighting: Replace screw-in (A-based for lamps) incandescent lamps and compact fluorescent lamps (CFLs) with light-emitting diode (LED) A-lamps. This analysis was conducted external to the energy model and evaluated replacement of a 13 W CFL lamp with an 9.6 W LED lamp operating 620 hours annually. Annual hour estimates were based on whole building average hours of operation from a 2010 lighting study by KEMA (KEMA, 2010). Lifetime assumptions were 10,000 hours for CFLs and 25,000 hours for LED lamps. For incremental cost calculations it was assumed CFLs have a lifetime of 15 years, are installed five years prior to the retrofit, and would need to be replaced at year ten and 25.

Exterior Lighting Controls/Photosensor: Evaluation of exterior lighting controls was completed on a per-luminaire basis external to the energy model and assumes a screw-in photosensor control is installed in outdoor lighting luminaires. Energy savings of 12.1 kWh per year was applied based on analysis done by the Consortium for Energy Efficiency, assuming LED lamps, 2.6 hours per day of operation, and that photosensor controls reduce operating hours on average 20 percent each day (CEE, 2014). Energy savings will be higher for incandescent or CFL luminaires.

Exterior Lighting Controls/Photosensor+LED: An additional evaluation was completed for exterior lighting controls on a per-luminaire basis external to the energy model and assumes a screw-in photosensor control is installed in outdoor lighting luminaires and incandescent lamps CFLs are replaced with light-emitting diode (LED) A-lamps. Energy savings of 14.3 kWh per year was applied based on the sum of the LED lighting and Exterior Lighting Controls with Photosensor kWh energy savings.

For the measures including a LED, a cost of $3.49 for LED dimmable A19 lamp 60 W equivalent is used. A cost of $1.74 is used for an equivalent CFL product which was used to estimate total replacement costs at years 10 and 25. Costs are based on a single LED lamp replacement. For the photosensor, an incremental cost of $12.62, based on a screw-in photosensor control, was obtained from an on-line product search of available products. A five-year lifetime for this type of control was assumed.

Table 8. [All Vintages] LED Lamp vs. CFL

Climate Zone	Electric/ Gas Utility	Measure Cost	Electricity Savings	First Year Utility Cost Savings	Customer On-Bill Modest Gas Escalation		Customer On-Bill High Gas Escalation	
					B/C Ratio	NPV	B/C Ratio	NPV
CZ01	PGE	$1.75	2.2	$0.77	10.05	$15.82	10.58	$16.74
CZ02	PGE	$1.75	2.2	$0.86	11.26	$17.94	11.85	$18.98
CZ03	PGE	$1.75	2.2	$0.78	10.14	$15.99	10.68	$16.92
CZ04	PGE	$1.75	2.2	$0.80	10.39	$16.42	10.94	$17.38
CZ04	CPAU	$1.75	2.2	$0.41	5.32	$7.56	5.60	$8.05
CZ05	PGE	$1.75	2.2	$0.78	10.14	$15.99	10.67	$16.92
CZ05	PGE/SCG	$1.75	2.2	$0.78	10.14	$15.99	10.67	$16.92
CZ06	SCE/SCG	$1.75	2.2	$0.66	8.44	$13.01	8.99	$13.97
CZ07	SDGE	$1.75	2.2	$0.95	13.15	$21.24	13.03	$21.04
CZ08	SCE/SCG	$1.75	2.2	$0.74	9.51	$14.89	10.14	$15.98
CZ09	SCE/SCG	$1.75	2.2	$0.71	9.17	$14.29	9.77	$15.33
CZ10	SCE/SCG	$1.75	2.2	$0.73	9.38	$14.65	9.99	$15.72
CZ10	SDGE	$1.75	2.2	$1.07	14.86	$24.24	14.74	$24.02
CZ11	PGE	$1.75	2.2	$0.85	11.05	$17.57	11.63	$18.59
CZ12	PGE	$1.75	2.2	$0.79	10.32	$16.29	10.86	$17.24
CZ12	SMUD/PGE	$1.75	2.2	$0.47	6.08	$8.88	6.40	$9.44
CZ13	PGE	$1.75	2.2	$0.86	11.27	$17.96	11.86	$19.00
CZ14	SCE/SCG	$1.75	2.2	$0.74	9.58	$15.00	10.21	$16.10
CZ14	SDGE	$1.75	2.2	$1.06	14.68	$23.93	14.56	$23.71
CZ15	SCE/SCG	$1.75	2.2	$0.78	10.01	$15.75	10.66	$16.90
CZ16	PGE	$1.75	2.2	$0.77	9.98	$15.71	10.51	$16.62

