

ORDINANCE NO.

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF SUNNYVALE AMENDING ORDINANCE NO. 3248-25 TO MAKE SUPPLEMENTAL FINDINGS FOR THE LOCALLY ADOPTED ENERGY STANDARDS IN ORDINANCE NO. 3248-25 AND TO AMEND VARIOUS SECTIONS OF TITLE 16 (BUILDINGS AND CONSTRUCTION) OF THE SUNNYVALE MUNICIPAL CODE TO MAKE MINOR CORRECTIONS AND CLARIFICATIONS AND REMOVE CERTAIN LOCAL AMENDMENTS TO THE 2025 CALIFORNIA BUILDING STANDARDS CODE

WHEREAS, on October 21, 2025, the City Council adopted Ordinance No. 3248-25, adopting the 2025 California Building Standards Code, including but not limited to the 2025 Green Building Standards Code and the 2025 Energy Code, together with local amendments to the state standards and required findings (referred to as the “2025 Triennial Building Code Update”), to be effective on January 1, 2026; and

WHEREAS, with respect to locally adopted energy standards that differ from the California Energy Code, Section 10-106 of the 2025 California Administrative Code establishes a process which allows local adoption of energy standards that are more stringent than the statewide standards, provided that a determination that the standards are cost effective is adopted at a public meeting and subsequently filed with the California Energy Commission, and the California Energy Commission finds that the standards will require buildings to be designed to consume less energy than permitted by the California Energy Code; and

WHEREAS, in adopting Ordinance No. 3248-25, the City Council considered analysis presented by City staff and consultants on the energy savings and cost effectiveness of the proposed local energy standards, set forth in the Report to Council and Attachments 1 and 5 for the City Council meeting on September 30, 2025 (these Attachments are included with this Ordinance No. [REDACTED] as Exhibit A-1 and Exhibit A-2 and incorporated herein by reference); and

WHEREAS, prior to the California Energy Commission’s review of the City’s local amendments to the Energy Code, the City desires to supplement the findings in support of the amendments related to the locally adopted energy standards (Sunnyvale Municipal Code [SMC] Section 16.43.070), consistent with information about cost-effectiveness included in the Report to Council (and attachments thereto) for the 2025 Triennial Building Code Update ordinance approved on September 30, 2025 (first reading) and adopted on October 21, 2025 (second reading); and

WHEREAS, after adoption of Ordinance No. 3248-25, City staff identified provisions of the State Green Building Standards Code regarding EV charging that had been inadvertently deleted

through a local amendment (in Section 50 of that Ordinance, codified in Section 16.43.060(c) of the Sunnyvale Municipal Code), as well as other unintended local amendments and typographical errors that require correction. In further consultation with Silicon Valley Clean Energy (SCVE) who have experience with the CEC through this triennial update cycle, staff also proposed to incorporate clarifications consistent with the energy code model ordinance developed and updated by SCVE; these are addressed in Section 17 of this Ordinance. The Ordinance will also restore the definition of newly constructed buildings to be the same as the California Energy Code definition; and

WHEREAS, the findings herein are supplemental and in addition to the findings previously adopted by the City Council; and

THE CITY COUNCIL OF THE CITY OF SUNNYVALE DOES ORDAIN AS FOLLOWS:

SECTION 1. Findings.

A. Recitals. The recitals above are hereby adopted and incorporated herein by reference as findings.

B. Cost Effectiveness and Energy Efficiency. The City Council finds, based on evidence presented before the City Council on September 30, 2025, October 21, 2025, and July 21, 2026 (including the cost effectiveness analysis set forth in Exhibits A-1 and A-2), and in accordance with Section 10-106 of the 2025 California Administrative Code, that the energy standards adopted as local amendments to the Green Building Standards Code contained in Ordinance No. 3248-25 are cost effective and will require buildings to be designed to consume less energy than permitted by the California Energy Code.

C. Local Conditions and All Previously Adopted Findings. Pursuant to California Health and Safety Code Sections 17958.5, 17958.7 and 18941.5, the City Council finds that each of the changes or modifications to measures referred to therein are reasonably necessary because of local climatic, geological, or topographical conditions in the area encompassed by the boundaries of Sunnyvale, and the City Council affirms and adopts the findings in Exhibit A of Ordinance No. 3248-25 with respect to this Ordinance No. [insert number of the subject ordinance after adoption].

D. The standards imposed by this Ordinance are identical to the standards imposed in Ordinance No. 3248-25 (adopted October 21, 2025), and substantially equivalent to standards imposed in Ordinance No. 3244-25 (adopted August 26, 2025), which amended the 2025 and 2022 California Building Energy Efficiency Standards and Green Building Standards. Amendments for these standards were previously filed and approved by the California Building Standards Commission on November 14, 2025 (Ord. 3248-25) and September 23, 2025 (Ord. 3244-25) and will have no material change in regulatory effect.

SECTION 2. Section 16.16.030 AMENDED. Section 16.16.030 of Chapter 16.16 (Building Code) of Title 16 (Buildings and Construction) of the Sunnyvale Municipal Code is hereby amended to read as follows:

16.16.030. Administration.

2025 California Building Code, Chapter 1, Division II, is hereby amended as follows:

105.3.2 Time Limitation of Application ~~[OSHPD 1, 1R, 2, 4 & 5] Time limitation shall be in accordance with the California Administrative Code, Chapter 7, Section 7-129.~~

An application for a permit for any proposed work shall be deemed to have been expired 180 days after the date of filing, unless such application has been pursued in good faith or a permit has been issued, the plans and other data submitted for review may thereafter be returned to the applicant or destroyed by the building official. The building official is authorized to grant one or more extensions of time for an additional period not exceeding 180 days each. The extension shall be requested in writing and justifiable cause demonstrated. In order to proceed with a project once an application has expired, a new application is required with new plan reviews fees and plans based on the code in effect at the time of the new application. [OSHPD 1, 1R, 2, 4&5] Time limitation shall be in accordance with the California Administrative Code, Chapter 7, Section 7-129

SECTION 3. Section 16.16.070 AMENDED. Section 16.16.070 of Chapter 16.16 (Building Code) of Title 16 (Buildings and Construction) of the Sunnyvale Municipal Code is hereby amended to read as follows:

16.16.070. Fire extinguishing systems.

Except for the application of Sections 504.2 and 506.~~23~~ of the 2025 California Building Code, the installation requirements for fire extinguishing systems, including 2025 California Building Code Section 903, shall be governed by the applicable provisions of the 2025 California Fire Code as adopted by Section 16.52.903 of Chapter 16.52.

SECTION 4. Section 16.16.090 AMENDED. Section 16.16.090 of Chapter 16.16 (Building Code) of Title 16 (Buildings and Construction) of the Sunnyvale Municipal Code is hereby amended to read as follows:

16.16.090. Roof material rating.

2025 California Building Code Section 1505.1.2 is amended to read as follows:

1505.1.2 Roof coverings within all other areas other than Fire Hazard Severity Zones or in the Wildland-Urban Interface (WUI).

The entire roof covering of every existing structure where more than 50 percent of the total roof area is replaced within any one-year period, the entire roof covering of every new structure, and any roof covering applied in the alteration, repair or replacement of the roof of every existing structure, shall be a fire-retardant roof covering that is at least Class BC fire classification.

SECTION 5. Section 16.16.120 AMENDED. Section 16.16.120 of Chapter 16.16 (Building Code) of Title 16 (Buildings and Construction) of the Sunnyvale Municipal Code is hereby amended to read as follows:

16.16.120. Wall bracing methods.

2025 California Building Code Table 2308.10.3(1) (Bracing Method) of CBC Chapter 23 (Wood) is amended as follows:

(1) The title of Table 2308.10.3(1) is amended to read:

TABLE 2308.10.3(1)^{b, c}

(2) Footnotes "b" and "c" are added to Table 2308.10.3(1), to read:

b. Methods PBS, HPS, LIB AND SFB are not permitted in Seismic Design Categories D or E.

c. Methods GB, DWB, AND PCP are not permitted in Seismic Design Category E.

SECTION 6. Section 16.17.060 AMENDED. Section 16.17.060 of Chapter 16.17 (Residential Code) of Title 16 (Buildings and Construction) of the Sunnyvale Municipal Code is hereby amended to read as follows:

16.17.060. Townhouse units.

2025 California Residential Code Section R302.2 is hereby amended as follows:

R302.2 Townhouse Units.

Walls separating townhouse units shall be constructed in accordance with Section R302.2.1 and shall comply with Sections R302.2.3 through R302.2.~~65~~.

SECTION 7. Section 16.17.080 AMENDED. Section 16.17.080 of Chapter 16.17 (Residential Code) of Title 16 (Buildings and Construction) of the Sunnyvale Municipal Code is hereby amended to read as follows:

- (a) 2025 California Residential Code Sections R309.2 and R309.2.1 are hereby amended to read as follows:

R309.2 One- and two-family dwellings automatic fire systems. An automatic residential fire sprinkler system shall be installed in one- and two-family dwellings.

Existing one- and two-family dwellings. An automatic residential fire sprinkler system shall be installed in existing one and two-family dwellings when additions or conversions from non-habitable to habitable spaces are made that are in excess of 50 percent of the habitable building area.

Firewalls used to separate building areas shall be constructed in accordance with the 2025 California Building Code and shall be without openings or penetrations.

Exception:

~~2.~~ Accessory Dwelling Unit, provided that all of the following are met:

~~2.1.1.~~ The unit meets the definition of an Accessory Dwelling Unit as defined in the Government Code Section 65852.2.

~~2.2.2.~~ The existing primary residence does not have automatic fire sprinklers.

~~2.3.3.~~ The accessory detached dwelling unit does not exceed 1,200 square feet in size.

~~2.4.4.~~ The unit is on the same lot as the primary residence.

R309.2.1 Design and Installation. Automatic residential fire sprinkler systems for one- and two-family dwellings shall be designed and installed in accordance with NFPA 13D and local standards.

SECTION 8. Section 16.17.100 AMENDED. Section 16.17.100 of Chapter 16.17 (Residential Code) of Title 16 (Buildings and Construction) of the Sunnyvale Municipal Code is hereby amended to read

as follows:

16.17.100. Lath, gypsum board and plaster as wall bracing materials.

2025 California Residential Code Table R602.10.3(3) (Bracing Requirements Based On Seismic Design Category) of CRC Chapter 6 (Wall Construction) is amended as follows:

[Refer to 2025 California Residential Code for Table R602.10.3(3)]

Table R602.10.3(3) ^{i,j} – Bracing Requirements Based on **Seismic**
Seismic Design Category [Text of Table
unchanged]

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SECTION 9. Section 16.18.030 AMENDED. Section 16.18.030 of Chapter 16.18 (Existing Building Code) of Title 16 (Buildings and Construction) of the Sunnyvale Municipal Code is hereby amended to read as follows:

16.18.030 Administration.

2025 California Existing Building Code Chapter 1 Division II is hereby amended as follows:

109.3.8 Other inspections. In addition to the inspections specified above the building official may make or require other inspections of any construction work to ascertain compliance with the provisions of this code and other laws which are enforced by the code enforcement agency.

Note: All noncompliant plumbing fixtures in any residential real property shall be replaced with water-conserving plumbing fixtures. Plumbing fixture replacement is required prior to issuance of a certificate of final completion, certificate of occupancy or final permit approval by the local building department. See Civil Code Section 1101.1, et seq., for the definition of a noncompliant plumbing fixture, types of residential buildings affected and other important enactment dates.

SECTION 10. Section 16.24.025 AMENDED. Section 16.24.025 of Chapter 16.24 (Plumbing Code) of Title 16 (Buildings and Construction) of the Sunnyvale Municipal Code is hereby amended to read as follows:

16.24.025. Administration.

2025 California Plumbing Code Chapter 1 Division II is hereby amended as follows:

101.2. Scope. The provisions of this chapter shall apply to grading and to the construction, alteration, movement, enlargement, replacement, repair, equipment, use and occupancy, location, maintenance, removal, and demolitions of every building or structure or any appurtenances connected or attached to such buildings or structures within the city, including all plumbing and drainage systems, mechanical systems, and electrical wiring and fire safety systems, or parts thereof, within and serving such building or structure, excluding therefrom the following:

- (1) Any building or structure located on real property belonging to:
 - (A) United States of America,
 - (B) State of California, or any political subdivision thereof,
 - (C) Any chartered city or non-chartered city, or
 - (D) Any school district, except when the proposed use is for non-classroom facilities;
- (2) Work located primarily in a public way;
- (3) Public utility towers and poles;
- (4) Mechanical equipment not specifically regulated in any of the codes; and
- (5) Hydraulic flood control structures.
- ~~(6) Detached one- and two-family dwellings and multiple single-family dwellings (townhouse units) not more than three stories above grade plane in height with a separate means of egress and their accessory structures shall comply with this code or the California Residential Code.~~

SECTION 11. Section 16.28.025 AMENDED. Section 16.28.025 of Chapter 16.28 (Mechanical Code) of Title 16 (Buildings and Construction) of the Sunnyvale Municipal Code is hereby amended to read as follows:

16.28.025. Administration.

2025 California Mechanical Code Chapter 1 Division II is hereby amended as follows:

101.2. Scope. The provisions of this chapter shall apply to grading and to the construction, alteration, movement, enlargement, replacement, repair, equipment, use and occupancy, location, maintenance, removal, and demolitions of every building or structure or any appurtenances connected or attached to such

buildings or structures within the city, including all plumbing and drainage systems, mechanical systems, and electrical wiring and fire safety systems, or parts thereof, within and serving such building or structure, excluding therefrom the following:

- (1) Any building or structure located on real property belonging to:
 - (A) United States of America,
 - (B) State of California, or any political subdivision thereof,
 - (C) Any chartered city or non-chartered city, or
 - (D) Any school district, except when the proposed use is for non- classroom facilities;
- (2) Work located primarily in a public way;
- (3) Public utility towers and poles;
- (4) Mechanical equipment not specifically regulated in any of the codes; and
- (5) Hydraulic flood control structures.
- ~~(6) Detached one- and two-family dwellings and multiple single-family dwellings (townhouse units) not more than three stories above grade plane in height with a separate means of egress and their accessory structures shall comply with this code or the California Residential Code.~~

SECTION 12. Section 16.32.030 AMENDED. Section 16.32.030 of Chapter 16.32 (Electrical Code) of Title 16 (Buildings and Construction) of the Sunnyvale Municipal Code is hereby amended to read as follows:

16.32.030. Administration.

2025 California Electrical Code Section 89.101 is hereby amended as follows:

89.101.15 Placement of Permit. The ~~building~~ permit, along with all plans and documentation approved by the building official, shall be kept on the site of the work until final approval has been granted by the building official.

89.101.19 Refunds. The building official may authorize refunding of any fee paid hereunder which was erroneously paid or collected.

The building official may authorize refunding of not more than 80 percent of the permit fee paid when the permit is canceled and no work has been done under a permit issued in accordance with this section.

The building official may authorize refunding of the plan review fee paid with an application for a permit for which a plan review fee has been paid is withdrawn or canceled before any plan reviewing is done.

The building official shall not authorize refunding of any fee paid except by written request filed by the original permittee and for ~~building~~ permits that are not expired.

SECTION 13. Section 16.42.030 REPEALED AND REPLACED. Section 16.42.030 of Chapter 16.42 (Energy Code) of Title 16 (Buildings and Construction) of the Sunnyvale Municipal Code is hereby repealed and replaced in its entirety with a new Section 16.42.030 to read as follows:

16.42.030. Definitions.

2025 California Energy Code Section 100.1 (Definitions), subsection (b) is hereby amended to add or amend the following definitions, reading as follows:

LEVEL 2 ELECTRIC VEHICLE (EV) CHARGING RECEPTACLE is a 208/240-volt 40-ampere minimum branch circuit and a receptacle.

LOW POWER LEVEL 2 ELECTRIC VEHICLE (EV) CHARGING RECEPTACLE is a 208/240-volt 20-ampere minimum branch circuit and a receptacle.

~~NEWLY CONSTRUCTED BUILDING is a building that has never been used or occupied for any purpose. It shall also include newly constructed additions and improvements in existing buildings where more than 50 percent of the exterior wall is modified. The Chief Building Official shall make the final determination regarding the application of this definition.~~ NEWLY CONSTRUCTED BUILDING is a building that has never been used or occupied for any purpose.

SECTION 14. Section 16.42.040 AMENDED. Section 16.42.040 of Chapter 16.42 (Energy Code) of Title 16 (Buildings and Construction) of the Sunnyvale Municipal Code is hereby amended to read as follows:

16.42.040. Mandatory Features and Devices.

2025 California Energy Code Section 150.0 (Mandatory Features and Devices), is hereby amended to add new subsection (w), and to read as follows:

Single-family residential buildings shall comply with the applicable requirements of Section 150(a) to 150(w).

NOTE: ~~[Text of 2025 California Energy Code unchanged]~~ The requirements of Sections 150.0(a) through 150.0(v) apply to newly constructed buildings. Sections 150.2(a) and 150.2(b) specify which requirements of Sections 150.0(a) through 150.0(w) also apply to additions or alterations.

(a) – (v) [Text of 2025 California Energy Code Section 150.0 unchanged]

(w) Electric Readiness for Remodels, Alterations, and Additions.

1. – 4. [Text of Section 16.42.040 unchanged]

5. Electrical Power Upgrades. Increases in the electrical power infrastructure capacity serving a building shall only be permitted when all the following are documented and submitted to the building official:

- A. Calculations in accordance with California Electrical Code Article 220.83 determining future loads will exceed the capacity of the current electrical power infrastructure.
- B. Where data is available, calculations in accordance with California Electrical Code Article 220.87 determining that future loads exceed the capacity of the current electrical service infrastructure.
- C. Calculations for item (A) and item (B) above shall include at least one of the following:
 - (i) At least one power management or circuit controlling device, serving electric-only appliances such as:
 - a. Water heater(s)
 - b. Clothes dryer(s)
 - c. Range(s)
 - d. Level 2 EV Charging Receptacle or
 - e. Low Power Level 2 EV Charging Receptacle
 - (ii) At least one of the following electric-only appliances operating on 120V:
 - a. Water heater(s)
 - b. Clothes dryer(s)
 - c. Range(s)
 - (iii) Circuit control between whole home load and Level 2 EV Charging Receptacle or Low Power Level 2 EV Charging Receptacle

Exception to Section 150.0(w)5: The upgrade is solely the result of a project proposing electrical improvements supporting loads related to devices and uses not regulated by 150.0(w).

Exceptions 1 – 7 to Section 150.0(w) [Text of Section 16.42.040 unchanged]

2025 California Energy Code Section 150.2 (Energy Efficiency Standards for Additions and Alterations to Existing Single-Family Residential Buildings) is hereby amended as follows:

The first paragraph of Section 150.2(a) (Additions) is modified to read as follows:

(a) Additions. Additions to existing single-family residential buildings shall meet the requirements of Sections 110.0 through 110.9, Sections 150.0(a) through (n), (p), (q), (w), and either Section 150.2(a)1 or 2.

The first paragraph of Section 150.2(b) (Alterations) is modified to read as follows:

(b) Alterations. Alterations to existing single-family residential buildings or alterations in conjunction with a change in building occupancy to a single-family residential occupancy shall meet the requirements of Section 150.0(w) and either Item 1 or 2 below.

SECTION 15. Section 16.43.040 AMENDED. Section 16.43.040 of Chapter 16.43 (Green Building Code) of Title 16 (Buildings and Construction) of the Sunnyvale Municipal Code is hereby amended to read as follows:

16.43.040. Definitions.

2025 California Green Building Code Section ~~201-202~~ (Definitions) is hereby amended as follows:

Electric Vehicle Charging Station (EVCS): A parking space that includes installation of electric vehicle supply equipment (EVSE). EVCS installation may be used to satisfy a Level 2 EV Ready Space requirement.

Level 3 Electric Vehicle Charging Station (EVCS): A parking space that includes installation of electric vehicle supply equipment (EVSE) connected to a circuit serving a Level 3 EV Ready Space. EVCS installation may be used to satisfy a Level 3 EV Ready Space requirement.

SECTION 16. Section 16.43.060 AMENDED. Section 16.43.060 of Chapter 16.43 (Green Building Code) of Title 16 (Buildings and Construction) of the Sunnyvale Municipal Code is hereby

amended to read as follows:

Section 16.43.060. Nonresidential mandatory measures—Electric vehicle (EV) charging

- (a) [Text unchanged]
- (b) 2025 California Green Building Code Section 5.106.5.3.1 (EV capable spaces) is hereby amended to read as follows:

EV capable spaces shall be provided in accordance with the following requirements:

1. Raceways complying with the *California Electrical Code* and no less than 1-inch (25 mm) diameter shall be provided and shall originate at a service panel or a subpanel(s) serving the area, and shall terminate in close proximity to the proposed location of the EV capable space and into a suitable listed cabinet, box, enclosure or equivalent. A common raceway may be used to serve multiple EV capable spaces.
2. A service panel or subpanel(s) shall be provided with panel space and electrical load capacity for a dedicated 208/240 volt, 40-ampere minimum branch circuit for each EV capable space, with delivery of 30-ampere minimum to an installed EVSE at each EVCS.
3. The electrical system and any on-site distribution transformers shall have sufficient capacity to supply full rated amperage at each EV capable space.
4. The service panel or subpanel circuit directory shall identify the reserved overcurrent protective device space(s) as “EV CAPABLE”. The raceway termination location shall be permanently and visibly marked as “EV CAPABLE.” ~~Note: A parking space served by electric vehicle supply equipment or designed as a future EV charging space shall count as at least one standard automobile parking space only for the purpose of complying with any applicable minimum parking space requirements established by an enforcement agency. See Vehicle Code Section 22511.2 for further details.~~

Note: A parking space served by electric vehicle supply equipment or designed as a future EV charging space shall count as at least one standard automobile parking space only for the purpose of complying with any applicable minimum parking

space requirements established by an enforcement agency. See Vehicle Code Section 22511.2 for further details.

(c) ~~2025 California Green Building Code Section 5.106.5.3.2 (Electric vehicle charging stations (EVCS), is hereby deleted. Reserved~~

(d) 2025 California Green Building Code Section 5.106.5.4.1 Existing buildings or parking areas without previously installed EV capable infrastructure shall be amended:

When EV capable infrastructure does not exist at an existing parking facility or building, and the parking facility or building undergoes an addition or alteration listed in Section 5.106.5.4, construction shall include electric vehicle charging in compliance with either Section 5.106.5.3.6 or Section 5.106.5.3.6 for the total number of actual parking spaces being added or altered.

(e)-(h) [Text unchanged]

SECTION 17. Section 16.43.070 AMENDED. Section 16.43.070 of Chapter 16.43 (Green Building Code) of Title 16 (Buildings and Construction) of the Sunnyvale Municipal Code is hereby amended to read as follows:

16.43.070. Energy Efficiency.

2025 California Green Building Standards Code Division 4.2 (Energy Efficiency) is hereby amended to add Section A4.204 (Requirements for Alterations to Existing Buildings) to read as follows:

A4.204 Requirements for Alterations to Existing Buildings

A4.204.1 Energy Efficiency. Alterations to existing residential buildings shall comply with Sections A4.204.1.1.

A4.204.1.1 Altered Space-Conditioning System Serving Existing Single-Family Dwelling Units – Mechanical Cooling. When a space-conditioning system serving an existing single-family dwelling unit is altered in climate zone 4 by installation or replacement of an air conditioner, the altered system shall comply with ~~either a, or b~~ or c below in addition to the requirements for installation specified by Title 24, Part 6, Sections 150.2(b)1E and 150.2(b)1F:

a. A heat pump shall be the primary heating source and sized according to the system selection requirements specified by Title 24, Part 6 ~~1, of~~

Section 150.0(h)5. Supplemental heating may be provided by a gas furnace or electric resistance heating as specified in Title 24, Part 6, Sections 150.0(h)7 and 150.0(i); or

- b. An air conditioner shall meet all the requirements in either subsection I or II below:

I. Systems with Existing Duct Distribution Systems:

- A. The duct system measured air leakage shall be equal to or less than 10 percent of the system air handler airflow as confirmed through field verification and diagnostic testing, per the requirements in Title 24, Part 6, Reference Residential Appendix Section RA3.1.4.3.; and

Exception 1 to A4.204.1.1.b.I.A. If it is not possible to meet the duct sealing requirements, all accessible leaks shall be sealed and verified through a visual inspection and a smoke test by a certified ECC-Rater utilizing the methods specified in Reference Residential Appendix Section RA3.1.4.3.5.

Exception 2 to A4.204.1.1.b.I.A: Existing duct systems, constructed, insulated or sealed with asbestos.

- B. Demonstrate, in every control mode, airflow greater than or equal to 300 CFM per ton of nominal cooling capacity through the return grilles, and an air-handling unit fan efficacy less than or equal to 0.45 W/CFM. The airflow rate and fan efficacy requirements in this section shall be confirmed through field verification and diagnostic testing, following the procedures outlined in Title 24, Part 6, Reference Residential Appendix RA3.3; and

Exception 1 to A4.204.1.1.b.I.B: Systems unable to comply with the minimum airflow rate and system efficacy requirements shall demonstrate compliance by satisfying all of the following:

1. Following the procedures in Section RA3.3.3.1.5;
2. Installing a system thermostat that conforms

to the specifications in Section 110.12;

3. For standard ducted systems (without zoning dampers), meet the applicable minimum total return filter grille nominal area requirements in Table 150.0-B or 150.0-C as confirmed by field verification and diagnostic testing in accordance with the procedures in Reference Residential Appendix Sections RA3.1.4.4 and RA3.1.4.5. The design clean-filter pressure drop requirements specified by Section 150.0(m)12D for the system air filter(s) shall conform to the requirements given in Tables 150.0-B and 150.0-C.

Exception 2 to Section A4.204.1.1.b.I.B: Multispeed compressor systems or variable speed compressor systems shall verify air flow (cfm/ton) and fan efficacy (watts/cfm) for system operation at the maximum compressor speed and the maximum air handler fan speed.

Exception 3 to Section A4.204.1.1.b.I.B: Gas furnace air- handling units manufactured prior to July 3, 2019 shall comply with a fan efficacy value less than or equal to 0.58 W/cfm as confirmed by field verification and diagnostic testing in accordance with the procedures given in Reference Residential Appendix RA3.3.

- C. In all climate zones, refrigerant charge verification requirements shall meet the requirements in Title 24, Part 6, Section 150.2(b)1Fiib, including the minimum airflow rate specified in Section 150.2(b)1Fiia; and
- D. Vented attics shall have insulation installed to achieve a U-factor of 0.020 or insulation installed at the ceiling level shall result in an insulated thermal resistance of R-49 or greater for the insulation alone; luminaires not rated for insulation contact must be replaced or retrofitted with a fireproof cover that allows for insulation to be installed directly over the cover; and

Exception 1 to Section A4.204.1.1.b.I.D: Dwelling units with at least R-38 existing insulation installed at the ceiling level.

Exception 2 to Section A4.204.1.1.b.I.D: Dwelling units

where the alteration would directly cause the disturbance of asbestos unless the alteration is made in conjunction with asbestos abatement.

Exception 3 to Section A4.204.1.1.b.I.D: Dwelling units with knob and tube wiring located in the vented attic.

Exception 4 to Section A4.204.1.1.b.I.D: Where the accessible space in the attic is not large enough to accommodate the required R-value, the entire accessible space shall be filled with insulation provided such installation does not violate Section 806.3 of Title 24, Part 2.5.

- E. Air seal all accessible areas of the ceiling plane between the attic and the conditioned space including all joints, penetrations and other openings that are potential sources of air leakage by caulking, gasketing, weather-stripping or otherwise sealing to limit infiltration and exfiltration.

Exception 1 to Section A4.204.1.1.b.I.E: Dwelling units with at least R-38 existing insulation installed at the ceiling level.

Exception 2 to Section A4.204.1.1.b.I.E: Dwelling units where the alteration would directly cause the disturbance of asbestos unless the alteration is made in conjunction with asbestos abatement.

Exception 3 to Section A4.204.1.1.b.I.E: Dwelling units with atmospherically vented space heating or water heating combustion appliances located inside the pressure boundary of the dwelling unit.

II. Entirely New or Complete Replacement Duct Systems:

- A. R-8 duct insulation shall be installed for all new ducts located in unconditioned space; and
- B. The total duct system measured air leakage shall be equal to or less than 5 percent of the system air handler airflow as confirmed through field verification and diagnostic testing, per the requirements in Title 24, Part 6, Reference Residential Appendix Section RA3.1.4.3.1; and

- C. Demonstrate, in every control mode, airflow greater than or equal to 350 CFM per ton of nominal cooling capacity through the return grilles, and an air-handling unit fan efficacy less than or equal to 0.35 W/CFM. The airflow rate and fan efficacy requirements in this section shall be confirmed through field verification and diagnostic testing, following the procedures outlined in Title 24, Part 6, Reference Residential Appendix RA3.3.; and
- D. In all climate zones, refrigerant charge verification requirements shall meet the requirements in Title 24, Part 6, Section 150.2(b)1Fiib; and
- E. If the air handler and ducts are located within a vented attic, vented attics shall have insulation installed to achieve a U-factor of 0.020 or insulation installed at the ceiling level shall result in an insulated thermal resistance of R-49 or greater for the insulation alone; luminaires not rated for insulation contact must be replaced or retrofitted with a fireproof cover that allows for insulation to be installed directly over the cover; and

~~Exception 1 to Section A4.204.1.1.b.II.E: In dwelling units with at least R-19 existing insulation installed at the ceiling level.~~

Exception ~~12~~ to Section A4.204.1.1.b.II.E: Dwelling units where the alteration would directly cause the disturbance of asbestos unless the alteration is made in conjunction with asbestos abatement.

Exception ~~23~~ to Section A4.204.1.1.b.II.E: Dwelling units with knob and tube wiring located in the vented attic.

Exception ~~34~~ to Section A4.204.1.1.b.II.E: Where the accessible space in the attic is not large enough to accommodate the required R-value, the entire accessible space shall be filled with insulation provided such installation does not violate Section 806.3 of Title 24, Part 2.5.

- F. Air seal all accessible areas of the ceiling plane between the attic and the conditioned space including all joints, penetrations and other openings that are potential sources of air leakage by caulking, gasketing, weather-

stripping or otherwise sealing to limit infiltration and exfiltration.

Exception 1 to Section A4.204.1.1.b.II.F:

Dwelling units with at least R-19 existing insulation installed at the ceiling level.

Exception 2 to Section A4.204.1.1.b.II.F: Dwelling units where the alteration would directly cause the disturbance of asbestos unless the alteration is made in conjunction with asbestos abatement.

Exception 3 to Section A4.204.1.1.b.II.F: Dwelling units with atmospherically vented space heating or water heating combustion appliances located inside the pressure boundary of the dwelling unit.

c. Performance approach.

The energy budget for alterations is expressed in terms of Long-term System Cost (LSC), and the altered component(s) and any newly installed equipment serving the alteration shall meet the applicable requirements of Subsections A, B, and C below.

- A. The altered components shall meet the applicable requirements of Title 24, Part 6, Sections 110.0 through 110.9, Sections 150.0(a) through (l), Sections 150.0(m)1 through 150.0 (m)10, and Sections 150.0(p) through (q). Entirely new or complete replacement mechanical ventilation systems as these terms are used in Section 150.2(b)1L, shall comply with the requirements in Section 150.2(b)1L. Altered mechanical ventilation systems shall comply with the requirements of Section 150.2(b)1M. Entirely new or complete replacement space-conditioning systems, and entirely new or complete replacement duct systems, as these terms are used in Sections 150.2(b)1C and 150.2(b)1Diia, shall comply with the requirements of Sections 150.0(m)12 and 150.0(m)13.
- B. The standard design for an altered component shall be the higher efficiency of existing conditions or the requirements stated in Table A4.204.1.1-A . For components not being altered, the standard design shall be based on the existing conditions. When the third party verification option is specified as a requirement, all components proposed for alteration for which the additional credit is taken, must be

verified by a certified ECC-rater.

Table A4.204.1.1-A Standard Design for an Altered Component

<u>Altered Component</u>	<u>Standard Design Without Third Party Verification of Existing Conditions Shall be Based On</u>	<u>Standard Design With Third Party Verification of Existing Conditions Shall be Based On</u>
<u>Ceiling Insulation, Wall Insulation, and Raised-floor Insulation</u>	<u>The requirements of Sections 150.0(a), (c), and (d).</u> <u>The requirements of Section 150.2(b)1J for altered ceilings and for entirely new or complete replacement duct systems where the air handler and ducts are located within a vented attic.</u> <u>The requirements of Section A4.204.1.1b for alterations which include new or replacement air-cooled air conditioners.</u>	<u>The existing insulation R-value</u>
<u>Fenestration</u>	<u>The requirements of Section 150.1(c)3A.</u>	<u>The existing fenestration U-factor and</u> <u>SHGC values as verified.</u>
<u>Window Film</u>	<u>The requirements of Section 150.1(c)3A.</u>	<u>The existing fenestration in the alteration shall be based on</u> <u>TABLE 110.6-A and TABLE 110.6-B.</u>
<u>Doors</u>	<u>The U-factor of 0.20. The door area shall be the door area of the existing building.</u>	<u>If the proposed U-factor is < 0.20, the standard design shall be based on the existing U-factor value as verified. Otherwise, the standard design shall be based on the U-factor of 0.20. The door area shall be the door area of the existing building.</u>
<u>Space-Heating and Space-</u>	<u>Table 150.1-A for equipment efficiency requirements;</u>	<u>The existing efficiency levels.</u>

<u>Cooling Equipment</u>	<u>Section 150.2(b)1C for entirely new or complete replacement systems;</u> <u>Section 150.2(b)1F for refrigerant charge verification, airflow, and fan efficacy requirements.</u> <u>Section A4.204.1.1b for new or replacement air-cooled air conditioners</u>	
<u>Air Distribution System – Duct Sealing</u>	<u>The requirements of Sections 150.2(b)1D and 150.2(b)1E</u>	<u>The requirements of Sections 150.2(b)1D and 150.2(b)1E</u>
<u>Air Distribution System – Duct Insulation</u>	<u>The proposed efficiency levels.</u> <u>The requirements of Sections 150.2(b)1D, and for new or replacement air-cooled air conditioners, Section A4.204.1.1b.</u>	<u>The existing efficiency levels.</u>
<u>Water Heating Systems</u>	<u>The requirements of Section 150.2(b)1Hii</u>	<u>The existing efficiency level.</u>
<u>Roofing Products</u>	<u>The requirements of Section 150.2(b)1I.</u>	<u>The requirements of Section 150.2(b)1I</u>
<u>All Other Measures</u>	<u>The proposed efficiency levels.</u>	<u>The existing efficiency levels.</u>

C. The proposed design shall be based on the actual values of the altered components.

Exception 1 to Section A4.204.1.1: Where the capacity of the existing main electrical service panel is insufficient to supply the electrical capacity of a heat pump and where the existing main electrical service panel is sufficient to supply a new or replacement air conditioner, as calculated according to the requirements of California Electrical Code Article 220.83 or Article 220.87. Documentation of electrical load calculations in accordance with

Article 220 must be submitted to the enforcement agency prior to permitting for both the heat pump and proposed air conditioner.

Exception 2 to Section A4.204.1.1: Where the required capacity of a heat pump to meet the system selection requirements of Section 150.0(h)5 is greater than or equal to 12,000 Btu/h more than the greater of the required capacity of an air conditioner to meet the design cooling load OR the capacity of the existing air conditioner. Documentation of heating and cooling load calculations in accordance with 150.0(h) must be submitted to the enforcement agency prior to permitting for both the heat pump and proposed air conditioner.

SECTION 15. STATUTORY REFERENCES, INCLUSIONS OF AMENDMENTS AND ADDITIONS.

Whenever reference is made to any portion of this ordinance, or of any other chapter or section of the Sunnyvale Municipal Code, or of any other ordinance of the city of Sunnyvale, or of any law of the State of California, the reference applies to all amendments and additions now or thereafter made.

SECTION 16. INTERPRETATIONS. In interpreting and applying the provisions of this ordinance, the requirements contained herein are declared to be minimum requirements for the purposes set forth. The provisions of this ordinance, insofar as they are substantially the same as existing statutory provisions relating to the same subject matter, shall be construed as restatements and continuations and not as new enactments. This ordinance shall not nullify the more restrictive provisions of covenants, agreements or other ordinances or laws, but shall prevail as to such provisions which are less restrictive.

SECTION 17. CEQA - EXEMPTION. The City Council finds, pursuant to Title 14 of the California Code of Regulations, Section 15061 of the CEQA Guidelines, that this ordinance is exempt from the requirements of the California Environmental Quality Act (CEQA) because it can be seen with certainty that there is no possibility that the changes adopted will have a significant effect on the environment, as the ordinance principally adopts supplemental findings in support of the local amendments to the Green Building Standards Code and makes minor corrections and clarifications to local amendments to the 2025 Building Codes previously adopted by the City Council. The ordinance is also exempt from CEQA under Section 15308 (Class 8) Actions by Regulatory Agencies for Protection of the Environment and Section 15305 (Class 5) Minor alterations in Land Use Limitations.

SECTION 18. CONSTITUTIONALITY; SEVERABILITY. If any section, subsection, sentence, clause or phrase of this ordinance is for any reason held to be invalid, such decision or decisions shall not affect the validity of the remaining portions of this ordinance. The City Council hereby declares that it would have passed this ordinance, and each section, subsection, sentence, clause and phrase thereof irrespective of the fact that any one or more sections, subsections, sentences, clauses or phrases be declared invalid.

SECTION 19. EFFECTIVE DATE. This ordinance shall be in full force and effect thirty (30) days from and after the date of its adoption.

SECTION 20. POSTING AND PUBLICATION. The City Clerk is directed to cause copies of this ordinance to be posted in three (3) prominent places in the City of Sunnyvale and to cause publication once in The Sun, the official publication of legal notices of the City of Sunnyvale, of a notice setting forth the date of adoption, the title of this ordinance, and a list of places where copies of this ordinance are posted, within fifteen (15) days after adoption of this ordinance.