Table 9. [All Vintages] Exterior Photosensor

Climate Zone	Electric/ Gas Utility	Measure Cost	Electricity Savings	First Year Utility Cost Savings	Customer On-Bill Modest Gas Escalation		Customer On-Bill High Gas Escalation	
					B/C Ratio	NPV	B/C Ratio	NPV
CZ01	PGE	$54.03	12.1	$4.16	1.75	$40.75	1.85	$45.74
CZ02	PGE	$54.03	12.1	$4.16	1.75	$40.75	1.85	$45.74
CZ03	PGE	$54.03	12.1	$4.16	1.75	$40.75	1.85	$45.74
CZ04	PGE	$54.03	12.1	$4.16	1.75	$40.75	1.85	$45.74
CZ04	CPAU	$54.03	12.1	$2.12	0.89	($5.69)	0.94	($3.15)
CZ05	PGE	$54.03	12.1	$4.16	1.75	$40.75	1.85	$45.74
CZ05	PGE/SCG	$54.03	12.1	$4.16	1.75	$40.75	1.85	$45.74
CZ06	SCE/SCG	$54.03	12.1	$3.48	1.45	$24.36	1.55	$29.48
CZ07	SDGE	$54.03	12.1	$5.07	2.27	$68.58	2.25	$67.53
CZ08	SCE/SCG	$54.03	12.1	$3.48	1.45	$24.36	1.55	$29.48
CZ09	SCE/SCG	$54.03	12.1	$3.48	1.45	$24.36	1.55	$29.48
CZ10	SCE/SCG	$54.03	12.1	$3.48	1.45	$24.36	1.55	$29.48
CZ10	SDGE	$54.03	12.1	$5.07	2.27	$68.58	2.25	$67.53
CZ11	PGE	$54.03	12.1	$4.16	1.75	$40.75	1.85	$45.74
CZ12	PGE	$54.03	12.1	$4.16	1.75	$40.75	1.85	$45.74
CZ12	SMUD/PGE	$54.03	12.1	$1.46	0.62	($20.73)	0.65	($18.98)
CZ13	PGE	$54.03	12.1	$4.16	1.75	$40.75	1.85	$45.74
CZ14	SCE/SCG	$54.03	12.1	$3.48	1.45	$24.36	1.55	$29.48
CZ14	SDGE	$54.03	12.1	$5.07	2.27	$68.58	2.25	$67.53
CZ15	SCE/SCG	$54.03	12.1	$3.48	1.45	$24.36	1.55	$29.48
CZ16	PGE	$54.03	12.1	$4.16	1.75	$40.75	1.85	$45.74