Introduced at a regular meeting of the City Council held on _____, 2026, and adopted as an ordinance of the City of Sunnyvale at a regular meeting of the City Council held on _____, 2026, by the following vote:

AYES:
NOES:
ABSTAIN:
ABSENT:
RECUSAL:

ATTEST:

APPROVED:

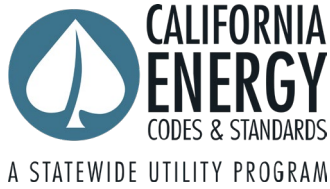
DAVID CARNAHAN
City Clerk
Date of Attestation: _____

LARRY KLEIN
Mayor

(SEAL)

APPROVED AS TO FORM:

REBECCA MOON
City Attorney



2025 Cost-Effectiveness Study: Single Family AC to Heat Pump Replacement

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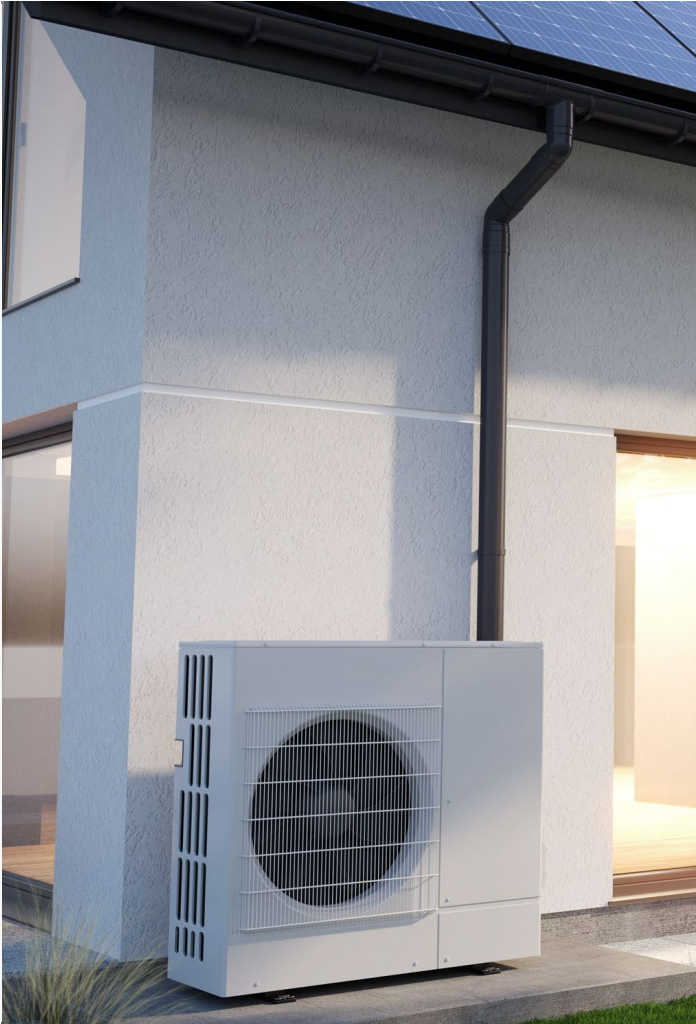


Table 1. Summary of Revisions

Date	Description	Reference (page or section)
6/09/2025	Original Release	N/A

Acronym List

AC – Air conditioner	EER – Energy Efficiency Ratio	SoCalGas – Southern California Gas Company
ACH50 – Air Changes per Hour at 50 pascals pressure differential	EF – Energy Factor	TDV – Time Dependent Valuation
AFUE – Annual Fuel Utilization Efficiency	GHG – Greenhouse Gas	Therm – Unit for quantity of heat that equals 100,000 British thermal units
B/C – Lifecycle Benefit-to-Cost Ratio	HPWH – Heat Pump Water Heater	Title 24 – Title 24, Part 6
BSC – Building Standards Commission	HSPF – Heating Seasonal Performance Factor	TOU – Time-Of-Use
CA IOUs – California Investor-Owned Utilities	HVAC – Heating, Ventilation, and Air Conditioning	UEF – Uniform Energy Factor
CARE – California Alternate Rates for Energy	IOU – Investor Owned Utility	
CASE – Codes and Standards Enhancement	kBtu – kilo-British thermal unit	
CBECC-Res – Computer program developed by the California Energy Commission for demonstrating compliance with the California Residential Building Energy Efficiency Standards	kWh – Kilowatt Hour	
CFM – Cubic Feet per Minute	LCC – Lifecycle Cost	
CO ₂ – Carbon Dioxide	LLAHU – Low Leakage Air Handler Unit	
CPAU – City of Palo Alto Utilities	VLLDCS – Verified Low Leakage Ducts in Conditioned Space	
CPUC – California Public Utilities Commission	NEEA – Northwest Energy Efficiency Alliance	
CZ – California Climate Zone	NEM – Net Energy Metering	
DFHP – Dual Fuel Heat Pump	NPV – Net Present Value	
DHW – Domestic Hot Water	PG&E – Pacific Gas and Electric Company	
DOE – Department of Energy	PV – Photovoltaic	
EDR – Energy Design Rating	SCE – Southern California Edison	
	SDG&E – San Diego Gas and Electric	
	SEER – Seasonal Energy Efficiency Ratio	
	SF – Single Family	
	SMUD – Sacramento Municipal Utility District	

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Executive Summary

The California Codes and Standards (C&S) Reach Codes program, also known as the Local Energy 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 (GHG) 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.

It is important to note that there is a voluntary measure in the 2025 CALGreen for replacing an air conditioner with a heat pump at time of air conditioner replacement, which can be adopted as is. This report seeks to provide options to modify the heat pump measure, and demonstrate the cost-effectiveness of these options.

This analysis used two different metrics to assess the cost-effectiveness of the proposed upgrades for a 1,665 square foot single family home prototype with an attached garage. Both methodologies require estimating and quantifying the incremental costs and energy savings associated with each energy efficiency measure over a 30-year analysis period. On-Bill cost-effectiveness is an occupant-based lifecycle cost (LCC) approach that values energy based upon estimated site energy usage and customer utility bill savings using today's electricity and natural gas utility tariffs. To reflect how natural gas prices fluctuate with seasonal supply and demand, a normalized curve was used to estimate the cost for the remaining months relative to today's rates. Long-term Systemwide Cost (LSC) is the California Energy Commission's metric for determining cost-effectiveness of efficiency measures in the 2025 Energy Code. This metric is intended to capture the long-term projected cost of energy including costs for providing energy during peak periods of demand, carbon emissions, grid transmission and distribution impacts.

Local jurisdictions may 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. For example, reach codes that amend Part 6 of the California Building Code (the Energy Code) and require energy performance beyond state code minimums must demonstrate the proposed changes are cost-effective and obtain approval from the Energy Commission as well as the Building Standards Commission (BSC). Amendments to Part 11, such as requirements for increased water efficiency or electric vehicle infrastructure only require BSC approval and do not require the Energy Commission approval. Although a cost-effectiveness study is only required to amend Part 6 of the California Building Code, this study provides valuable context for jurisdictions pursuing other ordinance paths to understand the economic impacts of the policy decision. This study documents the estimated costs, benefits, energy impacts and greenhouse gas emission reductions that may result from implementing an ordinance based on the results to help residents, local leadership, and other stakeholders make informed policy decisions.

The following summarizes key results:

1. Heat pumps are significantly more efficient than gas furnaces, requiring less than half the energy to meet the heating load. However, despite this reduction in heating energy use, the cost of heating a home using electricity (heat pump) could be higher than the cost to heat that same home with natural gas (furnace), depending on the electricity tariffs relative to the gas tariffs. Therefore, while a heat pump measure could be deemed as cost-effective over its lifecycle, installing a heat pump could result in a decrease *or* an increase in utility costs in the first years relative to a gas furnace and AC system.
2. The study assumes utility rates escalate over time. Because it is very difficult to predict how the rates will change, the analysis presents two escalation scenarios (modest and high gas escalation) to represent a range of outcomes.
3. The LSC metric most often produces more favorable cost-effectiveness results relative to the results produced using actual utility costs (On-Bill). When the analysis assumes a higher escalation rate for natural gas costs relative to electricity in future years (high gas escalation), the On-Bill results are more favorable in some cases.
 - a. In the oldest (pre-1978) vintage, all three measures (dual fuel heat pump with existing furnace, standard heat pump space heater, and high efficiency heat pump space heater) are cost-effective using the LSC metric in all climate zones. When using the On-Bill metric, the measures remain cost-effective in most climate zones.
 - b. In the newer (1978-1991 and 1992-2010) vintages, the dual fuel heat pump (DFHP Existing Furnace) and the standard efficiency HPSH are cost-effective based on LSC in all cases except for Climate Zone 15 when using both the standard and California Alternate Rates for Energy (CARE) tariff.
4. Using the CARE tariff results in higher cost savings and cost-effectiveness relative to standard rates, with almost all cases yielding first year utility cost savings. The DFHP Existing Furnace is On-Bill cost-effective based on the high gas escalation scenario in all cases in the pre-1978 vintage, and almost all cases in the 1978-1991 and 1992-2010 vintage. It is also On-Bill cost-effective in most climate zones for the modest gas escalation scenario across all vintages. In Climate Zones 5, 8, 9, 10, 14, and 15, cost-effectiveness declines relative to other areas, and in some cases is not cost-effective from an On-Bill perspective. This is the case for both the CARE tariff and the standard rate.
5. The analysis also modeled the cost impact of using a standard time-of-use electricity tariff versus switching to a newer electrification tariff, designed to reduce costs in homes with heat pumps and/or electric vehicles. Older homes tend to be the least efficient and achieve the most savings from improving equipment efficiency. In most of the state, because older homes tend to use more electricity than a similarly sized, newer vintage home, they realize more costs savings under the electrification tariff. Newer homes tend to use less electricity and therefore do not realize the same cost

savings from switching tariffs; they generally perform better under the standard tariff. This trend is different in milder climate zones in SCE territory (excluding CZ 15), where newer homes realize more cost savings. Both the standard and electrification tariffs in SCE territory include a daily allocation of lower-cost baseline electricity and a second, higher-priced tier when the baseline is exceeded. In many newer homes, a higher percentage of overall electricity use is within the baseline allocation, resulting in greater cost savings.

6. Higher efficiency equipment reduces utility costs in all cases and improves cost-effectiveness in many climate zones in the oldest vintage relative to standard efficiency equipment. However, in more efficient newer homes, where cost-effectiveness is generally lower, the savings are insufficient to offset the roughly \$3,000 increase in incremental cost.
7. Given the adopted Bay Area Air Quality Management District (BAAD) Zero NOx rule, and the proposed California Air Resource Board or South Coast Air Quality Management District (SCAQMD) Zero-NOx rules, and gas furnaces are no longer available or less available to be installed in 2030, a sensitivity analysis was performed for the Zero NOx scenario and found that cost-effectiveness declines in many cases except in Climate Zones 8-10, some results improve enough to become cost-effective. The improved cost-effectiveness in Climate Zones 8-10 is due to the higher baseline cost when a HPSH must be installed at year 10 when the furnace must be replaced. However, the overall magnitude of 30-year On-Bill cost-effectiveness is lower because there are only 10 years of utility cost savings. After year 10 the base case and upgrade measures are both heat pumps.

This report documents the key results and conclusions from the Reach Codes Team analysis. A full dataset of all results can be downloaded at <https://localenergycodes.com/content/resources>. Results alongside policy options can also be explored using the Cost-effectiveness Explorer at <https://explorer.localenergycodes.com/>. [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.

1 Introduction

The California Codes and Standards Reach Codes program, also known as the Local Energy Codes program, provides technical support to local governments considering adopting a local ordinance intended to support meeting local and/or statewide energy efficiency and greenhouse gas (GHG) 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.

Local jurisdictions may 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. For example, reach codes that amend Part 6 of the California Building Code (the Energy Code) (CEC, 2025) and require energy performance beyond state code minimums must demonstrate the proposed changes are cost-effective and obtain approval from the Energy Commission as well as the Building Standards Commission (BSC). Amendments to Part 11, such as requirements for increased water efficiency or electric vehicle infrastructure only require BSC approval and do not require the Energy Commission approval. Although a cost-effectiveness study is only required to amend Part 6 of the California Building Code, this study provides valuable context for jurisdictions pursuing other ordinance paths to understand the economic impacts of the policy decision. This study documents the estimated costs, benefits, energy impacts and greenhouse gas emission reductions that may result from implementing an ordinance based on the results to help residents, local leadership, and other stakeholders make informed policy decisions.

This report is an update to the [2022 Single Family Retrofit Cost-effectiveness Study](#) (Statewide Reach Codes Team, 2024) focused on an ordinance structure that encourages air conditioner (AC) to heat pump replacement. The methodology, prototype characteristics, and relevant measure packages are retained from the main study referenced above. The study includes updated utility rates, revised costs based on the TECH Clean California¹ incremental cost study data, estimated costs for the AC path, updated and expanded AC path options, and a new cost-effectiveness scenario that considers upcoming proposed zero-NOx emission regulations (SCAQMD, 2025) (California Air Resources Board, 2022) (BAAD, 2025).

Local jurisdictions in California may consider adopting local energy ordinances to achieve energy savings beyond what will be accomplished by enforcing building efficiency requirements that apply statewide.

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

¹ <https://techcleanca.com/>

decision regarding which code to amend will determine the specific requirements that must be followed for an ordinance to be legally enforceable. Although a cost-effectiveness study is only required to amend Part 6 of the CA Building Code, it is important to understand the economic impacts of any policy decision. This study documents the estimated costs, benefits, energy impacts and greenhouse gas emission reductions that may result from implementing an ordinance based on the results to help local leadership, residents, and other stakeholders make informed policy decisions.

This report was developed in coordination with the California Statewide Investor-Owned Utilities (IOUs) Codes and Standards Program, the California Energy Commission (CEC), key consultants, and engaged cities—collectively known as the Statewide Reach Codes Team. 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 Methodology and Assumptions

This study evaluates a potential reach code that encourages a heat pump or dual fuel system that includes a heat pump combined with a furnace when an air conditioner is replaced or installed new in existing single family homes. The ordinance structure and this analysis is based on the voluntary requirements adopted in 2025 Title 24, Part 11 California Green Building Standards Code (CALGreen), Section A4.204.1.1 for heat pump space conditioning alterations in single family homes (California Energy Commission, 2025). The proposed reach code also defines pathways for air conditioning equipment to be installed combined with additional efficiency measures. The heat pump path requires the heat pump as the primary heat source, with backup heating allowable either provided by electric resistance or natural gas. In cases where the existing furnace remains, the heat pump is installed alongside the existing furnace with integrated controls to allow for the furnace to provide backup heating. In alignment with the 2025 Energy Code requirements the heat pump must be sized to satisfy the heating load at the design heating temperature without the use of backup heat.

All methodology and assumptions are consistent with prior statewide analysis (Statewide Reach Codes Team, 2024) with the following exceptions:

1. Updated utility rates to January 2025
2. Equipment costs based on TECH data where available; the original report was based on Statewide contractor survey costs
3. Cost estimates were obtained for the AC path
4. Expanded AC path options
5. Cost-effectiveness results for the scenario if gas furnaces are no longer available for sale in California in 2030

2.1 Modeling

The Reach Codes Team performed energy simulations using the 2025 research version of the Residential California Building Energy Code Compliance software (CBECC). The 2025 version of CBECC includes updated weather files, metrics, and the weather stations were changed in Climate Zones 4 and 6 from San Jose to Paso Robles and Torrance to Los Angeles International Airport, respectively. Note that at the time of this report, the Energy Commission was working on integrating a new heat pump model into the CBECC-Res software to better reflect the actual energy use of heat pumps. The updated model results in lower heating energy use than is currently estimated. Once the revised software is released, the reach codes team plans to update this analysis.

Three unique building vintages are included: pre-1978, 1978-1991, and 1992-2010. The vintages were defined based on review of historic building code requirements and defining periods with distinguishing features. The proposed measures were modeled to determine the projected site energy (therm and kWh), source energy, GHG emissions, and long-term systemwide cost (LSC) impacts. Annual utility costs were calculated using hourly data

output from CBECC, and updated (as of 1/1/2025) electricity and natural gas tariffs for each of the investor-owned utilities (IOUs) as appropriate for that climate zone.

Site energy results are similar between CBECC-Res 2022 and 2025. The 2025 compliance metrics include assumptions that more appliances will be electric in the future. This is predicted to result in higher natural gas retail rates as a result of gas utilities continuing to maintain safe and reliable infrastructure amidst declining natural gas use.

Equivalent CO₂ emission reductions were calculated based on outputs from the CBECC-Res simulation software. Electricity emissions vary by region and by hour of the year. CBECC-Res applies two distinct hourly profiles, one for Climate Zones 1 through 5 and 11 through 13 and another for Climate Zones 6 through 10 and 14 through 16. Natural gas emissions do not vary hourly. To compare the mixed-fuel and all-electric cases side-by-side, GHG emissions are presented as pounds of CO₂-equivalent (CO₂e) emissions.

The Statewide Reach Codes Team designed the approach and selected measures for evaluation based on the 2019 existing building single family reach code analysis (Statewide Reach Codes Team, 2021) and supporting analysis used in the 2025 Energy Code development cycle as well as from outreach to architects, builders, and engineers.

2.2 Prototype Characteristics

The Energy Commission defines building prototypes which it uses to evaluate the cost-effectiveness of proposed changes to Energy Code requirements. Average home size has steadily increased over time, and the Energy Commission single family new construction prototypes are larger than many existing single family homes across California. For this analysis, a 1,665 square foot prototype was evaluated. Table 2 describes the basic characteristics of the single family prototype. Additions are not evaluated in this analysis as they are already addressed in Section 150.2 of the Energy Code. In the 2025 Energy Code heat pumps are prescriptively required for space and water heating for additions (California Energy Commission, 2023).

Table 2. Residential Prototype Characteristics

Climate Zone	Specification
Existing Conditioned Floor Area	1,665 ft ²
Num. of Stories	1
Num. of Bedrooms	3
Window-to-Floor Area Ratio	13%
Attached Garage	2-car garage

Three building vintages were evaluated to determine sensitivity of existing building performance on cost-effectiveness of upgrades. For example, it is widely recognized that adding attic insulation in an older home with no insulation is cost-effective, however, newer homes will likely have existing attic insulation reducing the cost-effectiveness of an incremental addition of insulation. The building characteristics for each vintage were

determined based on either prescriptive requirements from the building code that were in effect or standard construction practice during that time period. For example, homes built under 2001 Title 24 are subject to prescriptive envelope code requirements very similar to homes built under the 2005 code cycle, which was in effect until January 1, 2010.

Table 3 summarizes the assumptions for each of the three vintages. Additionally, the analysis assumed the following features when modeling the prototype buildings.

- Efficiencies were defined by year of the most recent equipment replacement based on standard equipment lifetimes.
- Individual space conditioning and water heating systems, one per single family building.
- Split-system air conditioner with natural gas furnace.
- Gas cooktop, oven, and clothes dryer.

The methodology applied in the analyses begins with a design that matches the specifications as described in Table 3 for each of the three vintages. Heat pump space conditioning measures were modeled to determine the projected energy performance and utility cost impacts relative to the baseline vintage.

Building Component Efficiency Feature	Pre-1978 Vintage	1978-1991 Vintage	1992-2010 Vintage
Envelope			
Exterior Walls	2x4, 16-inch on center wood frame, R-0 ²	2x4 16 inch on center wood frame, R-11	2x4 16 inch on center wood frame, R-13
Foundation Type & Insulation	Uninsulated slab (CZ 2-15) Raised floor, R-0 (CZ 1 & 16)	Uninsulated slab (CZ 2-15) Raised floor, R-0 (CZ 1 & 16)	Uninsulated slab (CZ 2-15) Raised floor, R-19 (CZ 1 & 16)
Ceiling Insulation & Attic Type	Vented attic, R-5 @ ceiling level for CZ 6 & 7, Vented attic, R-11 @ ceiling level (all other CZs)	Vented attic, R-19 @ ceiling level	Vented attic, R-30 @ ceiling level
Roofing Material & Color	Asphalt shingles, dark (0.10 reflectance, 0.85 emittance)	Asphalt shingles, dark (0.10 reflectance, 0.85 emittance)	Asphalt shingles, dark (0.10 reflectance, 0.85 emittance)
Radiant Barrier	No	No	No
Window Type: U-factor/SHGC ³	Metal, single pane: 1.16/0.76	Metal, dual pane: 0.79/0.70	Vinyl, dual pane Low-E: 0.55/0.40
House Infiltration at 50 Pascals	15 ACH50	10 ACH50	7 ACH50
HVAC Equipment			
Heating Efficiency	78 AFUE (assumes 2 replacements)	78 AFUE (assumes 1 replacement)	78 AFUE
Cooling Efficiency	10 SEER (assumes 2 replacements)	10 SEER (assumes 1 replacement)	13 SEER, 11 EER
Duct Location & Details	Attic, R-2.1, 30% leakage at 25 Pa	Attic, R-2.1, 25% leakage at 25 Pa	Attic, R-4.2, 15% leakage at 25 Pa
Whole Building Mechanical Ventilation	None	None	None
Water Heating Equipment			
Water Heater Efficiency	0.575 Energy Factor (assumes 2 replacements)	0.575 Energy Factor (assumes 1 replacement)	0.575 Energy Factor
Water Heater Type	40-gallon gas storage	40-gallon gas storage	40-gallon gas storage
Pipe Insulation	None	None	None
Hot Water Fixtures	Standard, non-low flow	Standard, non-low flow	Standard, non-low flow

² Pre-1978 wall modeled with R-5 cavity insulation to better align wall system performance with monitored field data and not overestimate energy use.

³ Window type selections were made based on conversations with window industry expert, Ken Nittler. If a technology was entering the market during the time period (e.g., Low-E during 1992-2010 or dual-pane during 1978-1991) that technology was included in the analysis. This provides a conservative assumption for overall building performance and additional measures may be cost-effective for buildings with lower performing windows, for example buildings with metal single pane windows in the 1978-1991 vintage

2.3 Cost-Effectiveness Approach

2.3.1 Benefits

This analysis used two different metrics to assess the cost-effectiveness of the proposed upgrades. Both methodologies require estimating and quantifying the incremental costs and energy savings associated with each energy efficiency measure. The main difference between the methodologies is the way they value energy impacts:

- **On-Bill:** Customer-based lifecycle cost approach that values energy based upon estimated site energy usage and customer On-Bill savings using electricity and natural gas utility rate schedules over a 30-year duration, accounting for a three percent discount rate and energy cost inflation per Appendix 6.3.7.
- **Long-term Systemwide Cost (LSC):** Formerly known as Time Dependent Valuation (TDV) energy cost savings, LSC reflects the Energy Commission's current lifecycle cost (LCC) methodology, which is intended to capture the total value or cost of energy use over 30 years. This method accounts for the hourly cost of marginal generation, transmission and distribution, fuel, capacity, losses, and cap-and-trade-based CO₂ emissions (California Energy Commission, 2023). This is the methodology used by the Energy Commission in evaluating cost-effectiveness for measures in the 2025 Energy Code.

Energy simulations were completed using the 2025 research version of the Residential California Building Energy Code Compliance software (CBECC).

2.3.2 Costs

The Reach Codes Team assessed the incremental costs and savings of the packages over the lifecycle of 30-years. Incremental costs represent the equipment, installation, replacement, and maintenance costs of the proposed measure relative to the 2025 Energy Code minimum requirements or standard industry practices.

In February 2024, the TECH Clean California statewide program completed an incremental cost study from cost data collected from 64 contractor participants (Opinion Dynamics, 2024). This report directly uses the TECH costs for all the scenarios for which there was TECH cost data available. These costs were supplemented with measure costs the Reach Codes Team obtained from a contractor survey conducted in the summer of 2023. Additional detail on the contractor cost survey is available in the prior existing building statewide study (Statewide Reach Codes Team, 2024). The following summarizes key assumptions in this costing approach.

- Average statewide costs from the TECH Study were used, no regional specific costs were applied.
- Costs for 3-ton and 4-ton units were scaled for smaller and larger systems based on linear interpolation between the 3-ton and 4-ton costs.

- The TECH study provided cost for a minimum efficiency 60,000 Btu/h gas furnace. However, beginning in 2028, newly installed residential gas furnaces must comply with updated federal efficiency standards requiring a minimum of 95% AFUE⁴. Because the TECH study did not include cost estimates for a 95% AFUE condensing furnace, an adjustment was made using data from the statewide contractor cost survey. For systems requiring larger furnace capacities, cost estimates were derived as follows:
 - **80,000 Btu/h furnaces** (serving systems sized 3 tons): The cost difference between the minimum efficiency and 95% AFUE versions of the 80,000 Btu/h furnace and the cost difference between the minimum efficiency 80,000 Btu/h furnace and the minimum efficiency 60,000 Btu/h furnace, as reported in the contractor survey, was added to the TECH cost for the 60,000 Btu/h unit.
 - **100,000 Btu/h furnaces** (serving systems 4 tons and larger): The same method was applied using the corresponding cost differential for 100,000 Btu/h units.
- At time of replacement for the heat pump, based on heating loads and contractor feedback it is assumed an electric resistance backup coil would be installed with the air handler for Climate Zones 1 and 16. The CBECC-Res software applies back up electric resistance heating for all climate zones whenever it is assumed that the heat pump cannot meet the heating load based on the performance of currently available products (Heinemeier, 2025). The TECH costs did not include this option. The \$819 incremental cost from the statewide study was added in this case.
- At the time of replacement for a furnace when it fails, the statewide study assumed a fan motor replacement. The TECH costs did not include this option. A \$1,200 incremental cost was added to the TECH cost.
- At time of replacement for high efficiency heat pump, the sum of the TECH cost for standard efficiency heat pump and the incremental cost difference from the statewide study for high efficiency and standard efficiency heat pump was applied.

Costs were applied based on the system capacity from heating and cooling load calculations in CBECC-Res as presented in Table 4. Air conditioner nominal capacity was calculated as the CBECC-Res cooling load, rounded up to the nearest half ton. Heat pump nominal capacity was calculated as the maximum of either the CBECC-Res heating or cooling load, rounded up to the nearest half ton. In both cases a minimum capacity of 1.5-ton was applied as this represents the typical smallest available split system heat pump equipment. Load calculations revealed that Climate Zones 2 through 15 were cooling-dominated, whereas Climate Zones 1 and 16 were heating-dominated. In these heating-

⁴ <https://www.energy.gov/articles/doe-finalizes-energy-efficiency-standards-residential-furnaces-save-americans-15-billion#:~:text=These%20furnace%20efficiency%20standards%20were,heat%20for%20the%20living%20space.>

dominated zones, the heat pump was upsized compared to an air conditioner designed solely for cooling to ensure adequate heating performance.

Table 4. System Sizing by Climate Zone

Climate Zone	Air Conditioner Capacity (tons)	Heat Pump Capacity (tons)
1	1.5	3.0
2	3.5	3.5
3	2.5	2.5
4	3.5	3.5
5	3.0	3.0
6	3.0	3.0
7	3.0	3.0
8	4.0	4.0
9	4.0	4.0
10	4.0	4.0
11	4.5	4.5
12	4.0	4.0
13	4.5	4.5
14	4.0	4.0
15	5.0	5.0
16	3.5	4.0

2.3.3 Metrics

Cost-effectiveness is presented using net present value (NPV).

- NPV: The Reach Codes Team uses net savings (NPV benefits minus NPV costs) as the cost-effectiveness metric. If the net savings of a measure or package is positive, it is considered cost effective. Negative net savings represent net costs to the consumer. A measure that has negative energy cost benefits (energy cost increase) can still be cost effective if the costs to implement the measure are even more negative (i.e., construction and maintenance cost savings).

Improving the energy performance of a building often requires an initial investment. In most cases the benefit is represented by annual On-Bill utility or LSC savings, and the cost by incremental first cost and replacement costs. However, some packages result in initial construction cost savings (negative incremental cost), and either energy cost savings (positive benefits), or increased energy costs (negative benefits). In cases where both construction costs and energy-related savings are negative, the construction cost savings are treated as the benefit while the increased energy costs are the cost. In cases where a measure or package is cost-effective immediately (i.e., upfront construction cost savings and lifetime energy cost savings).

2.3.4 Utility Rates

In coordination with the CA IOU rates team (comprised of representatives from Pacific Gas and Electric (PG&E), Southern California Edison (SCE) and San Diego Gas and Electric (SDG&E)) and two Publicly-Owned-Utilities (POUs) (Sacramento Municipal Utility District (SMUD) and City of Palo Alto Utilities (CPAU)), the Reach Codes Team determined appropriate utility rates for each climate zone to calculate utility costs and determine On-Bill cost-effectiveness for the proposed measures and packages. The utility tariffs, summarized in Table 5 and Table 6 with details in Section 6.2.26.2.2, were determined based on the appropriate rate for each. Utility rates were applied to each climate zone based on the predominant IOU serving the population of each zone, with a few climate zones evaluated multiple times under different utility scenarios. Climate Zones 10 and 14 were evaluated with both SCE for electricity and Southern California Gas Company (SoCalGas) for gas and SDG&E tariffs for both electricity and gas since each utility has customers within these climate zones. Climate Zone 5 is evaluated under both PG&E and SoCalGas natural gas rates. Two POU or municipal utility rates were also evaluated: SMUD in Climate Zone 12 and CPAU in Climate Zone 4.

First-year utility costs were calculated using hourly electricity and natural gas output from CBECC-Res and applying the utility tariffs summarized in Table 5 and Table 6. Homes with a heat pump in IOU territory are eligible for either the electrification or the standard tariff. Utility costs were calculated under both tariffs with results presented using the one that yielded the lower annual utility cost. The electrification tariff resulted in better utility costs savings when there was high kWh usage, typically in older, less efficient homes. Conversely, newer homes which are more efficient, tend to benefit more under the standard tariff. However, in SCE's milder climate zones, older homes benefit more under the standard tariff. Annual costs were also estimated for IOU customers eligible for the CARE tariff discounts on both electricity and natural gas bills.

Table 5. Investor-Owned Utility Tariffs Used Based on Climate Zone

Climate Zones	Electric / Gas Utility	Electricity Tariff: Standard Rate	Electricity Tariff: Electrification Rate	Natural Gas Tariff
1-5,11-13,16	PG&E / PG&E	E-TOU-C	E-ELEC	G1
5	PG&E / SoCalGas	E-TOU-C	E-ELEC	GR
6, 8-10, 14, 15	SCE / SoCalGas	TOU-D-4-9	TOU-D-PRIME	GR
7, 10, 14	SDG&E / SDG&E	TOU-DR-1	EV-TOU-5	GR

Table 6. Publicly Owned Utility Tariffs Used Based on Climate Zone

Climate Zones	Electric / Gas Utility Electricity Tariff: Standard Rate	Electricity Tariff: Electrification Rate	Natural Gas Tariff
4	CPAU / CPAU	E-1	G1
12	SMUD / PG&E	R-TOD	G1

Utility rates are assumed to escalate over time. Because it is very difficult to predict how rates will change, two escalation scenarios are presented in this study to represent a range of outcomes. See Appendix 6.3.7 Fuel Escalation Assumptions for details.

- 1) Modest Gas Escalation: This scenario is based on assumptions from the CPUC 2021 En Banc hearings on utility costs through 2030 (California Public Utilities Commission, 2021a). Escalation rates throughout the remainder of the 30-year evaluation period are based on the escalation rate assumptions within the 2022 Energy Code TDV factors developed by the Energy Commission (California Energy Commission, 2021b).
- 2) High Gas Escalation: This scenario is based on escalation rates developed by the Energy Commission and used within the 2025 Energy Code LSC factors (LSC replaces TDV in the 2025 Energy Code) which assumed steep increases in gas rates in the latter half of the analysis period.

Electricity tariff structures will evolve over time. Most recently, the CPUC approved an income-graduated fixed charge intended to benefit low-income customers and support electrification measures.⁵ The IOUs are currently developing tariffs that meet the direction given by the CPUC in this proceeding. These tariffs were not available at the time of this study, but this analysis may be re-evaluated later in 2025 once the rates are finalized.

⁵ <https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/electric-costs/demand-response-dr/demand-flexibility-rulemaking>

2.4 Measure Details and Cost

This section describes the details of the measures and documents incremental costs. All measure costs were obtained from the TECH cost survey and contractor survey unless otherwise noted. These surveys reflect the cost to the customer and include equipment, labor, permit fees, and required HERS testing.

The following heat pump space heater (HPSH) measures were evaluated as described below. All included HERS verified refrigerant charge, 10% duct sealing, and 300 CFM/ton airflow, aligned with the proposed code requirements for the 2025 Title 24 code.

- 1) **Dual Fuel Heat Pump (DFHP Existing Furnace):** Replace existing ducted AC with an electric heat pump and install controls to operate the heat pump as the primary space conditioning source and to use the existing gas furnace (78 AFUE) for backup heat when heating demands cannot be met by the heat pump. In this report, dual fuel heat pumps were modeled to disable furnace operation above an outdoor temperature of 35°F in compliance with Energy Code Section 150.0(h)7, which requires this lockout for any heat pump with supplemental heating. A minimum federal efficiency (14.3 SEER2, 11.7 EER2, 7.5 HSPF2) heat pump was evaluated. Savings are compared to a new AC (14.3 SEER2, 11.7 EER2) alongside the existing furnace (78 AFUE). A new evaporator coil is assumed to be installed with the AC system.
- 2) **HPSH:** Replace existing ducted AC and natural gas furnace with an electric heat pump and air handler. Minimum federal efficiency (14.3 SEER2, 11.7 EER2, 7.5 HSPF2) heat pumps were evaluated. Savings are compared to a new ducted natural gas furnace and AC (14.3 SEER2, 11.7 EER2, 80 AFUE).
- 3) **High Efficiency HPSH:** Replace existing ducted AC and natural gas furnace with an electric heat pump and air handler. Higher efficiency (17 SEER2, 12.48 EER2, 9.5 HSPF2) heat pumps were evaluated. Savings are compared to a new ducted natural gas furnace and AC (14.3 SEER2, 11.7 EER2, 80 AFUE).

Over the 30-year analysis period, certain changes are assumed when the equipment is replaced that impact both lifetime costs and energy use. Table 7 and Table 8 present the lifetime scenario for the DFHP Existing Furnace and HPSH measures, respectively. The analysis assumed a 20-year effective useful lifetime (EUL) for a furnace, a 15-year EUL for an air conditioner and a 15-year EUL for a heat pump. Lifetimes are based on the Database for Energy Efficient Resources (DEER) (California Public Utilities Commission, 2021b). The existing furnace is assumed to be halfway through its EUL at the beginning of the analysis period. After 10 years when the furnace reaches the end of its life and needs to be replaced, it will be subject to new federal efficiency standards for residential gas furnaces that go into effect in 2028 requiring 95 AFUE⁶. Five years later the air conditioner reaches the end of its life and is replaced with a new air conditioner.

⁶ <https://www.energy.gov/articles/doe-finalizes-energy-efficiency-standards-residential-furnaces-save-americans-15-billion#:~:text=These%20furnace%20efficiency%20standards%20were.heat%20for%20the%20living%20space>.

For the DFHP upgrade case, after 10 years when the furnace fails it's expected that the furnace is abandoned in place since the heat pump serves primary heating and was sized to provide the full design heating load. In this case it is assumed that the fan motor is replaced with a new aftermarket unit and operates another five years until the heat pump fails and is replaced with a new heat pump and air handler. Table 7 through Table 8 present the lifecycle incremental cost breakdown for a 4-ton system. The heat pump is sized for each climate zone based on the heating and cooling load as shown in Table 4, and the 4-ton system was selected as an example to show the lifecycle cost breakdown.

Table 7. Lifecycle Incremental Cost Breakdown for a 4-Ton DFHP Existing Furnace

Calendar Year	Baseline AC Replacement Schedule	Baseline Future Cost	Baseline Present Value Cost	Heat Pump	Heat Pump Future Cost	Heat Pump Present Value Cost
2026	AC fails, install new AC, keep existing furnace	\$10,431	\$10,431	AC fails, install new HP, keep existing furnace	\$12,347	\$12,347
2036	Furnace fails, install new 95AFUE furnace	\$7,476	\$5,563	Furnace fails, replace fan motor	\$1,200	\$893
2041	AC fails, install new AC	\$10,431	\$6,695	HP fails, install new HP and air handler	\$14,529	\$9,326
Total			\$22,689			\$22,566
Incremental Cost				-\$123		

Table 8. Lifecycle Incremental Cost Breakdown for 4-Ton HPSH

Calendar Year	Baseline AC Replacement Schedule	Baseline Future Cost	Baseline Present Value Cost	Heat Pump	Heat Pump Future Cost	Heat Pump Present Value Cost
2026	AC fails, install new AC & furnace	\$13,808	\$13,808	AC fails, install new HP & AHU	\$14,529	\$14,529
2041	AC fails, install new AC	\$10,431	\$6,695	HP fails, install new HP & AHU	\$13,529	\$8,684
2046	Furnace fails, install new 95AFUE furnace	\$7,476	\$4,139	-	-	-
2056	Remaining useful life for furnace	-	-\$1,540	-	-	-
Total			\$23,103			\$23,213
Incremental Cost				\$110		

Table 9 presents estimated first and lifetime costs for the baseline and heat pump scenarios for 4-ton equipment. Costs include all material and installation labor including providing new 240 V electrical service to the air handler location for all new air handler installations and decommissioning of the furnace for the cases where the furnace is removed. DFHP costs incorporate controls installation and commissioning to ensure the heat pump and the furnace communicate properly and don't operate at the same time. Future replacement costs do not include any initial costs associated with 240V electrical service or furnace decommissioning.

Table 9. HVAC Measure Cost Assumptions – 4-Ton Electric Replacements

Measure Case	AC + Evaporator Coil	Gas Furnace /AC	DFHP Existing Furnace	HPSH	High Efficiency HPSH
Base Case	-	-	AC + Evaporator Coil	Gas Furnace /AC	Gas Furnace /AC
First Cost	\$10,431	\$13,808	\$12,347	\$14,529	\$17,506
Replacement Cost (Future Value)	\$17,907	\$17,907	\$15,729	\$13,529	\$16,506
Replacement Cost (Present Value)	\$12,258	\$11,639	\$10,219	\$8,684	\$10,594
Remaining Value at Year 30	\$0	-\$1,540	\$0	\$0	\$0
Total Lifecycle Cost	\$22,689	\$23,103	\$22,566	\$23,213	\$28,100
Incremental Cost	-	-	-\$123	\$110	\$4,997

2.4.1 Lifecycle Cost Assuming Zero-NOx Standards for Space Heating After 2030

The California Air Resource Board proposed a strategy for reducing emissions in their 2022 Scoping Plan for Achieving Carbon Neutrality that includes a zero-emission standard for space and water heaters sold in California that would go into effect in 2030 (California Air Resources Board, 2022).

The South Coast Air Quality Management District (SCAQMD) proposed Rule 1111 for the Reduction of NOx Emissions from Natural Gas-Fired Furnaces. This rule applies to furnaces less than 175,000 Btu/hr and sets compliance goals for manufacturers with the proposed dates in Table 10. The sale of gas furnaces above the compliance target will incur a mitigation fee (SCAQMD, 2025).

Table 10. SCAQMD Rule 1111 Proposed Manufacturer Compliance Targets

Target Dates	2027-2028	2029-2032	2033-2035	2036 and after
NOx Emitting Units (e.g. gas)	70%	50%	25%	10%
Zero-Emission Units	30%	50%	75%	90%

The Bay Area Air Quality Management District (BAAD) adopted Rule 9-4 that similarly requires zero NOx standards for space heating systems sold in the Bay Area. Implementation for residential furnaces will begin January 2029 (BAAD, 2025).

The BAAD Rule 9-4 has been adopted, but both the California Air Resources Board and SCAQMD Rule 1111 are proposed rules that have not yet been adopted, but given the implications these rulings would have on the 30-year cost-effectiveness if gas furnaces were very limited or no longer available in 2030, a sensitivity analysis for this scenario is included in this study for the DFHP Existing Furnace scenario. The other heat pump measures would also be impacted by this ruling; however, for simplicity the team selected one measure to give a sense of the impact on the results. The following costs reflect the scenario where gas furnaces are not available in 2030. This 30-year lifecycle analysis assumes that in 10 years when the furnace reaches the end of its useful life and needs to be replaced, it will be subjected to the SCAQMD Rule 1111 or California Air Resources Board proposal and will be replaced with a heat pump.

Table 11. Lifecycle Incremental Cost Breakdown for 4-Ton System with no Gas Furnaces after 2030

Calendar Year	Baseline AC Replacement Schedule	Baseline Future Cost	Baseline Present Value Cost	Heat Pump	Heat Pump Future Cost	Heat Pump Present Value Cost
2026	AC fails, install new AC, keep existing furnace	\$10,431	\$10,431	AC fails, install new HP, keep existing furnace	\$12,347	\$12,347
2036	Furnace fails, install new HP	\$14,529	\$10,811	Furnace fails, replace fan motor	\$1,200	\$893
2041	-	-	-	HP fails, install new HP and air handler	\$14,529	\$9,326
2051	HP fails, install new HP	\$13,529	\$6,462	-	-	-
2056	Remaining useful life for HP	-	-\$4,459	-	-	-
Total			\$23,244	\$22,566		
Incremental Cost			-\$679			

3 Results

The primary objective of the evaluation is to identify cost-effective HPSH upgrade measures for existing single family buildings, to support the design of local ordinances encouraging installation of a heat pump when replacing an air conditioner. While this section focuses primarily on the results of the cost-effectiveness analysis, it is important to highlight that the associated greenhouse gas (GHG) emissions savings are significant – averaging a 25% annual reduction across the climate zones and vintages. A full dataset of all results, including site energy, source energy, LSC and GHG emissions, can be downloaded at <https://localenergycodes.com/content/resources>. Results alongside policy options can also be explored using the Cost-effectiveness Explorer at <https://explorer.localenergycodes.com/>.

3.1 Cost-Effectiveness Results

Table 12 through Table 14 present results across the 16 climate zones for the 1992-2010 vintage using standard tariffs and Table 15 through Table 17 present results across the 16 climate zones and three vintages using CARE tariffs. Results show the incremental cost and utility bill savings for the first year along with cost effectiveness results for LSC and On-Bill under both the modest and high gas escalation scenarios. Results for additional vintages using standard tariffs are in Appendix 6.2 Cost-Effectiveness Results.