Table 10. [All Vintages] LED and Photosensor

Climate Zone	Electric/ Gas Utility	Measure Cost	Electricity Savings	First Year Utility Cost Savings	Customer On-Bill Modest Gas Escalation		Customer On-Bill High Gas Escalation	
					B/C Ratio	NPV	B/C Ratio	NPV
CZ01	PGE	$55.77	14.3	$4.93	2.01	$56.57	2.12	$62.48
CZ02	PGE	$55.77	14.3	$5.02	2.05	$58.70	2.16	$64.72
CZ03	PGE	$55.77	14.3	$4.94	2.02	$56.74	2.12	$62.66
CZ04	PGE	$55.77	14.3	$4.95	2.03	$57.17	2.13	$63.12
CZ04	CPAU	$55.77	14.3	$2.53	1.03	$1.87	1.09	$4.90
CZ05	PGE	$55.77	14.3	$4.94	2.02	$56.74	2.12	$62.66
CZ05	PGE/SCG	$55.77	14.3	$4.94	2.02	$56.74	2.12	$62.66
CZ06	SCE/SCG	$55.77	14.3	$4.13	1.67	$37.37	1.78	$43.45
CZ07	SDGE	$55.77	14.3	$6.02	2.61	$89.82	2.59	$88.57
CZ08	SCE/SCG	$55.77	14.3	$4.22	1.70	$39.25	1.82	$45.46
CZ09	SCE/SCG	$55.77	14.3	$4.19	1.69	$38.65	1.80	$44.82
CZ10	SCE/SCG	$55.77	14.3	$4.21	1.70	$39.01	1.81	$45.20
CZ10	SDGE	$55.77	14.3	$6.14	2.66	$92.82	2.64	$91.55
CZ11	PGE	$55.77	14.3	$5.00	2.05	$58.33	2.15	$64.33
CZ12	PGE	$55.77	14.3	$4.95	2.02	$57.05	2.13	$62.98
CZ12	SMUD/PGE	$55.77	14.3	$1.93	0.79	($11.85)	0.83	($9.54)
CZ13	PGE	$55.77	14.3	$5.02	2.05	$58.71	2.16	$64.73
CZ14	SCE/SCG	$55.77	14.3	$4.22	1.71	$39.37	1.82	$45.58
CZ14	SDGE	$55.77	14.3	$6.13	2.66	$92.51	2.64	$91.24
CZ15	SCE/SCG	$55.77	14.3	$4.26	1.72	$40.12	1.83	$46.38
CZ16	PGE	$55.77	14.3	$4.92	2.01	$56.46	2.12	$62.36

4 Water Heating Package

This package includes the following:

- R-6 water heater blanket
- R-3 hot water pipe insulation
- Low flow fixtures: two low flow showerheads and three sink aerators.

This analysis assumes the homeowner installs these measures themselves and therefore no labor costs. Costs are based on Home Depot prices from August of 2025. The water heater package is evaluated over a 15-year analysis period and assumes the modest gas escalation rate.

Table 11. [All Vintages] Water Heating Package

Climate Zone	Electric/ Gas Utility	Measure Cost	Gas Savings (therms)	First Year Utility Cost Savings	Customer On-Bill	
					B/C Ratio	NPV
CZ01	PGE	$125.68	14.69	$31.11	3.96	$371.76
CZ02	PGE	$125.68	15.60	$35.20	4.48	$437.15
CZ03	PGE	$125.68	15.70	$31.43	4.00	$376.88
CZ04	PGE	$125.68	16.05	$32.62	4.15	$395.78
CZ04	CPAU	$125.68	16.05	$31.99	4.07	$385.77
CZ05	PGE	$125.68	15.83	$31.37	3.99	$375.88
CZ05	PGE/SCG	$125.68	15.83	$28.29	3.60	$326.59
CZ06	SCE/SCG	$125.68	16.67	$29.18	3.71	$340.84
CZ07	SDGE	$125.68	16.75	$37.25	4.74	$469.81
CZ08	SCE/SCG	$125.68	16.78	$29.36	3.74	$343.80
CZ09	SCE/SCG	$125.68	16.66	$29.27	3.72	$342.34
CZ10	SCE/SCG	$125.68	16.58	$28.99	3.69	$337.73
CZ10	SDGE	$125.68	16.58	$37.77	4.80	$478.19
CZ11	PGE	$125.68	15.87	$32.96	4.19	$401.32
CZ12	PGE	$125.68	15.90	$32.85	4.18	$399.47
CZ12	SMUD/PGE	$125.68	15.90	$32.85	4.18	$399.47
CZ13	PGE	$125.68	16.32	$33.00	4.20	$401.93
CZ14	SCE/SCG	$125.68	16.11	$29.79	3.79	$350.57
CZ14	SDGE	$125.68	16.11	$39.23	4.99	$501.49
CZ15	SCE/SCG	$125.68	17.40	$30.16	3.84	$356.50
CZ16	PGE	$125.68	15.14	$31.75	4.04	$381.87