3.1.1 Cost Effectiveness Results Using Standard Tariffs

Table 12. [1992-2010] DFHP Existing Furnace

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	\$2,405	\$60	\$10,843	\$5,471	\$21,616
CZ02	PGE	\$1,670	(\$86)	\$8,387	\$2,238	\$12,692
CZ03	PGE	\$1,178	\$15	\$8,383	\$4,891	\$13,958
CZ04	PGE	\$1,670	(\$68)	\$7,322	\$1,880	\$10,049
CZ04	CPAU	\$1,670	(\$9)	\$7,322	\$2,132	\$7,104
CZ05	PGE	\$1,424	(\$12)	\$6,848	\$3,425	\$11,150
CZ05	PGE/SCG	\$1,424	(\$195)	\$6,848	(\$1,864)	\$2,099
CZ06	SCE/SCG	\$1,424	(\$34)	\$2,647	\$675	\$1,468
CZ07	SDGE	\$1,424	(\$36)	\$2,691	\$599	\$1,734
CZ08	SCE/SCG	\$1,916	(\$65)	\$1,879	(\$811)	\$162
CZ09	SCE/SCG	\$1,916	(\$90)	\$2,600	(\$1,186)	\$288
CZ10	SCE/SCG	\$1,916	(\$79)	\$2,295	(\$982)	\$394
CZ10	SDGE	\$1,916	\$54	\$2,295	\$2,201	\$4,708
CZ11	PGE	\$2,162	\$68	\$7,597	\$4,639	\$14,675
CZ12	PGE	\$1,916	\$44	\$8,317	\$4,702	\$15,222
CZ12	SMUD/PGE	\$1,916	\$353	\$8,317	\$11,622	\$22,364
CZ13	PGE	\$2,162	\$76	\$5,244	\$3,897	\$11,138
CZ14	SCE/SCG	\$1,916	(\$179)	\$4,654	(\$2,364)	\$1,340
CZ14	SDGE	\$1,916	(\$22)	\$4,654	\$1,282	\$7,058
CZ15	SCE/SCG	\$2,408	(\$133)	(\$271)	(\$3,438)	(\$3,209)
CZ16	PGE	\$2,243	(\$66)	\$8,842	\$1,260	\$11,982

Table 13. [1992-2010] Standard Efficiency HPSH

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	\$3,067	(\$145)	\$10,949	(\$34)	\$17,899
CZ02	PGE	\$652	(\$229)	\$9,362	(\$702)	\$11,825
CZ03	PGE	\$514	(\$62)	\$8,244	\$2,373	\$11,665
CZ04	PGE	\$652	(\$205)	\$8,680	(\$572)	\$10,753
CZ04	CPAU	\$652	(\$85)	\$8,680	\$556	\$7,194
CZ05	PGE	\$583	(\$113)	\$6,957	\$752	\$9,206
CZ05	PGE/SCG	\$583	(\$316)	\$6,957	(\$5,101)	(\$811)
CZ06	SCE/SCG	\$583	(\$37)	\$2,134	(\$63)	\$716
CZ07	SDGE	\$583	(\$39)	\$2,156	(\$149)	\$981
CZ08	SCE/SCG	\$721	(\$79)	\$1,812	(\$1,356)	(\$371)
CZ09	SCE/SCG	\$721	(\$118)	\$2,589	(\$2,038)	(\$524)
CZ10	SCE/SCG	\$721	(\$103)	\$2,311	(\$1,723)	(\$259)
CZ10	SDGE	\$721	\$34	\$2,311	\$1,533	\$4,218
CZ11	PGE	\$790	(\$35)	\$8,817	\$2,833	\$14,504
CZ12	PGE	\$721	(\$94)	\$9,199	\$1,812	\$13,563
CZ12	SMUD/PGE	\$721	\$363	\$9,199	\$12,027	\$24,107
CZ13	PGE	\$790	\$6	\$5,948	\$2,558	\$10,687
CZ14	SCE/SCG	\$721	(\$412)	\$6,635	(\$6,964)	(\$1,073)
CZ14	SDGE	\$721	(\$107)	\$6,635	\$166	\$10,249
CZ15	SCE/SCG	\$859	(\$139)	(\$112)	(\$3,434)	(\$3,186)
CZ16	PGE	\$2,095	(\$385)	\$13,600	(\$2,842)	\$19,424

Table 14. [1992-2010] High Efficiency HPSH

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	\$5,998	\$56	\$9,783	(\$350)	\$17,727
CZ02	PGE	\$3,606	(\$94)	\$7,527	(\$2,544)	\$10,080
CZ03	PGE	\$3,422	\$59	\$5,701	\$312	\$9,692
CZ04	PGE	\$3,606	(\$61)	\$6,961	(\$2,193)	\$9,235
CZ04	CPAU	\$3,606	\$0	\$6,961	(\$2,389)	\$4,310
CZ05	PGE	\$3,514	\$4	\$4,176	(\$1,450)	\$7,088
CZ05	PGE/SCG	\$3,514	(\$199)	\$4,176	(\$7,303)	(\$2,929)
CZ06	SCE/SCG	\$3,514	(\$14)	(\$2,162)	(\$4,367)	(\$3,567)
CZ07	SDGE	\$3,514	(\$12)	(\$2,090)	(\$4,312)	(\$3,191)
CZ08	SCE/SCG	\$3,698	\$13	(\$1,660)	(\$4,217)	(\$3,149)
CZ09	SCE/SCG	\$3,698	(\$26)	(\$750)	(\$4,883)	(\$3,284)
CZ10	SCE/SCG	\$3,698	(\$4)	(\$844)	(\$4,418)	(\$2,864)
CZ10	SDGE	\$3,698	\$132	(\$844)	(\$1,068)	\$1,587
CZ11	PGE	\$3,789	\$186	\$7,738	\$2,845	\$14,675
CZ12	PGE	\$3,698	\$88	\$7,575	\$996	\$12,879
CZ12	SMUD/PGE	\$3,698	\$422	\$7,575	\$8,459	\$20,580
CZ13	PGE	\$3,789	\$208	\$4,419	\$2,165	\$10,439
CZ14	SCE/SCG	\$3,698	(\$219)	\$5,760	(\$7,575)	(\$1,506)
CZ14	SDGE	\$3,698	\$77	\$5,760	(\$424)	\$9,604
CZ15	SCE/SCG	\$3,881	\$50	(\$2,144)	(\$4,209)	(\$3,786)
CZ16	PGE	\$5,071	(\$97)	\$14,557	(\$1,291)	\$21,181

3.1.2 Cost Effectiveness Results Using CARE Tariffs

Table 15. [1992-2010] DFHP Existing Furnace 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	\$2,405	\$153	\$10,843	\$6,436	\$19,266
CZ02	PGE	\$1,670	\$18	\$8,387	\$3,842	\$12,159
CZ03	PGE	\$1,178	\$73	\$8,383	\$5,574	\$12,777
CZ04	PGE	\$1,670	\$14	\$7,322	\$3,143	\$9,641
CZ04	CPAU	\$1,670	\$0	\$7,322	\$711	\$711
CZ05	PGE	\$1,424	\$47	\$6,848	\$4,198	\$10,337
CZ05	PGE/SCG	\$1,424	(\$98)	\$6,848	\$23	\$3,191
CZ06	SCE/SCG	\$1,424	(\$18)	\$2,647	\$967	\$1,600
CZ07	SDGE	\$1,424	(\$16)	\$2,691	\$1,000	\$1,887
CZ08	SCE/SCG	\$1,916	(\$38)	\$1,879	(\$285)	\$495
CZ09	SCE/SCG	\$1,916	(\$52)	\$2,600	(\$450)	\$731
CZ10	SCE/SCG	\$1,916	(\$45)	\$2,295	(\$331)	\$771
CZ10	SDGE	\$1,916	\$51	\$2,295	\$1,998	\$3,963
CZ11	PGE	\$2,162	\$115	\$7,597	\$4,993	\$12,965
CZ12	PGE	\$1,916	\$103	\$8,317	\$5,287	\$13,643
CZ12	SMUD/PGE	\$1,916	\$418	\$8,317	\$12,339	\$20,922
CZ13	PGE	\$2,162	\$100	\$5,244	\$3,939	\$9,686
CZ14	SCE/SCG	\$1,916	(\$98)	\$4,654	(\$849)	\$2,119
CZ14	SDGE	\$1,916	\$23	\$4,654	\$2,007	\$6,528
CZ15	SCE/SCG	\$2,408	(\$88)	(\$271)	(\$2,456)	(\$2,260)
CZ16	PGE	\$2,243	\$33	\$8,842	\$2,737	\$11,267

Table 16. [1992-2010] Standard Efficiency HPSH 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	\$3,067	\$33	\$10,949	\$2,703	\$16,973
CZ02	PGE	\$652	(\$59)	\$9,362	\$2,211	\$12,188
CZ03	PGE	\$514	\$25	\$8,244	\$3,685	\$11,074
CZ04	PGE	\$652	(\$53)	\$8,680	\$2,048	\$11,067
CZ04	CPAU	\$652	\$0	\$8,680	\$255	\$255
CZ05	PGE	\$583	(\$13)	\$6,957	\$2,389	\$9,117
CZ05	PGE/SCG	\$583	(\$173)	\$6,957	(\$2,232)	\$1,208
CZ06	SCE/SCG	\$583	(\$20)	\$2,134	\$249	\$872
CZ07	SDGE	\$583	(\$18)	\$2,156	\$279	\$1,161
CZ08	SCE/SCG	\$721	(\$47)	\$1,812	(\$728)	\$62
CZ09	SCE/SCG	\$721	(\$70)	\$2,589	(\$1,094)	\$122
CZ10	SCE/SCG	\$721	(\$61)	\$2,311	(\$892)	\$281
CZ10	SDGE	\$721	\$39	\$2,311	\$1,509	\$3,612
CZ11	PGE	\$790	\$60	\$8,817	\$4,141	\$13,421
CZ12	PGE	\$721	\$22	\$9,199	\$3,592	\$12,940
CZ12	SMUD/PGE	\$721	\$471	\$9,199	\$13,622	\$23,292
CZ13	PGE	\$790	\$61	\$5,948	\$3,234	\$9,693
CZ14	SCE/SCG	\$721	(\$241)	\$6,635	(\$3,632)	\$1,098
CZ14	SDGE	\$721	(\$5)	\$6,635	\$1,996	\$9,885
CZ15	SCE/SCG	\$859	(\$91)	(\$112)	(\$2,414)	(\$2,201)
CZ16	PGE	\$2,095	(\$92)	\$13,600	\$2,163	\$19,892

Table 17. [1992-2010] High Efficiency HPSH 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	\$5,998	\$164	\$9,783	\$813	\$15,177
CZ02	PGE	\$3,606	\$28	\$7,527	(\$683)	\$9,357
CZ03	PGE	\$3,422	\$104	\$5,701	\$674	\$8,120
CZ04	PGE	\$3,606	\$41	\$6,961	(\$703)	\$8,383
CZ04	CPAU	\$3,606	\$0	\$6,961	(\$4,595)	(\$4,595)
CZ05	PGE	\$3,514	\$62	\$4,176	(\$727)	\$6,056
CZ05	PGE/SCG	\$3,514	(\$98)	\$4,176	(\$5,348)	(\$1,853)
CZ06	SCE/SCG	\$3,514	(\$5)	(\$2,162)	(\$4,219)	(\$3,583)
CZ07	SDGE	\$3,514	(\$0)	(\$2,090)	(\$4,112)	(\$3,235)
CZ08	SCE/SCG	\$3,698	\$15	(\$1,660)	(\$4,248)	(\$3,401)
CZ09	SCE/SCG	\$3,698	(\$8)	(\$750)	(\$4,603)	(\$3,330)
CZ10	SCE/SCG	\$3,698	\$6	(\$844)	(\$4,300)	(\$3,065)
CZ10	SDGE	\$3,698	\$103	(\$844)	(\$1,892)	\$191
CZ11	PGE	\$3,789	\$203	\$7,738	\$2,425	\$11,808
CZ12	PGE	\$3,698	\$141	\$7,575	\$1,351	\$10,784
CZ12	SMUD/PGE	\$3,698	\$471	\$7,575	\$8,735	\$18,405
CZ13	PGE	\$3,789	\$192	\$4,419	\$1,255	\$7,809
CZ14	SCE/SCG	\$3,698	(\$111)	\$5,760	(\$5,632)	(\$783)
CZ14	SDGE	\$3,698	\$115	\$5,760	(\$98)	\$7,755
CZ15	SCE/SCG	\$3,881	\$36	(\$2,144)	(\$4,549)	(\$4,220)
CZ16	PGE	\$5,071	\$95	\$14,557	\$1,460	\$19,324

3.2 Zero-NOx Scenario Results

This section presents cost-effectiveness results for the DFHP Existing Furnace under the scenario where proposed air quality district zero-NOx rules go into effect over the next 10 years. In the base case, at time of replacement of the gas furnace at year 10 a heat pump is installed. The energy profile between the base case and the heat pump upgrade case are subsequently identical for the remaining 20 years of the 30-year analysis period. As a result, energy and cost savings only persist for the first 10 years.

Table 18 shows the On-Bill NPV cost-effectiveness results and Table 19 the LSC cost-effectiveness results for all three vintages. 2025 LSC savings were calculated using individual year multipliers for the first 10 years, 2026 through 2035.

Table 18. DFHP Existing Furnace On-Bill NPV (Zero-NOx Rule)

Climate Zone	Electric/ Gas Utility	On-Bill NPV		
		Pre-1978	1978-1991	1992-2010
CZ01	PGE	\$5,473	\$4,136	\$2,349
CZ02	PGE	\$1,785	\$1,031	\$1,101
CZ03	PGE	\$2,863	\$2,097	\$2,052
CZ04	PGE	\$2,133	\$1,162	\$1,019
CZ04	CPAU	\$2,340	\$1,599	\$1,213
CZ05	PGE	\$1,918	\$1,486	\$1,576
CZ05	PGE/SCG	(\$1,308)	(\$834)	(\$491)
CZ06	SCE/SCG	\$401	\$605	\$635
CZ07	SDGE	\$1,473	\$999	\$641
CZ08	SCE/SCG	(\$125)	\$99	\$195
CZ09	SCE/SCG	(\$563)	(\$183)	\$22
CZ10	SCE/SCG	(\$259)	\$53	\$110
CZ10	SDGE	\$2,985	\$2,261	\$1,430
CZ11	PGE	\$3,287	\$2,866	\$2,279
CZ12	PGE	\$2,935	\$2,578	\$2,202
CZ12	SMUD/PGE	\$7,877	\$5,978	\$5,040
CZ13	PGE	\$2,927	\$2,556	\$2,053
CZ14	SCE/SCG	(\$864)	(\$943)	(\$543)
CZ14	SDGE	\$2,204	\$1,655	\$1,064
CZ15	SCE/SCG	\$1,338	\$396	(\$688)
CZ16	PGE	\$1,192	\$1,071	\$1,096

Table 19. DFHP Existing Furnace LSC Savings (Zero-NOx Rule)

Climate Zone	Electric/ Gas Utility	LSC NPV		
		Pre-1978	1978-1991	1992-2010
CZ01	PGE	\$3,019	\$2,510	\$1,558
CZ02	PGE	\$1,256	\$1,025	\$1,006
CZ03	PGE	\$1,460	\$1,120	\$1,036
CZ04	PGE	\$1,242	\$949	\$887
CZ04	CPAU	\$1,242	\$949	\$887
CZ05	PGE	\$1,127	\$816	\$820
CZ05	PGE/SCG	\$1,127	\$816	\$820
CZ06	SCE/SCG	\$545	\$318	\$251
CZ07	SDGE	\$639	\$403	\$314
CZ08	SCE/SCG	\$428	\$279	\$244
CZ09	SCE/SCG	\$608	\$424	\$372
CZ10	SCE/SCG	\$469	\$320	\$293
CZ10	SDGE	\$469	\$320	\$293
CZ11	PGE	\$1,871	\$1,475	\$1,263
CZ12	PGE	\$1,924	\$1,539	\$1,356
CZ12	SMUD/PGE	\$1,375	\$1,090	\$939
CZ13	PGE	(\$206)	(\$186)	\$50
CZ14	SCE/SCG	(\$206)	(\$186)	\$50
CZ14	SDGE	\$127	\$60	\$38
CZ15	SCE/SCG	(\$185)	(\$12)	\$77
CZ16	PGE	\$3,019	\$2,510	\$1,558

3.3 AC Pathways for Heat Pump Replacements

Many jurisdictions are interested in seeing alternative pathways for residents who may prefer to replace an air conditioner with similar equipment, rather than migrating to a heat pump system. Alternative packages analyzed to support this request include air conditioning equipment combined with additional efficiency measures resulting in options that are reasonably energy or LSC cost equivalent to a heat pump system, to the extent feasible.

Figure 1 shows two AC pathways, one with an existing duct system and another path with a new duct system, alongside the heat pump pathways. The figure presents the proposed efficiency upgrade measures that would be part of a reach code (solid blue) along with the relevant requirements from Title 24, Part 6 that are triggered as part of equipment replacements (white or gradient blue). A reach code that establishes requirements when an air conditioner is replaced or installed new could allow for either a heat pump to be installed or an AC as long as the performance measures listed below are met.

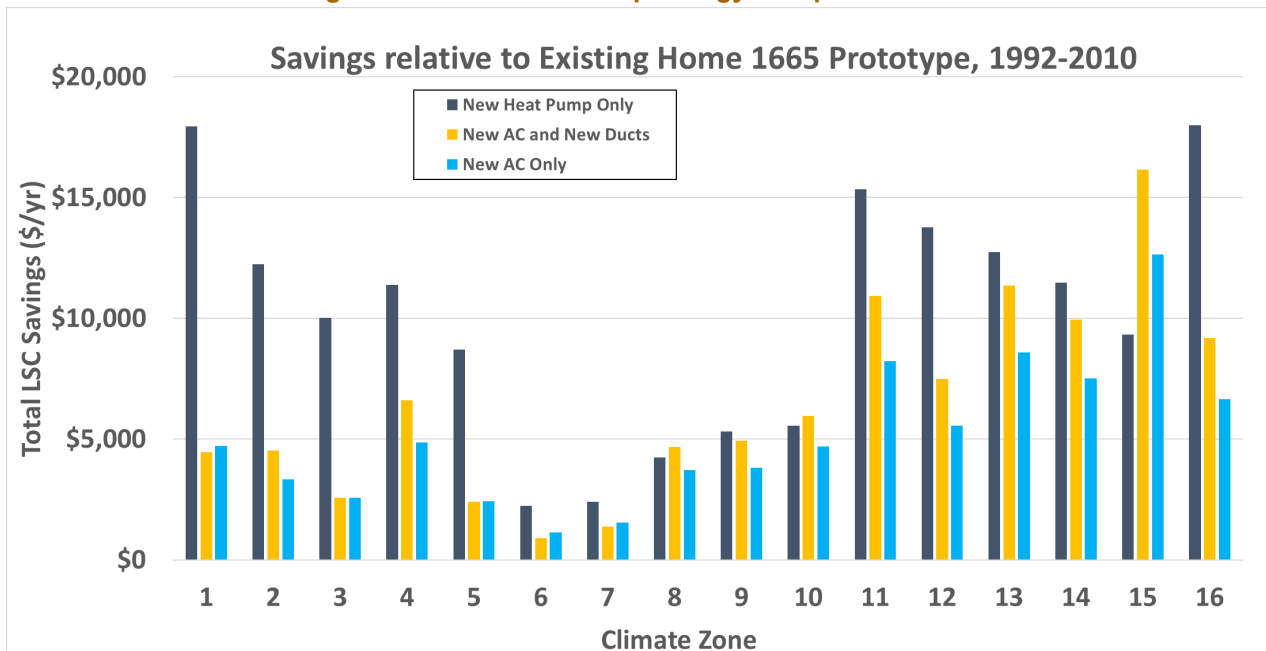
Figure 1. AC vs. Heat Pump Pathway Requirements

New Heat Pump Only	New AC Only	New Heat Pump and New Ducts	New AC/Furnace and New Ducts
Duct Insulation: No Requirement	Duct Insulation: No Requirement	Duct Insulation: R-6 in CZ 3, 5-7 R-8 in CZ 1, 2, 4, 8-16	Duct Insulation: R-8
Duct Sealing: 10% or RA Path	Duct Sealing: 10% or RA Path	Duct Sealing: 5%	Duct Sealing: 5%
Airflow: 300 CFM/ton or RA Path	Airflow: 300 CFM/ton or RA Path	Airflow: 350 CFM/ton	Airflow: 350 CFM/ton
Fan Efficacy: No requirement	Fan Efficacy: 0.45 W/CFM or RA Path	Fan Efficacy: 0.58 W/CFM	Fan Efficacy: 0.35 W/CFM
Ref Charge	Ref Charge	Ref Charge	Ref Charge
Solid blue: Reach over state code Gradient: Reach in some CZ No fill: Same as state code RA: Reference Appendix	Attic Insulation: R-49 Exception: Exist R-38	Attic Insulation: R-49 CZ 1-4, 6, 8-16 Only. Exc. R-19 in CZ 1, 3, 6	Attic Insulation: R-49 CZ 1-4, 6, 8-16 Only. Exc. R-19 in CZ 1, 3, 6
	Air Sealing: Ceiling Exception: Exist R-38	Air Sealing: Ceiling CZ 2, 4, 8-16 Only. Exception - Exist R-19	Air Sealing: Ceiling CZ 2, 4, 8-16 Only. Exception - Exist R-19

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The heat pump only and two AC pathways are presented in Figure 2 comparing total LSC energy use relative to the existing home for the 1992-2010 vintage. The heat pump path is represented by the DFHP Existing Furnace scenario. In most climate zones, the heat pump path results in higher energy savings, in the milder climates the AC and new ducts and New AC Only paths save marginally more energy.

Figure 2. AC vs. Heat Pump Energy Comparison



Though the AC path does not need to meet cost-effectiveness criteria to be adopted as a reach code since it's an alternative path, in order to understand the implications of the AC path on the customer, Table 20 and Table 21 present estimated costs for the new AC only and the new AC + new ducts paths respectively.

Table 20. New AC Only Path Cost Estimates

New AC Only Path	Pre-1978	1978-1991	1992-2010
Fan Efficacy: 0.45 W/CFM	-	-	-
Refrigerant Charge Verification	\$100	\$100	\$100 ⁷
R-49 Attic Insulation	\$5,483	\$3,612	\$1,827
Air Sealing	\$1,963	\$1,963	\$1,963
Total	\$7,546	\$5,675	\$3,790

Table 21. New AC/Furnace and New Ducts Path Cost Estimates

New AC and New Ducts Path	Pre-1978	1978-1991	1992-2010
New R-8 Ducts	\$6,311	\$6,311	\$6,311
Furnace	\$5,951	\$5,951	\$5,951
Fan Efficacy: 0.35 W/CFM	\$500	\$500	\$500
Refrigerant Charge Verification	\$100	\$100	\$100
Total	\$12,862	\$12,862	\$12,862

⁷ This is an incremental cost and in some climate zones, refrigerant charge verification is required so there is no incremental cost added.

4 Recommendations and Discussion

This analysis evaluated the feasibility and cost-effectiveness of AC to heat pump measures in California existing homes built before 2010. To meet the needs of jurisdictions evaluating this option, Statewide Reach Codes Team used both On-Bill and LSC-based lifecycle cost approaches to evaluate cost-effectiveness and quantify the energy cost savings associated with energy efficiency measures compared to the incremental costs associated with the measures.

Conclusions and Discussion:

1. Heat pumps are significantly more efficient than gas furnaces, requiring less than half the energy to meet the heating load. However, despite this reduction in heating energy use, the cost of heating a home using electricity (heat pump) could be higher than the cost to heat that same home with natural gas (furnace), depending on the electricity tariffs relative to the gas tariffs. Therefore, while a heat pump measure could be deemed as cost-effective over its lifecycle, installing a heat pump could result in a decrease *or* an increase in utility costs in the first years relative to a gas furnace and AC system. For example, the heat pump space heater measure in climate zone 12 in the newest vintage results in the customer saving money on their utility bill in SMUD territory but paying more on their utility bill in PG&E territory. Both PG&E and SMUD territory use PG&E gas rates, but SMUD has lower electricity rates than PG&E. With fuel switching measures like the AC to HP measure, the electricity to gas ratio has a significant impact on the savings or costs the customer will see by switching from gas to an electric heat pump space heater.
2. The LSC metric most often produces more favorable cost-effectiveness results relative to the results produced using actual utility costs (On-Bill). When the analysis assumes a higher escalation rate for natural gas costs relative to electricity in future years (high gas escalation), the On-Bill results are more favorable in some cases.
 - a. In the oldest (pre-1978) vintage, all three measures (dual fuel heat pump with existing furnace, standard heat pump space heater, and high efficiency heat pump space heater) are cost-effective using the LSC metric in all climate zones. When using the On-Bill metric, the measures remain cost-effective in most climate zones.
 - b. In the newer (1978-1991 and 1992-2010) vintages, the dual fuel heat pump (DFHP Existing Furnace) and the standard efficiency HPSH are cost-effective based on LSC in all cases except for Climate Zone 15 when using both the standard and California Alternative Rates for Energy (CARE) tariff.
3. Using the CARE tariff results in higher cost savings and cost-effectiveness relative to standard rates, with almost all cases yielding first year utility cost savings. The DFHP Existing Furnace is On-Bill cost-effective based on the high gas escalation scenario in all cases in the pre-1978 vintage, and almost all cases in the 1978-1991 and 1992-2010 vintage. It is also On-Bill cost-effective in most climate zones for the

modest gas escalation scenario across all vintages. In Climate Zones 5, 8, 9, 10, 14, and 15, cost-effectiveness declines relative to other areas, and in some cases is not cost-effective from an On-Bill perspective. This is the case for both the CARE tariff and the standard rate.

4. The analysis also modeled the cost impact of using a standard time-of-use electricity tariff versus switching to a newer electrification tariff, designed to reduce costs in homes with heat pumps and/or electric vehicles. Older homes tend to be the least efficient and achieve the most savings from improving equipment efficiency. In most of the state, because older homes tend to use more electricity than a similarly sized, newer vintage home, they realize more costs savings under the electrification tariff. Newer homes tend to use less electricity and therefore do not realize the same cost savings from switching tariffs; they generally perform better under the standard tariff. This trend is different in milder climate zones in SCE territory (excluding CZ 15), where newer homes realize more cost savings than older homes. Both the standard and electrification tariffs in SCE territory include a daily allocation of lower-cost baseline electricity and a second, higher-priced tier when the baseline is exceeded. In many newer homes, a higher percentage of overall electricity use is within the baseline allocation, resulting in greater cost savings.
5. Higher efficiency equipment reduces utility costs in all cases and improves cost-effectiveness in many climate zones in the oldest vintage relative to standard efficiency equipment. However, in more efficient newer homes, where cost-effectiveness is generally lower, the savings are insufficient to offset the roughly \$3,000 increase in incremental cost.
6. Given the adopted Bay Area Air Quality Management District Zero NO_x rule, and the proposed California Air Resource Board or South Coast Air Quality Management District (SCAQMD) Zero-NO_x rules, and gas furnaces may not be available to be installed in 2030, a sensitivity analysis was performed for the Zero NO_x scenario and found that cost-effectiveness decreases in many cases except in Climate Zones 8-10, some results improve enough to become cost-effective. The improved cost-effectiveness in Climate Zones 8-10 is due to the higher baseline cost when a HPSH must be installed at year 10 when the furnace must be replaced. However, the overall magnitude of 30-year On-Bill cost-effectiveness is lower because there are only 10 years of utility cost savings. After year 10 the base case and upgrade measures are both heat pumps.
7. While not evaluated in this report, the [2022 Single Family Retrofit Cost-effectiveness Study](#) (Statewide Reach Codes Team, 2024) shows it is beneficial to combine a heat pump space conditioning system with photovoltaics (PV) because the additional electricity required by the heat pump can be met by the PV system and result in reduced utility bills.
8. In this study the dual fuel heat pump is evaluated with an existing furnace, however the homeowner could choose to replace the existing furnace with a new furnace at

this time as well. This measure (DFHP New Furnace) was evaluated in the [2022 Single Family Retrofit Cost-effectiveness Study](#) (Statewide Reach Codes Team, 2024) but found to be less cost-effective than the DFHP Existing Furnace case.

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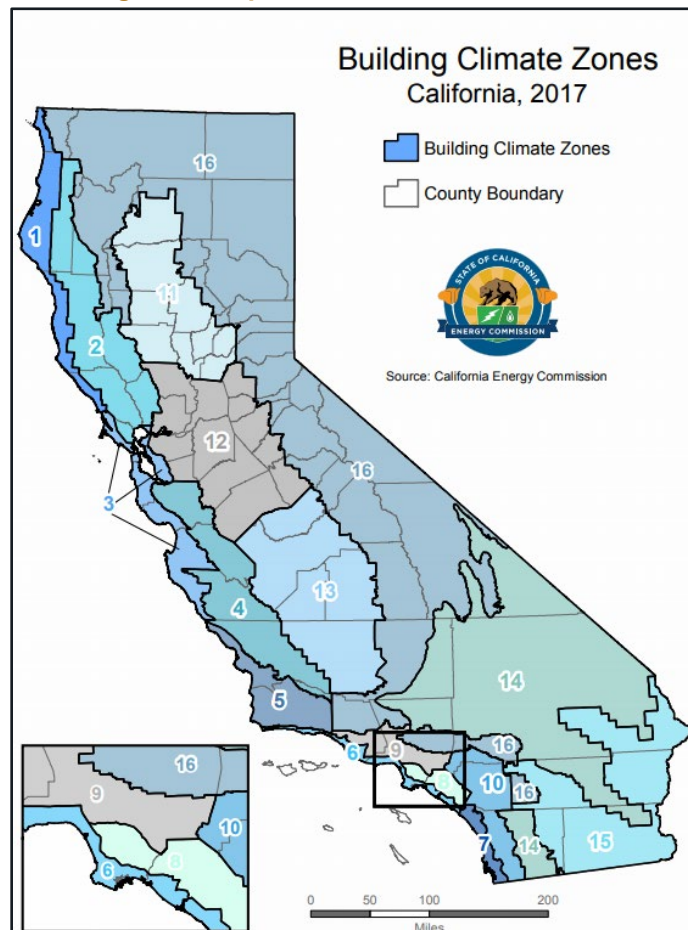
6 Appendices

6.1 Map of California Climate Zones

Climate zone geographical boundaries are depicted in Figure 3. The map in Figure 3 along with a zip-code search directory is available at:

https://ww2.energy.ca.gov/maps/renewable/building_climate_zones.html

Figure 3. Map of California climate zones.



6.2 Cost-Effectiveness Results

6.2.1 Standard Rates

The following tables present results across the 16 climate zones for the pre-1978 (Table 22 through Table 24) and the 1978-1991 (Table 25 through Table 27) vintages supplementing the results in Section 3.

Table 22. [Pre-1978] DFHP Existing Furnace

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	\$2,405	\$155	\$25,223	\$14,524	\$51,831
CZ02	PGE	\$1,670	(\$81)	\$11,551	\$4,316	\$20,806
CZ03	PGE	\$1,178	\$39	\$11,680	\$7,248	\$21,906
CZ04	PGE	\$1,670	(\$7)	\$10,574	\$4,948	\$18,321
CZ04	CPAU	\$1,670	\$63	\$10,574	\$5,177	\$14,531
CZ05	PGE	\$1,424	(\$29)	\$9,462	\$4,574	\$16,955
CZ05	PGE/SCG	\$1,424	(\$314)	\$9,462	(\$3,674)	\$2,838
CZ06	SCE/SCG	\$1,424	(\$70)	\$4,223	\$179	\$1,795
CZ07	SDGE	\$1,424	\$41	\$4,278	\$2,725	\$5,055
CZ08	SCE/SCG	\$1,916	(\$111)	\$3,216	(\$1,507)	\$375
CZ09	SCE/SCG	\$1,916	(\$168)	\$4,238	(\$2,500)	\$125
CZ10	SCE/SCG	\$1,916	(\$133)	\$3,755	(\$1,774)	\$774
CZ10	SDGE	\$1,916	\$201	\$3,755	\$6,175	\$10,683
CZ11	PGE	\$2,162	\$93	\$11,970	\$7,593	\$24,951
CZ12	PGE	\$1,916	\$46	\$12,302	\$6,948	\$24,190
CZ12	SMUD/PGE	\$1,916	\$584	\$12,302	\$18,997	\$36,626
CZ13	PGE	\$2,162	\$112	\$8,180	\$6,374	\$18,740
CZ14	SCE/SCG	\$1,916	(\$244)	\$6,646	(\$2,926)	\$3,332
CZ14	SDGE	\$1,916	\$65	\$6,646	\$4,203	\$13,297
CZ15	SCE/SCG	\$2,408	\$80	\$401	\$1,506	\$2,532
CZ16	PGE	\$2,243	(\$199)	\$17,538	\$2,333	\$25,276

Table 23. [Pre-1978] Standard Efficiency HPSH

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	\$3,067	(\$127)	\$27,155	\$7,800	\$48,445
CZ02	PGE	\$652	(\$242)	\$13,342	\$1,420	\$21,282
CZ03	PGE	\$514	(\$46)	\$11,946	\$4,614	\$19,670
CZ04	PGE	\$652	(\$139)	\$13,059	\$3,274	\$21,888
CZ04	CPAU	\$652	(\$48)	\$13,059	\$3,194	\$15,372
CZ05	PGE	\$583	(\$131)	\$9,998	\$2,045	\$15,648
CZ05	PGE/SCG	\$583	(\$449)	\$9,998	(\$7,152)	(\$94)
CZ06	SCE/SCG	\$583	(\$76)	\$3,860	(\$652)	\$931
CZ07	SDGE	\$583	\$35	\$3,876	\$1,901	\$4,218
CZ08	SCE/SCG	\$721	(\$128)	\$3,305	(\$2,112)	(\$199)
CZ09	SCE/SCG	\$721	(\$219)	\$4,415	(\$3,839)	(\$1,141)
CZ10	SCE/SCG	\$721	(\$188)	\$3,982	(\$3,168)	(\$483)
CZ10	SDGE	\$721	\$166	\$3,982	\$5,200	\$10,049
CZ11	PGE	\$790	(\$74)	\$14,045	\$4,727	\$24,836
CZ12	PGE	\$721	(\$179)	\$13,850	\$2,374	\$21,622
CZ12	SMUD/PGE	\$721	\$601	\$13,850	\$19,845	\$39,654
CZ13	PGE	\$790	(\$14)	\$9,394	\$3,998	\$17,858
CZ14	SCE/SCG	\$721	(\$450)	\$10,103	(\$6,294)	\$4,015
CZ14	SDGE	\$721	(\$66)	\$10,103	\$2,757	\$18,994
CZ15	SCE/SCG	\$859	\$68	\$643	\$1,364	\$2,430
CZ16	PGE	\$2,095	(\$484)	\$27,492	\$2,918	\$49,419

Table 24. [Pre-1978] High Efficiency HPSH

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	\$5,998	\$249	\$30,518	\$11,401	\$52,316
CZ02	PGE	\$3,606	(\$24)	\$13,354	\$1,431	\$21,449
CZ03	PGE	\$3,422	\$100	\$10,768	\$3,122	\$18,282
CZ04	PGE	\$3,606	\$118	\$13,537	\$4,185	\$22,984
CZ04	CPAU	\$3,606	\$101	\$13,537	\$1,665	\$13,950
CZ05	PGE	\$3,514	\$10	\$8,416	\$384	\$14,087
CZ05	PGE/SCG	\$3,514	(\$308)	\$8,416	(\$8,814)	(\$1,654)
CZ06	SCE/SCG	\$3,514	\$3	\$380	(\$3,709)	(\$2,052)
CZ07	SDGE	\$3,514	\$114	\$430	(\$1,063)	\$1,230
CZ08	SCE/SCG	\$3,698	\$31	\$1,065	(\$3,478)	(\$1,420)
CZ09	SCE/SCG	\$3,698	(\$40)	\$2,358	(\$4,759)	(\$1,897)
CZ10	SCE/SCG	\$3,698	\$6	\$2,191	(\$3,746)	(\$882)
CZ10	SDGE	\$3,698	\$344	\$2,191	\$4,481	\$9,276
CZ11	PGE	\$3,789	\$283	\$15,614	\$7,801	\$28,167
CZ12	PGE	\$3,698	\$152	\$14,490	\$4,899	\$24,385
CZ12	SMUD/PGE	\$3,698	\$708	\$14,490	\$17,350	\$37,236
CZ13	PGE	\$3,789	\$326	\$10,164	\$6,697	\$20,802
CZ14	SCE/SCG	\$3,698	(\$173)	\$11,876	(\$5,041)	\$5,522
CZ14	SDGE	\$3,698	\$244	\$11,876	\$5,111	\$21,254
CZ15	SCE/SCG	\$3,881	\$335	\$393	\$2,323	\$3,635
CZ16	PGE	\$5,071	\$45	\$34,043	\$9,856	\$56,737

Table 25. [1978-1991] DFHP Existing Furnace

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	\$2,405	\$99	\$20,184	\$10,746	\$40,368
CZ02	PGE	\$1,670	(\$114)	\$9,142	\$2,185	\$14,361
CZ03	PGE	\$1,178	\$3	\$9,033	\$5,101	\$15,624
CZ04	PGE	\$1,670	(\$68)	\$8,160	\$2,319	\$11,818
CZ04	CPAU	\$1,670	\$18	\$8,160	\$3,161	\$9,418
CZ05	PGE	\$1,424	(\$32)	\$7,070	\$3,268	\$11,902
CZ05	PGE/SCG	\$1,424	(\$238)	\$7,070	(\$2,666)	\$1,747
CZ06	SCE/SCG	\$1,424	(\$39)	\$2,941	\$614	\$1,557
CZ07	SDGE	\$1,424	\$1	\$3,046	\$1,512	\$2,837
CZ08	SCE/SCG	\$1,916	(\$78)	\$2,145	(\$1,026)	\$145
CZ09	SCE/SCG	\$1,916	(\$116)	\$2,978	(\$1,655)	\$122
CZ10	SCE/SCG	\$1,916	(\$89)	\$2,606	(\$1,096)	\$571
CZ10	SDGE	\$1,916	\$139	\$2,606	\$4,321	\$7,320
CZ11	PGE	\$2,162	\$103	\$9,118	\$6,239	\$18,777
CZ12	PGE	\$1,916	\$60	\$9,604	\$5,770	\$18,506
CZ12	SMUD/PGE	\$1,916	\$430	\$9,604	\$14,059	\$27,062
CZ13	PGE	\$2,162	\$111	\$6,237	\$5,242	\$14,247
CZ14	SCE/SCG	\$1,916	(\$230)	\$4,931	(\$3,277)	\$1,039
CZ14	SDGE	\$1,916	\$35	\$4,931	\$2,793	\$9,271
CZ15	SCE/SCG	\$2,408	(\$17)	(\$99)	(\$807)	(\$310)
CZ16	PGE	\$2,243	(\$161)	\$14,397	\$1,740	\$20,318

Table 26. [1978-1991] Standard Efficiency HPSH

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	\$3,067	(\$128)	\$21,427	\$5,043	\$37,346
CZ02	PGE	\$652	(\$235)	\$10,428	(\$90)	\$14,711
CZ03	PGE	\$514	(\$67)	\$8,999	\$2,767	\$13,608
CZ04	PGE	\$652	(\$164)	\$9,984	\$1,062	\$14,605
CZ04	CPAU	\$652	(\$66)	\$9,984	\$1,535	\$9,914
CZ05	PGE	\$583	(\$132)	\$7,290	\$703	\$10,264
CZ05	PGE/SCG	\$583	(\$361)	\$7,290	(\$5,939)	(\$1,104)
CZ06	SCE/SCG	\$583	(\$43)	\$2,450	(\$151)	\$775
CZ07	SDGE	\$583	(\$3)	\$2,539	\$747	\$2,065
CZ08	SCE/SCG	\$721	(\$96)	\$2,111	(\$1,658)	(\$472)
CZ09	SCE/SCG	\$721	(\$152)	\$3,022	(\$2,659)	(\$831)
CZ10	SCE/SCG	\$721	(\$121)	\$2,672	(\$2,017)	(\$239)
CZ10	SDGE	\$721	\$114	\$2,672	\$3,568	\$6,801
CZ11	PGE	\$790	(\$46)	\$10,682	\$3,545	\$18,156
CZ12	PGE	\$721	(\$110)	\$10,747	\$2,278	\$16,574
CZ12	SMUD/PGE	\$721	\$445	\$10,747	\$14,697	\$29,392
CZ13	PGE	\$790	\$1	\$7,141	\$3,112	\$13,232
CZ14	SCE/SCG	\$721	(\$398)	\$7,556	(\$6,191)	\$1,058
CZ14	SDGE	\$721	(\$53)	\$7,556	\$1,909	\$13,834
CZ15	SCE/SCG	\$859	(\$25)	\$71	(\$848)	(\$322)
CZ16	PGE	\$2,095	(\$445)	\$22,236	\$708	\$37,873