5 PV

The results for 3 kW PV have been updated from the 2022 study to remove the federal solar tax credit from the cost-effectiveness calculations. The removal of the solar tax credit has a substantial impact on many climate zones across all vintages and will impact the FlexPath.

The following describes the impacts and changes to cost-effectiveness from the 2022 study. These observations are utilizing standard rates. Previously, with the solar tax credit, the 3 kW PV measure in the pre-1978 vintage was on-bill cost effective in all climate zones using both the modest and high gas escalation rates. However, with the credit removed, Climate Zones 1-3, 5, 6, and 12 are no longer cost effective on-bill for both the modest and high gas escalations.

Previously for the 1978-1991 vintage the only cases that were not on-bill cost effective were climate zones 2 and 6 utilizing the modest gas escalation. Now, with the credit removed, many more climate zones are no longer cost effective. Using the modest gas escalation, climate zones 1-3, 5, 6, 12, and 16 are not cost effective on-bill. Using the high gas escalation, climate zones 1-3, 5, 6, and 12 (SMUD) are not cost effective on-bill.

Previously for the 1992-2010 vintage the following cases were not cost effective on-bill: climate zones 1-3, 5, and 6 utilizing the modest gas escalation and climate zone 6 using the high gas escalation. With the credit removed an increased number of climate zones are no longer cost effective. Using the modest gas escalation, climate zones 1-3, 4 (PGE) 5-9, 10 (SCE/SCG),12, and 16 are not cost effective on-bill. Using the high gas escalation, climate zones 1-3, 4 (PGE), 5-7, 9, 12, and 16 are not cost effective on-bill.

The cost-effectiveness results are presented in Table 12 through Table 1717.

Table 12. [Pre-1978] 3 kW PV without Solar Tax Credit (Std)

Climate Zone	Electric/ Gas Utility	First Incremental Cost	On-Bill Savings			
			On-Bill B/C Modest Gas Escalation	On-Bill NPV Modest Gas Escalation	On-Bill B/C High Gas Escalation	On-Bill NPV High Gas Escalation
CZ01	PGE	$13,726	0.80	($3,074)	0.85	($2,410)
CZ02	PGE	$13,726	0.80	($3,072)	0.85	($2,409)
CZ03	PGE	$13,726	0.77	($3,567)	0.81	($2,930)
CZ04	PGE	$13,726	1.11	$1,652	1.16	$2,564
CZ04	CPAU	$13,726	1.38	$5,983	1.45	$7,123
CZ05	PGE	$13,726	0.78	($3,431)	0.82	($2,786)
CZ05	PGE/SCG	$13,726	0.78	($3,431)	0.82	($2,786)
CZ06	SCE/SCG	$13,726	0.87	($2,118)	0.92	($1,231)
CZ07	SDGE	$13,726	1.31	$4,886	1.30	$4,711
CZ08	SCE/SCG	$13,726	1.30	$4,655	1.38	$5,984
CZ09	SCE/SCG	$13,726	1.18	$2,821	1.26	$4,030
CZ10	SCE/SCG	$13,726	1.29	$4,622	1.38	$5,948
CZ10	SDGE	$13,726	1.99	$15,550	1.97	$15,284
CZ11	PGE	$13,726	1.55	$8,684	1.64	$9,967
CZ12	PGE	$13,726	1.07	$1,117	1.13	$2,002
CZ12	SMUD/PGE	$13,726	0.93	($1,109)	0.98	($342)
CZ13	PGE	$13,726	1.80	$12,597	1.90	$14,085
CZ14	SCE/SCG	$13,726	1.58	$9,098	1.68	$10,717
CZ14	SDGE	$13,726	2.15	$17,983	2.13	$17,695
CZ15	SCE/SCG	$13,726	2.24	$19,477	2.39	$21,774
CZ16	PGE	$13,726	1.04	$579	1.09	$1,435