Table 27. [1978-1991] High Efficiency HPSH

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	\$5,998	\$169	\$23,092	\$6,895	\$39,412
CZ02	PGE	\$3,606	(\$75)	\$9,242	(\$1,370)	\$13,547
CZ03	PGE	\$3,422	\$53	\$6,872	\$675	\$11,602
CZ04	PGE	\$3,606	\$26	\$9,114	\$463	\$14,143
CZ04	CPAU	\$3,606	\$43	\$9,114	(\$868)	\$7,590
CZ05	PGE	\$3,514	(\$16)	\$4,859	(\$1,522)	\$8,122
CZ05	PGE/SCG	\$3,514	(\$246)	\$4,859	(\$8,164)	(\$3,246)
CZ06	SCE/SCG	\$3,514	(\$1)	(\$1,546)	(\$4,024)	(\$3,059)
CZ07	SDGE	\$3,514	\$47	(\$1,407)	(\$2,879)	(\$1,576)
CZ08	SCE/SCG	\$3,698	\$37	(\$828)	(\$3,608)	(\$2,300)
CZ09	SCE/SCG	\$3,698	(\$17)	\$232	(\$4,573)	(\$2,623)
CZ10	SCE/SCG	\$3,698	\$20	\$82	(\$3,764)	(\$1,856)
CZ10	SDGE	\$3,698	\$251	\$82	\$1,869	\$5,060
CZ11	PGE	\$3,789	\$259	\$10,685	\$5,452	\$20,283
CZ12	PGE	\$3,698	\$138	\$10,023	\$2,954	\$17,430
CZ12	SMUD/PGE	\$3,698	\$525	\$10,023	\$11,609	\$26,363
CZ13	PGE	\$3,789	\$289	\$6,612	\$4,624	\$14,951
CZ14	SCE/SCG	\$3,698	(\$188)	\$7,697	(\$6,429)	\$1,012
CZ14	SDGE	\$3,698	\$182	\$7,697	\$2,525	\$14,378
CZ15	SCE/SCG	\$3,881	\$193	(\$1,111)	(\$992)	(\$267)
CZ16	PGE	\$5,071	(\$30)	\$26,407	\$5,118	\$42,581

6.2.2 CARE tariffs

Table 28. [Pre-1978] DFHP Existing Furnace 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	\$2,405	\$364	\$25,223	\$16,641	\$46,300
CZ02	PGE	\$1,670	\$64	\$11,551	\$6,432	\$19,553
CZ03	PGE	\$1,178	\$128	\$11,680	\$8,248	\$19,898
CZ04	PGE	\$1,670	\$90	\$10,574	\$6,198	\$16,835
CZ04	CPAU	\$1,670	\$0	\$10,574	\$711	\$711
CZ05	PGE	\$1,424	\$69	\$9,462	\$5,901	\$15,746
CZ05	PGE/SCG	\$1,424	(\$157)	\$9,462	(\$613)	\$4,598
CZ06	SCE/SCG	\$1,424	(\$37)	\$4,223	\$776	\$2,067
CZ07	SDGE	\$1,424	\$42	\$4,278	\$2,609	\$4,434
CZ08	SCE/SCG	\$1,916	(\$63)	\$3,216	(\$595)	\$911
CZ09	SCE/SCG	\$1,916	(\$97)	\$4,238	(\$1,132)	\$972
CZ10	SCE/SCG	\$1,916	(\$75)	\$3,755	(\$660)	\$1,379
CZ10	SDGE	\$1,916	\$160	\$3,755	\$4,963	\$8,500
CZ11	PGE	\$2,162	\$183	\$11,970	\$8,415	\$22,212
CZ12	PGE	\$1,916	\$152	\$12,302	\$8,126	\$21,834
CZ12	SMUD/PGE	\$1,916	\$686	\$12,302	\$20,080	\$34,172
CZ13	PGE	\$2,162	\$160	\$8,180	\$6,595	\$16,418
CZ14	SCE/SCG	\$1,916	(\$126)	\$6,646	(\$779)	\$4,233
CZ14	SDGE	\$1,916	\$101	\$6,646	\$4,530	\$11,652
CZ15	SCE/SCG	\$2,408	\$60	\$401	\$982	\$1,788
CZ16	PGE	\$2,243	\$34	\$17,538	\$5,963	\$24,236

Table 29. [Pre-1978] Standard Efficiency HPSH 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	\$3,067	\$205	\$27,155	\$12,440	\$44,777
CZ02	PGE	\$652	(\$16)	\$13,342	\$5,095	\$20,910
CZ03	PGE	\$514	\$76	\$11,946	\$6,319	\$18,293
CZ04	PGE	\$652	\$41	\$13,059	\$6,031	\$20,843
CZ04	CPAU	\$652	\$0	\$13,059	\$255	\$255
CZ05	PGE	\$583	\$12	\$9,998	\$4,285	\$15,110
CZ05	PGE/SCG	\$583	(\$240)	\$9,998	(\$2,978)	\$2,679
CZ06	SCE/SCG	\$583	(\$42)	\$3,860	(\$7)	\$1,259
CZ07	SDGE	\$583	\$37	\$3,876	\$1,837	\$3,652
CZ08	SCE/SCG	\$721	(\$75)	\$3,305	(\$1,076)	\$457
CZ09	SCE/SCG	\$721	(\$131)	\$4,415	(\$2,095)	\$72
CZ10	SCE/SCG	\$721	(\$110)	\$3,982	(\$1,649)	\$504
CZ10	SDGE	\$721	\$139	\$3,982	\$4,305	\$8,106
CZ11	PGE	\$790	\$94	\$14,045	\$7,108	\$23,108
CZ12	PGE	\$721	\$20	\$13,850	\$5,506	\$20,829
CZ12	SMUD/PGE	\$721	\$772	\$13,850	\$22,326	\$38,189
CZ13	PGE	\$790	\$89	\$9,394	\$5,347	\$16,369
CZ14	SCE/SCG	\$721	(\$241)	\$10,103	(\$2,418)	\$5,836
CZ14	SDGE	\$721	\$62	\$10,103	\$4,832	\$17,541
CZ15	SCE/SCG	\$859	\$52	\$643	\$930	\$1,769
CZ16	PGE	\$2,095	\$16	\$27,492	\$10,883	\$47,907

Table 30. [Pre-1978] High Efficiency HPSH 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	\$5,998	\$450	\$30,518	\$13,096	\$45,609
CZ02	PGE	\$3,606	\$126	\$13,354	\$3,405	\$19,322
CZ03	PGE	\$3,422	\$172	\$10,768	\$3,678	\$15,720
CZ04	PGE	\$3,606	\$209	\$13,537	\$4,926	\$19,859
CZ04	CPAU	\$3,606	\$0	\$13,537	(\$4,595)	(\$4,595)
CZ05	PGE	\$3,514	\$103	\$8,416	\$1,521	\$12,412
CZ05	PGE/SCG	\$3,514	(\$148)	\$8,416	(\$5,742)	(\$19)
CZ06	SCE/SCG	\$3,514	\$11	\$380	(\$3,634)	(\$2,319)
CZ07	SDGE	\$3,514	\$89	\$430	(\$1,774)	\$25
CZ08	SCE/SCG	\$3,698	\$33	\$1,065	(\$3,586)	(\$1,955)
CZ09	SCE/SCG	\$3,698	(\$10)	\$2,358	(\$4,304)	(\$2,027)
CZ10	SCE/SCG	\$3,698	\$21	\$2,191	(\$3,628)	(\$1,354)
CZ10	SDGE	\$3,698	\$255	\$2,191	\$2,127	\$5,893
CZ11	PGE	\$3,789	\$327	\$15,614	\$7,382	\$23,549
CZ12	PGE	\$3,698	\$236	\$14,490	\$5,437	\$20,914
CZ12	SMUD/PGE	\$3,698	\$772	\$14,490	\$17,439	\$33,302
CZ13	PGE	\$3,789	\$310	\$10,164	\$5,378	\$16,558
CZ14	SCE/SCG	\$3,698	(\$54)	\$11,876	(\$3,161)	\$5,265
CZ14	SDGE	\$3,698	\$263	\$11,876	\$4,651	\$17,300
CZ15	SCE/SCG	\$3,881	\$232	\$393	(\$35)	\$970
CZ16	PGE	\$5,071	\$360	\$34,043	\$13,682	\$50,953

Table 31. [1978-1991] DFHP Existing Furnace 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	\$2,405	\$273	\$20,184	\$12,619	\$36,168
CZ02	PGE	\$1,670	\$12	\$9,142	\$4,166	\$13,857
CZ03	PGE	\$1,178	\$76	\$9,033	\$6,011	\$14,375
CZ04	PGE	\$1,670	\$23	\$8,160	\$3,702	\$11,261
CZ04	CPAU	\$1,670	\$0	\$8,160	\$711	\$711
CZ05	PGE	\$1,424	\$40	\$7,070	\$4,285	\$11,150
CZ05	PGE/SCG	\$1,424	(\$122)	\$7,070	(\$400)	\$3,130
CZ06	SCE/SCG	\$1,424	(\$21)	\$2,941	\$952	\$1,705
CZ07	SDGE	\$1,424	\$9	\$3,046	\$1,631	\$2,667
CZ08	SCE/SCG	\$1,916	(\$45)	\$2,145	(\$395)	\$544
CZ09	SCE/SCG	\$1,916	(\$67)	\$2,978	(\$712)	\$712
CZ10	SCE/SCG	\$1,916	(\$50)	\$2,606	(\$357)	\$976
CZ10	SDGE	\$1,916	\$110	\$2,606	\$3,472	\$5,826
CZ11	PGE	\$2,162	\$155	\$9,118	\$6,542	\$16,502
CZ12	PGE	\$1,916	\$128	\$9,604	\$6,434	\$16,553
CZ12	SMUD/PGE	\$1,916	\$506	\$9,604	\$14,879	\$25,269
CZ13	PGE	\$2,162	\$135	\$6,237	\$5,170	\$12,318
CZ14	SCE/SCG	\$1,916	(\$128)	\$4,931	(\$1,351)	\$2,112
CZ14	SDGE	\$1,916	\$65	\$4,931	\$3,123	\$8,195
CZ15	SCE/SCG	\$2,408	(\$9)	(\$99)	(\$653)	(\$256)
CZ16	PGE	\$2,243	\$28	\$14,397	\$4,676	\$19,471

Table 32. [1978-1991] Standard Efficiency HPSH 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	\$3,067	\$146	\$21,427	\$8,941	\$34,641
CZ02	PGE	\$652	(\$47)	\$10,428	\$3,076	\$14,864
CZ03	PGE	\$514	\$33	\$8,999	\$4,259	\$12,882
CZ04	PGE	\$652	(\$10)	\$9,984	\$3,558	\$14,338
CZ04	CPAU	\$652	\$0	\$9,984	\$255	\$255
CZ05	PGE	\$583	(\$18)	\$7,290	\$2,586	\$10,196
CZ05	PGE/SCG	\$583	(\$199)	\$7,290	(\$2,659)	\$1,219
CZ06	SCE/SCG	\$583	(\$24)	\$2,450	\$215	\$956
CZ07	SDGE	\$583	\$6	\$2,539	\$898	\$1,929
CZ08	SCE/SCG	\$721	(\$57)	\$2,111	(\$896)	\$57
CZ09	SCE/SCG	\$721	(\$91)	\$3,022	(\$1,455)	\$13
CZ10	SCE/SCG	\$721	(\$71)	\$2,672	(\$1,035)	\$390
CZ10	SDGE	\$721	\$96	\$2,672	\$2,939	\$5,474
CZ11	PGE	\$790	\$74	\$10,682	\$5,209	\$16,830
CZ12	PGE	\$721	\$30	\$10,747	\$4,418	\$15,794
CZ12	SMUD/PGE	\$721	\$573	\$10,747	\$16,567	\$28,332
CZ13	PGE	\$790	\$72	\$7,141	\$4,003	\$12,047
CZ14	SCE/SCG	\$721	(\$224)	\$7,556	(\$2,880)	\$2,930
CZ14	SDGE	\$721	\$42	\$7,556	\$3,476	\$12,809
CZ15	SCE/SCG	\$859	(\$13)	\$71	(\$639)	(\$219)
CZ16	PGE	\$2,095	(\$25)	\$22,236	\$7,529	\$37,120

Table 33. [1978-1991] High Efficiency HPSH 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	\$5,998	\$339	\$23,092	\$8,460	\$34,300
CZ02	PGE	\$3,606	\$57	\$9,242	\$547	\$12,409
CZ03	PGE	\$3,422	\$111	\$6,872	\$1,228	\$9,907
CZ04	PGE	\$3,606	\$113	\$9,114	\$1,472	\$12,340
CZ04	CPAU	\$3,606	\$0	\$9,114	(\$4,595)	(\$4,595)
CZ05	PGE	\$3,514	\$58	\$4,859	(\$544)	\$7,120
CZ05	PGE/SCG	\$3,514	(\$124)	\$4,859	(\$5,789)	(\$1,857)
CZ06	SCE/SCG	\$3,514	\$5	(\$1,546)	(\$3,963)	(\$3,196)
CZ07	SDGE	\$3,514	\$39	(\$1,407)	(\$3,143)	(\$2,122)
CZ08	SCE/SCG	\$3,698	\$32	(\$828)	(\$3,800)	(\$2,766)
CZ09	SCE/SCG	\$3,698	(\$0)	\$232	(\$4,336)	(\$2,784)
CZ10	SCE/SCG	\$3,698	\$25	\$82	(\$3,803)	(\$2,290)
CZ10	SDGE	\$3,698	\$184	\$82	\$124	\$2,631
CZ11	PGE	\$3,789	\$272	\$10,685	\$4,725	\$16,488
CZ12	PGE	\$3,698	\$191	\$10,023	\$3,148	\$14,639
CZ12	SMUD/PGE	\$3,698	\$573	\$10,023	\$11,680	\$23,445
CZ13	PGE	\$3,789	\$259	\$6,612	\$3,262	\$11,441
CZ14	SCE/SCG	\$3,698	(\$82)	\$7,697	(\$4,629)	\$1,311
CZ14	SDGE	\$3,698	\$195	\$7,697	\$2,166	\$11,452
CZ15	SCE/SCG	\$3,881	\$133	(\$1,111)	(\$2,349)	(\$1,794)
CZ16	PGE	\$5,071	\$245	\$26,407	\$8,685	\$38,470

6.3 Utility Rate Schedules

6.3.1 Pacific Gas & Electric

The following pages provide details on the PG&E electricity and natural gas tariffs applied in this study. Table 34 describes the baseline territories that were assumed for each climate zone. A net surplus compensation rate of \$ 0.03396/ kWh was applied to any net annual electricity generation based on a one-year average of the rates between February 2024 and January 2025.

Table 34. PG&E Baseline Territory by Climate Zone

Climate Zone	Baseline Territory
CZ01	V
CZ02	X
CZ03	T
CZ04	X
CZ05	T
CZ11	R
CZ12	S
CZ13	R
CZ16	Y

The PG&E monthly gas rate in \$/therm was applied on a monthly basis according to the rates shown in Table 35. The gas rates were developed based on the latest available gas rate for January 2025 and a curve to reflect how natural gas prices fluctuate with seasonal supply and demand. The seasonal curve was estimated from PG&E's monthly residential tariffs between 2015 and 2024. 12-month curves were created from monthly gas rates for each of the ten years. The ten annual curves were then averaged to arrive at an average normalized annual curve. The baseline and excess transmission charges were found to be consistent over the course of a year and applied for the entire year based on January 2025 rates. The costs presented in Table 35 were then derived by establishing the baseline and excess rates from the latest January 2025 tariff as a reference point, and then using the normalized curve to estimate the cost for the remaining months relative to the January rates. Corresponding CARE tariffs reflect the 20 percent discount per the GL-1 tariff.

Table 35. PG&E Monthly Gas Rate (\$/therm)

Month	Total Charge	
	Baseline	Excess
January	\$2.63	\$3.15
February	\$2.64	\$3.16
March	\$2.41	\$2.94
April	\$2.24	\$2.77
May	\$2.21	\$2.74
June	\$2.23	\$2.77
July	\$2.26	\$2.80
August	\$2.36	\$2.90
September	\$2.42	\$2.98
October	\$2.52	\$3.07
November	\$2.63	\$3.17
December	\$2.70	\$3.23

Residential GAS Baseline Territories and Quantities ^{1/}

Effective April 1, 2022 - Present

BASELINE QUANTITIES (Therms Per Day Per Dwelling Unit)

Individually Metered			
Baseline Territories	Summer (April-October) Effective Apr. 1, 2022	Winter Off-Peak (Nov, Feb, Mar) Effective Nov. 1, 2022	Winter On-Peak (Dec, Jan) Effective Dec. 1, 2022
P	0.39	1.88	2.19
Q	0.56	1.48	2.00
R	0.36	1.24	1.81
S	0.39	1.38	1.94
T	0.56	1.31	1.68
V	0.59	1.51	1.71
W	0.39	1.14	1.68
X	0.49	1.48	2.00
Y	0.72	2.22	2.58

Master Metered			
Baseline Territories	Summer (April-October) Effective Apr. 1, 2022	Winter Off-Peak (Nov, Feb, Mar) Effective Nov. 1, 2022	Winter On-Peak (Dec, Jan) Effective Dec. 1, 2022
P	0.29	1.01	1.13
Q	0.56	0.67	0.77
R	0.33	0.87	1.16
S	0.29	0.61	0.65
T	0.56	1.01	1.10
V	0.59	1.28	1.32
W	0.26	0.71	0.87
X	0.33	0.67	0.77
Y	0.52	1.01	1.13

Summer Season: Apr-Oct
Winter Off-Peak: Nov, Feb, Mar
Winter On-Peak: Dec, Jan

Advice Letter: 4589-G
Decision 21-11-016
GRC 2020 Ph II [Application 19-11-019]
Filed: Nov 22, 2019



**Pacific Gas and
Electric Company®**

Oakland, California

Cancelling Revised Cal. P.U.C. Sheet No. 59120-E
 Revised Cal. P.U.C. Sheet No. 58758-E

ELECTRIC SCHEDULE E-TOU-C Sheet 2
 RESIDENTIAL TIME-OF-USE (PEAK PRICING 4 - 9 p.m. EVERY DAY)

RATES:
 (Cont'd.)

E-TOU-C TOTAL BUNDLED RATES

Total Energy Rates (\$ per kWh)	PEAK		OFF-PEAK	
<i>Summer</i>				
Total Usage	\$0.60729	(R)	\$0.50429	(R)
Baseline Credit (Applied to Baseline Usage Only)	(\$0.10135)	(R)	(\$0.10135)	(R)
<i>Winter</i>				
Total Usage	\$0.49312	(R)	\$0.46312	(R)
Baseline Credit (Applied to Baseline Usage Only)	(\$0.10135)	(R)	(\$0.10135)	(R)
Delivery Minimum Bill Amount (\$ per meter per day)	\$0.39167			
California Climate Credit (per household, per semi-annual payment occurring in the April and October bill cycles)	(\$58.23)	(R)		

Total bundled service charges shown on customer's bills are unbundled according to the component rates shown below. Where the delivery minimum bill amount applies, the customer's bill will equal the sum of (1) the delivery minimum bill amount plus (2) for bundled service, the generation rate times the number of kWh used. For revenue accounting purposes, the revenues from the delivery minimum bill amount will be assigned to the Transmission, Transmission Rate Adjustments, Reliability Services, Public Purpose Programs, Nuclear Decommissioning, Competition Transition Charges, Energy Cost Recovery Amount, Wildfire Fund Charge, and New System Generation Charges based on kWh usage times the corresponding unbundled rate component per kWh, with any residual revenue assigned to Distribution.

(Continued)

Advice	7469-E	Issued by	Submitted	December 30, 2024
Decision		Shilpa Ramaiya	Effective	January 1, 2025
		Vice President	Resolution	
		Regulatory Proceedings and Rates		



**Pacific Gas and
Electric Company**
 U 39 Oakland, California

Cancelling Revised Cal. P.U.C. Sheet No. 59121-E
 Revised Cal. P.U.C. Sheet No. 58759-E

ELECTRIC SCHEDULE E-TOU-C Sheet 3
 RESIDENTIAL TIME-OF-USE (PEAK PRICING 4 - 9 p.m. EVERY DAY)

RATES:
 (Cont'd.)