Table 13. [1978-1991] 3 kW PV without Solar Tax Credit (Std)

Climate Zone	Electric/ Gas Utility	First Incremental Cost	On-Bill Savings			
			On-Bill B/C Modest Gas Escalation	On-Bill NPV Modest Gas Escalation	On-Bill B/C High Gas Escalation	On-Bill NPV High Gas Escalation
CZ01	PGE	$13,726	0.77	($3,570)	0.81	($2,932)
CZ02	PGE	$13,726	0.71	($4,549)	0.75	($3,963)
CZ03	PGE	$13,726	0.74	($4,106)	0.78	($3,497)
CZ04	PGE	$13,726	1.00	$7	1.05	$833
CZ04	CPAU	$13,726	1.35	$5,517	1.42	$6,633
CZ05	PGE	$13,726	0.75	($3,985)	0.79	($3,369)
CZ05	PGE/SCG	$13,726	0.75	($3,985)	0.79	($3,369)
CZ06	SCE/SCG	$13,726	0.73	($4,249)	0.78	($3,501)
CZ07	SDGE	$13,726	1.17	$2,623	1.16	$2,466
CZ08	SCE/SCG	$13,726	1.20	$3,086	1.27	$4,313
CZ09	SCE/SCG	$13,726	1.09	$1,487	1.17	$2,609
CZ10	SCE/SCG	$13,726	1.18	$2,884	1.26	$4,097
CZ10	SDGE	$13,726	1.85	$13,356	1.84	$13,108
CZ11	PGE	$13,726	1.41	$6,420	1.48	$7,583
CZ12	PGE	$13,726	0.97	($512)	1.02	$287
CZ12	SMUD/PGE	$13,726	0.93	($1,109)	0.98	($342)
CZ13	PGE	$13,726	1.63	$9,953	1.72	$11,302
CZ14	SCE/SCG	$13,726	1.42	$6,655	1.52	$8,115
CZ14	SDGE	$13,726	2.00	$15,653	1.98	$15,386
CZ15	SCE/SCG	$13,726	1.94	$14,686	2.06	$16,670
CZ16	PGE	$13,726	0.95	($737)	1.00	$49

Table 1414. [1992-2010] 3 kW PV without Solar Tax Credit (Std)

Climate Zone	Electric/ Gas Utility	First Incremental Cost	On-Bill Savings			
			On-Bill B/C Modest Gas Escalation	On-Bill NPV Modest Gas Escalation	On-Bill B/C High Gas Escalation	On-Bill NPV High Gas Escalation
CZ01	PGE	$13,726	0.71	($4,475)	0.75	($3,885)
CZ02	PGE	$13,726	0.73	($4,198)	0.77	($3,593)
CZ03	PGE	$13,726	0.72	($4,411)	0.76	($3,817)
CZ04	PGE	$13,726	0.80	($3,121)	0.84	($2,459)
CZ04	CPAU	$13,726	1.16	$2,477	1.22	$3,433
CZ05	PGE	$13,726	0.73	($4,299)	0.76	($3,700)
CZ05	PGE/SCG	$13,726	0.73	($4,299)	0.76	($3,700)
CZ06	SCE/SCG	$13,726	0.61	($6,143)	0.65	($5,520)
CZ07	SDGE	$13,726	0.94	($931)	0.93	($1,057)
CZ08	SCE/SCG	$13,726	0.98	($242)	1.05	$767
CZ09	SCE/SCG	$13,726	0.88	($1,890)	0.94	($988)
CZ10	SCE/SCG	$13,726	0.96	($676)	1.02	$305
CZ10	SDGE	$13,726	1.51	$8,054	1.50	$7,852
CZ11	PGE	$13,726	1.10	$1,569	1.16	$2,477
CZ12	PGE	$13,726	0.80	($3,169)	0.84	($2,510)
CZ12	SMUD/PGE	$13,726	0.93	($1,109)	0.98	($342)
CZ13	PGE	$13,726	1.27	$4,170	1.33	$5,215
CZ14	SCE/SCG	$13,726	1.15	$2,295	1.22	$3,470
CZ14	SDGE	$13,726	1.66	$10,386	1.65	$10,164
CZ15	SCE/SCG	$13,726	1.37	$5,788	1.46	$7,191
CZ16	PGE	$13,726	0.81	($3,006)	0.85	($2,338)

Table 1515. [Pre-1978] 3 kW PV without Solar Tax Credit (CARE)

Climate Zone	Electric/ Gas Utility	First Incremental Cost	On-Bill Savings			
			On-Bill B/C Modest Gas Escalation	On-Bill NPV Modest Gas Escalation	On-Bill B/C High Gas Escalation	On-Bill NPV High Gas Escalation
CZ01	PGE	$13,726	0.62	($6,030)	0.65	($5,522)
CZ02	PGE	$13,726	0.64	($5,707)	0.67	($5,182)
CZ03	PGE	$13,726	0.60	($6,344)	0.63	($5,853)
CZ04	PGE	$13,726	0.83	($2,725)	0.87	($2,042)
CZ05	PGE	$13,726	0.60	($6,266)	0.63	($5,771)
CZ05	PGE/SCG	$13,726	0.60	($6,266)	0.63	($5,771)
CZ06	SCE/SCG	$13,726	0.71	($4,578)	0.75	($3,852)
CZ07	SDGE	$13,726	0.71	($4,508)	0.71	($4,604)
CZ08	SCE/SCG	$13,726	0.97	($483)	1.03	$510
CZ09	SCE/SCG	$13,726	0.90	($1,530)	0.96	($605)
CZ10	SCE/SCG	$13,726	0.97	($465)	1.03	$530
CZ10	SDGE	$13,726	1.19	$3,032	1.18	$2,872
CZ11	PGE	$13,726	1.07	$1,150	1.13	$2,036
CZ12	PGE	$13,726	0.79	($3,324)	0.83	($2,673)
CZ13	PGE	$13,726	1.23	$3,587	1.29	$4,601
CZ14	SCE/SCG	$13,726	1.17	$2,662	1.25	$3,861
CZ14	SDGE	$13,726	1.28	$4,436	1.27	$4,264
CZ15	SCE/SCG	$13,726	1.57	$8,962	1.67	$10,572
CZ16	PGE	$13,726	0.79	($3,342)	0.83	($2,692)

Table 1616. [1978-1991] 3 kW PV without Solar Tax Credit (CARE)

Climate Zone	Electric/ Gas Utility	First Incremental Cost	On-Bill Savings			
			On-Bill B/C Modest Gas Escalation	On-Bill NPV Modest Gas Escalation	On-Bill B/C High Gas Escalation	On-Bill NPV High Gas Escalation
CZ01	PGE	$13,726	0.60	($6,343)	0.63	($5,851)
CZ02	PGE	$13,726	0.56	($6,845)	0.59	($6,380)
CZ03	PGE	$13,726	0.57	($6,757)	0.60	($6,287)
CZ04	PGE	$13,726	0.76	($3,715)	0.80	($3,085)
CZ05	PGE	$13,726	0.57	($6,686)	0.60	($6,213)
CZ05	PGE/SCG	$13,726	0.57	($6,686)	0.60	($6,213)
CZ06	SCE/SCG	$13,726	0.61	($6,195)	0.64	($5,575)
CZ07	SDGE	$13,726	0.62	($6,004)	0.61	($6,087)
CZ08	SCE/SCG	$13,726	0.91	($1,483)	0.96	($555)
CZ09	SCE/SCG	$13,726	0.85	($2,368)	0.90	($1,497)
CZ10	SCE/SCG	$13,726	0.90	($1,597)	0.96	($676)
CZ10	SDGE	$13,726	1.10	$1,560	1.09	$1,413
CZ11	PGE	$13,726	0.98	($295)	1.03	$515
CZ12	PGE	$13,726	0.72	($4,320)	0.76	($3,722)
CZ13	PGE	$13,726	1.12	$1,893	1.18	$2,818
CZ14	SCE/SCG	$13,726	1.07	$1,051	1.14	$2,144
CZ14	SDGE	$13,726	1.18	$2,878	1.17	$2,719
CZ15	SCE/SCG	$13,726	1.37	$5,735	1.45	$7,135
CZ16	PGE	$13,726	0.74	($4,126)	0.78	($3,517)

Table 1717. [1992-2010] 3 kW PV without Solar Tax Credit (CARE)

Climate Zone	Electric/ Gas Utility	First Incremental Cost	On-Bill Savings			
			On-Bill B/C Modest Gas Escalation	On-Bill NPV Modest Gas Escalation	On-Bill B/C High Gas Escalation	On-Bill NPV High Gas Escalation
CZ01	PGE	$13,726	0.56	($6,963)	0.59	($6,504)
CZ02	PGE	$13,726	0.26	($11,640)	0.20	($12,611)
CZ03	PGE	$13,726	0.55	($6,997)	0.58	($6,540)
CZ04	PGE	$13,726	0.62	($5,900)	0.66	($5,385)
CZ05	PGE	$13,726	0.56	($6,932)	0.59	($6,471)
CZ05	PGE/SCG	$13,726	0.56	($6,932)	0.59	($6,471)
CZ06	SCE/SCG	$13,726	0.51	($7,652)	0.55	($7,127)
CZ07	SDGE	$13,726	0.48	($8,115)	0.48	($8,180)
CZ08	SCE/SCG	$13,726	0.78	($3,430)	0.83	($2,629)
CZ09	SCE/SCG	$13,726	0.72	($4,462)	0.76	($3,728)
CZ10	SCE/SCG	$13,726	0.76	($3,748)	0.81	($2,968)
CZ10	SDGE	$13,726	0.86	($2,225)	0.85	($2,340)
CZ11	PGE	$13,726	0.79	($3,259)	0.83	($2,605)
CZ12	PGE	$13,726	0.63	($5,876)	0.66	($5,359)
CZ13	PGE	$13,726	0.89	($1,678)	0.94	($941)
CZ14	SCE/SCG	$13,726	0.89	($1,676)	0.95	($761)
CZ14	SDGE	$13,726	0.95	($838)	0.94	($964)
CZ15	SCE/SCG	$13,726	0.99	($142)	1.06	$873
CZ16	PGE	$13,726	0.63	($5,850)	0.66	($5,333)

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The adoption of reach codes can differentiate jurisdictions as efficiency leaders and help accelerate the adoption of new equipment, technologies, code compliance, and energy savings strategies.

As part of the Statewide Codes & Standards Program, the Reach Codes Subprogram is a resource available to any local jurisdiction located throughout the state of California.

Our experts develop robust toolkits as well as provide specific technical assistance to local jurisdictions (cities and counties) considering adopting energy reach codes. These include cost-effectiveness research and analysis, model ordinance language and other code development and implementation tools, and specific technical assistance throughout the code adoption process.

If you are interested in finding out more about local energy reach codes, the Reach Codes Team stands ready to assist jurisdictions at any stage of a reach code project.

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