UNBUNDLING OF E-TOU-C TOTAL RATES

Energy Rates by Component (\$ per kWh)	PEAK		OFF-PEAK	
Generation:				
Summer (all usage)	\$0.24730	(I)	\$0.16430	(I)
Winter (all usage)	\$0.18725	(I)	\$0.16057	(I)
Distribution**:				
Summer (all usage)	\$0.24056	(I)	\$0.22056	(I)
Winter (all usage)	\$0.18645	(I)	\$0.18313	(I)
Conservation Incentive Adjustment (Baseline Usage)		(\$0.03733)	(I)	
Conservation Incentive Adjustment (Over Baseline Usage)		\$0.06402	(I)	
Transmission* (all usage)		\$0.05122	(I)	
Transmission Rate Adjustments* (all usage)		(\$0.01509)	(R)	
Reliability Services* (all usage)		\$0.00032	(I)	
Public Purpose Programs (all usage)		\$0.02644	(R)	
Nuclear Decommissioning (all usage)		(\$0.00013)	(I)	
Competition Transition Charges (all usage)		(\$0.00072)	(R)	
Energy Cost Recovery Amount (all usage)		\$0.00001	(I)	
Wildfire Fund Charge (all usage)		\$0.00595	(I)	
New System Generation Charge (all usage)**		\$0.00574	(R)	
Wildfire Hardening Charge (all usage)		\$0.00494		
Recovery Bond Charge (all usage)		\$0.00650		
Recovery Bond Credit (all usage)		(\$0.00650)		
Bundled Power Charge Indifference Adjustment (all usage)***		(\$0.02327)	(R)	

* Transmission, Transmission Rate Adjustments and Reliability Service charges are combined for presentation on customer bills.

** Distribution and New System Generation Charges are combined for presentation on customer bills.

*** Direct Access, Community Choice Aggregation and Transitional Bundled Service Customers pay the applicable Vintaged Power Charge Indifference Adjustment. Generation and Bundled PCIA are combined for presentation on bundled customer bills.

(Continued)

Advice	7469-E	Issued by	Submitted	December 30, 2024
Decision		Shilpa Ramaiya	Effective	January 1, 2025
		Vice President	Resolution	
		Regulatory Proceedings and Rates		



**Pacific Gas and
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U 39 Oakland, California

Cancelling Revised Cal. P.U.C. Sheet No. 59109-E
Revised Cal. P.U.C. Sheet No. 58755-E

ELECTRIC SCHEDULE E-ELEC
RESIDENTIAL TIME-OF-USE (ELECTRIC HOME)
SERVICE FOR CUSTOMERS WITH QUALIFYING ELECTRIC TECHNOLOGIES

Sheet 2

RATES:(Cont'd.)

Direct Access (DA) and Community Choice Aggregation (CCA) charges shall be calculated in accordance with the paragraph in this rate schedule titled Billing.

TOTAL BUNDLED RATES

Base Services Charge (\$ per meter per day)	\$0.49281		
Total Energy Rates (\$ per kWh)	PEAK	PART-PEAK	OFF-PEAK
Summer Usage	\$0.60728 (R)	\$0.44540 (R)	\$0.38872 (R)
Winter Usage	\$0.37577 (R)	\$0.35368 (R)	\$0.33982 (R)
California Climate Credit (per household, per semi-annual payment occurring in the April and October bill cycles)	(\$58.23)	(R)	

Total bundled service charges shown on a customer's bills are unbundled according to the component rates shown below.

UNBUNDLING OF TOTAL RATES

Energy Rates by Component (\$ per kWh)	PEAK		PART-PEAK		OFF-PEAK	
Generation:						
Summer Usage	\$0.31659	(I)	\$0.21748	(I)	\$0.17238	(I)
Winter Usage	\$0.15446	(I)	\$0.13449	(I)	\$0.12114	(I)
Distribution**:						
Summer Usage	\$0.23528	(I)	\$0.17251	(I)	\$0.16093	(I)
Winter Usage	\$0.16590	(I)	\$0.16378	(I)	\$0.16327	(I)
Transmission* (all usage)	\$0.05122	(I)	\$0.05122	(I)	\$0.05122	(I)
Transmission Rate Adjustments* (all usage)	(\$0.01509)	(R)	(\$0.01509)	(R)	(\$0.01509)	(R)
Reliability Services* (all usage)	\$0.00032	(I)	\$0.00032	(I)	\$0.00032	(I)
Public Purpose Programs (all usage)	\$0.02644	(R)	\$0.02644	(R)	\$0.02644	(R)
Nuclear Decommissioning (all usage)	(\$0.00013)	(I)	(\$0.00013)	(I)	(\$0.00013)	(I)
Competition Transition Charges (all usage)	(\$0.00072)	(R)	(\$0.00072)	(R)	(\$0.00072)	(R)
Energy Cost Recovery Amount (all usage)	\$0.00001	(I)	\$0.00001	(I)	\$0.00001	(I)
Wildfire Fund Charge (all usage)	\$0.00595	(I)	\$0.00595	(I)	\$0.00595	(I)
New System Generation Charge (all usage)**	\$0.00574	(R)	\$0.00574	(R)	\$0.00574	(R)
Wildfire Hardening Charge (all usage)	\$0.00494		\$0.00494		\$0.00494	
Recovery Bond Charge (all usage)	\$0.00650		\$0.00650		\$0.00650	
Recovery Bond Credit (all usage)	(\$0.00650)		(\$0.00650)		(\$0.00650)	
Bundled Power Charge Indifference Adjustment (all usage)***	(\$0.02327)	(R)	(\$0.02327)	(R)	(\$0.02327)	(R)

* Transmission, Transmission Rate Adjustments and Reliability Service charges are combined for presentation on customer bills.

** Distribution and New System Generation Charges are combined for presentation on customer bills.

*** Direct Access, Community Choice Aggregation and Transitional Bundled Service Customers pay the applicable Vintaged Power Charge Indifference Adjustment. Generation and Bundled PCIA are combined for presentation on bundled customer bills.

(Continued)

Advice	7469-E	Issued by	Submitted	December 30, 2024
Decision		Shilpa Ramaiya	Effective	January 1, 2025
		Vice President	Resolution	
		Regulatory Proceedings and Rates		



**Pacific Gas and
Electric Company**
San Francisco, California

Original Cal. P.U.C. Sheet No. 54738-E

ELECTRIC SCHEDULE E-ELEC Sheet 3 (N)
RESIDENTIAL TIME-OF-USE (ELECTRIC HOME) (N)
SERVICE FOR CUSTOMERS WITH QUALIFYING ELECTRIC TECHNOLOGIES

SPECIAL CONDITIONS:	1. TIME PERIODS: Times of the year and times of the day are defined as follows: (N) All Year: Peak: 4:00 p.m. to 9:00 p.m. every day including weekends and holidays. Partial-Peak: 3:00 p.m. to 4:00 p.m. and 9:00 p.m. to 12:00 a.m. every day including weekends and holidays. Off-Peak: All other hours. 2. SEASONAL CHANGES: The summer season is June 1 through September 30 and the winter season is October 1 through May 31. When billing includes use in both the summer and winter periods, charges will be prorated based upon the number of days in each period. 3. ADDITIONAL METERS: If a residential dwelling unit is served by more than one electric meter, the customer must designate which meter is the primary meter and which is (are) the additional meter(s). 4. BILLING: A customer's bill is calculated based on the option applicable to the customer. Bundled Service Customers receive generation and delivery services solely from PG&E. The customer's bill is based on the Unbundling of Total Rates set forth above. Transitional Bundled Service (TBS) Customers take TBS as prescribed in Rules 22.1 and 23.1, or take PG&E bundled service prior to the end of the six (6) month advance notice period required to elect PG&E bundled service as prescribed in Rules 22.1 and 23.1. TBS customers shall pay all charges shown in the Unbundling of Total Rates except for the Bundled Power Charge Indifference Adjustment and the generation charge. TBS customers shall also pay for their applicable Vintaged Power Charge Indifference Adjustment provided in the table below, and the short-term commodity prices as set forth in Schedule TBCC.	(N)
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Advice Decision	6768-E D.21-11-016	Issued by Meredith Allen Vice President, Regulatory Affairs	Submitted Effective Resolution	November 18, 2022 December 1, 2022
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**Pacific Gas and
Electric Company**

U 39

Oakland, California

Revised	Cal. P.U.C. Sheet No.	59329-E
Cancelling Revised	Cal. P.U.C. Sheet No.	59086-E

ELECTRIC SCHEDULE D-CARE

Sheet 1

**LINE-ITEM DISCOUNT FOR CALIFORNIA ALTERNATE RATES FOR ENERGY (CARE)
CUSTOMERS**

APPLICABILITY: This schedule is applicable to single-phase and polyphase residential service in single-family dwellings and in flats and apartments separately metered by PG&E and domestic submetered tenants residing in multifamily accommodations, mobilehome parks and to qualifying recreational vehicle parks and marinas and to farm service on the premises operated by the person whose residence is supplied through the same meter, where the applicant qualifies for California Alternate Rates for Energy (CARE) under the eligibility and certification criteria set forth in Electric Rule 19.1. CARE service is available on Schedules E-1, E-TOU-B, E-TOU-C, E-TOU-D, EV2, E-ELEC, EM, ES, ESR, ET and EM-TOU.

TERRITORY: This rate schedule applies everywhere PG&E provides electric service.

RATES: Customers taking service on this rate schedule whose otherwise applicable rate schedule has no Delivery Minimum Bill Amount (Schedule E-ELEC) will receive a CARE percentage discount of 38.351% (R) on their total bundled charges (except for the California Climate Credit, which will not be discounted). Customers taking service on this rate schedule whose otherwise applicable rate schedule has a Delivery Minimum Bill Amount (all other schedules) will receive a CARE percentage discount ("A" or "C" below) on their total bundled charges less charges from which they are exempt (Wildfire Fund Charge, Recovery Bond Charge, Recovery Bond Credit, and the CARE surcharge portion of the public purpose program charge used to fund the CARE discount) on their otherwise applicable rate schedule (except for the California Climate Credit, which will not be discounted) and also will receive a percentage discount ("B" or "D" below) on the delivery minimum bill amount, if applicable. The CARE discount will be calculated for direct access and community choice aggregation customers based on the total charges as if they were subject to bundled service rates. Discounts will be applied as a reduction to distribution charges. These conditions also apply to master-metered customers and to qualified sub-metered tenants where the master-meter customer is jointly served under PG&E's Rate Schedule D-CARE and either Schedule EM, ES, ESR, ET, or EM-TOU.

For master-metered customers where one or more of the submetered tenants qualifies for CARE rates under the eligibility and certification criteria set forth in Rule 19.1, 19.2, or 19.3, the CARE discount is equal to a percentage ("C" below) of the total bundled charges, multiplied by the number of CARE units divided by the total number of units. In addition, master-metered customers eligible for D-CARE will receive a percentage discount ("D" below) on the delivery minimum bill amount, if applicable.

It is the responsibility of the master-metered customer to advise PG&E within 15 days following any change in the number of dwelling units and/or any decrease in the number of qualifying CARE applicants that results when such applicants move out of their submetered or non-submetered dwelling unit, or submetered permanent-residence RV or permanent-residence boat.

(Continued)

Advice Decision	7516-E	Issued by Shilpa Ramaiya Vice President Regulatory Proceedings and Rates	Submitted Effective Resolution	February 26, 2025 March 1, 2025
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**Pacific Gas and
Electric Company**

U 39

Oakland, California

Cancelling

Revised
Revised

Cal. P.U.C. Sheet No. 59087-E
Cal. P.U.C. Sheet No. 58198-E

ELECTRIC SCHEDULE D-CARE

Sheet 2

**LINE-ITEM DISCOUNT FOR CALIFORNIA ALTERNATE RATES FOR ENERGY (CARE)
CUSTOMERS**

RATES: (Cont'd)	A. D-CARE Discount:	35.000	% (Percent)	(I)
	B. Delivery Minimum Bill Discount:	50.000	% (Percent)	
	C. Master-Meter D-CARE Discount:	35.000	% (Percent)	(I)
	D. Master-Meter Delivery Minimum Bill Discount:	50.000	% (Percent)	

- SPECIAL CONDITIONS:**
1. OTHERWISE APPLICABLE SCHEDULE: The Special Conditions of the Customer's otherwise applicable rate schedule will apply to this schedule.
 2. ELIGIBILITY: To be eligible to receive D-CARE the applicant must qualify under the criteria set forth in PG&E's Electric Rules 19.1, 19.2, and 19.3 and meet the certification requirements thereof to the satisfaction of PG&E. Qualifying Direct Access, Community Choice Aggregation Service, and Transitional Bundled Service customers are also eligible to take service on Schedule D-CARE. Applicants may qualify for D-CARE at their primary residence only. Customers or sub-metered tenants participating in the Family Electric Rate Assistance (FERA) program cannot concurrently participate in the CARE program.

Advice 7469-E
Decision

Issued by
Shilpa Ramaiya
Vice President
Regulatory Proceedings and Rates

Submitted December 30, 2024
Effective January 1, 2025
Resolution _____

6.3.2 Southern California Edison

The following pages provide details on the SCE electricity tariffs applied in this study. Table describes the baseline territories that were assumed for each climate zone. A net surplus compensation rate of \$ 0.01532/ kWh was applied to any net annual electricity generation based on a one-year average of the rates between February 2024 and January 2025.

Table 36. SCE Baseline Territory by Climate Zone

Climate Zone	Baseline Territory
CZ06	6
CZ08	8
CZ09	9
CZ10	10
CZ14	14
CZ15	15

Summer Daily Allocations (June through September)

Baseline Region Number	Daily kWh Allocation	All-Electric Allocation
5	17.2	17.9
6	11.4	8.8
8	12.6	9.8
9	16.5	12.4
10	18.9	15.8
13	22.0	24.6
14	18.7	18.3
15	46.4	24.1
16	14.4	13.5

Winter Daily Allocations (October through May)

Baseline Region Number	Daily kWh Allocation	All-Electric Allocation
5	18.7	29.1
6	11.3	13.0
8	10.6	12.7
9	12.3	14.3
10	12.5	17.0
13	12.6	24.3
14	12.0	21.3
15	9.9	18.2
16	12.6	23.1

Schedule TOU-D
TIME-OF-USE
DOMESTIC
 (Continued)

Sheet 12 (T)

SPECIAL CONDITIONS

1. Applicable rate time periods are defined as follows:

Option 4-9 PM, Option 4-9 PM-CPP, Option PRIME, Option PRIME-CPP :

TOU Period	Weekdays		Weekends and Holidays	
	Summer	Winter	Summer	Winter
On-Peak	4 p.m. - 9 p.m.	N/A	N/A	N/A
Mid-Peak	N/A	4 p.m. - 9 p.m.	4 p.m. - 9 p.m.	4 p.m. - 9 p.m.
Off-Peak	All other hours	9 p.m. - 8 a.m.	All other hours	9 p.m. - 8 a.m.
Super-Off-Peak	N/A	8 a.m. - 4 p.m.	N/A	8 a.m. - 4 p.m.
CPP Event Period	4 p.m. - 9 p.m.	4 p.m. - 9 p.m.	N/A	N/A

(T)



Southern California Edison
Rosemead, California (U 338-E)

Cancelling Revised Cal. PUC Sheet No. 89278-E
Revised Cal. PUC Sheet No. 88856-E

Schedule TOU-D
TIME-OF-USE
DOMESTIC
(Continued)

Sheet 2

RATES

Customers receiving service under this Schedule will be charged the applicable rates under Option 4-9 PM, Option 4-9 PM-CPP, Option 5-8 PM, Option 5-8 PM-CPP, Option PRIME, Option PRIME-CPP Option A, Option A-CPP, Option B, or Option B-CPP, as listed below. CPP Event Charges will apply to all energy usage during CPP Event Energy Charge periods and CPP Non-Event Energy Credits will apply as a reduction on CPP Non-Event Energy Credit Periods during Summer Season days, 4:00 p.m. to 9:00 p.m., as described in Special Conditions 1 and 3, below:

	Delivery Service Total ¹	Generation ²	
		UG ³	DWREC ⁴
Option 4-9 PM / Option 4-9 PM-CPP			
Energy Charge - \$/kWh			
Summer Season - On-Peak	0.35546 (I)	0.24264 (R)	0.00000
Mid-Peak	0.35546 (I)	0.12948 (R)	0.00000
Off-Peak	0.30374 (I)	0.06976 (R)	0.00000
Winter Season - Mid-Peak	0.35546 (I)	0.17237 (R)	0.00000
Off-Peak	0.30374 (I)	0.09602 (R)	0.00000
Super-Off-Peak	0.28513 (I)	0.07779 (R)	0.00000
Baseline Credit ⁵ - \$/kWh	(0.09514) (I)	0.00000	
Fixed Recovery Charge - \$/kWh	0.00198 (I)		
MCAM Charge ⁶ - \$/kWh	0.00160 (I)		
Basic Charge - \$/day			
Single-Family Residence	0.031		
Multi-Family Residence	0.024		
Minimum Charge ⁷ - \$/day			
Single Family Residence	0.346		
Multi-Family Residence	0.346		
Minimum Charge (Medical Baseline) ⁸ - \$/day			
Single Family Residence	0.173		
Multi-Family Residence	0.173		
California Climate Credit ⁹	(56.00) (R)		
California Alternate Rates for Energy Discount - %	100.00*		
Family Electric Rate Assistance Discount - %	100.00		
Option 4-9 PM-CPP			
CPP Event Energy Charge - \$/kWh		0.80000	
Summer CPP Non-Event Credit			
On-Peak Energy Credit - \$/kWh		(0.15170)	
Maximum Available Credit - \$/kWh ¹⁰			
Summer Season		(0.54821) (R)	

* Represents 100% of the discount percentage as shown in the applicable Special Condition of this Schedule.

** The Minimum Charge is applicable when the Delivery Service Energy Charge, plus the applicable Basic Charge is less than the Minimum Charge.

*** The ongoing Competition Transition Charge CTC of (\$0.00056) per kWh is recovered in the UG component of Generation.

**** The Baseline Credit applies up to 100% of the Baseline Allocation, regardless of Time-of-Use time period. Additional Baseline Allocations apply for Customers with Heat Pump Water Heaters served under this Option. The Baseline Allocations are set forth in Preliminary Statement, Part H. (R)

***** The Maximum Available Credit is the capped credit amount for CPP Customers dual participating in other demand response programs.

1 Total = Total Delivery Service rates are applicable to Bundled Service, Direct Access (DA) and Community Choice Aggregation Service (CCA Service) Customers, except DA and CCA Service Customers are not subject to the DWRBC rate component of this Schedule but instead pay the DWRBC as provided by Schedule DA-CRS or Schedule CCA-CRS.

2 Generation = The Gen rates are applicable only to Bundled Service Customers. See Special Condition below for PCA recovery.

3 DWREC = Department of Water Resources (DWR) Energy Credit - For more information on the DWR Energy Credit, see the Billing Calculation Special Condition of this Schedule.

4 Applied on an equal basis, per household, semi-annually. See the Special Conditions of this Schedule for more information.

5 The Modified Cost Allocation Mechanism (MCAM) charge recovers the net cost associated with system reliability procurement ordered by the CPUC that SCE has procured on behalf of customers whose generation services are provided by certain Electric Service Providers or Community Choice Aggregators.

(Continued)

(To be inserted by utility)

Advice 5449-E
Decision _____

207

Issued by
Michael Backstrom
Vice President

(To be inserted by Cal. PUC)

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Southern California Edison
Rosemead, California (U 338-E)

Revised Cal. PUC Sheet No. 89282-E
Cancelling Revised Cal. PUC Sheet No. 88860-E

Schedule TOU-D
TIME-OF-USE
DOMESTIC
(Continued)

Sheet 6

RATES (Continued)

Option PRIME / Option PRIME-CPP	Delivery Service		Generation ²	
	Total ¹		UG**	DWREC ³
Energy Charge - \$/kWh/Meter/Day				
Summer Season				
	On-Peak	0.28716 (I)	0.28317 (R)	0.00000
	Mid-Peak	0.28716 (I)	0.10077 (R)	0.00000
	Off-Peak	0.20039 (I)	0.06728 (R)	0.00000
Winter Season				
	Mid-Peak	0.29246 (I)	0.24759 (R)	0.00000
	Off-Peak	0.19215 (I)	0.05686 (R)	0.00000
	Super-Off-Peak	0.19215 (I)	0.05686 (R)	0.00000
Fixed Recovery Charge - \$/kWh		0.00198 (I)		
MCAM Charge ⁵ - \$/kWh		0.00160 (I)		
Basic Charge - \$/Meter/Day		0.539 (R)		
EV Meter Credit (Separately Metered EV Option) - \$/Meter/Day		(0.408) (I)		
EV Submeter Credit - \$/Meter/Day		(0.139) (I)		
California Climate Credit ⁴		(56.00) (R)		
California Alternate Rates for				
Energy Discount - %		100.00*		
Family Electric Rate Assistance Discount - %		100.00		
Medical Line Item Discount - %		100.000		
Option PRIME-CPP				
CPP Event Energy Charge - \$/kWh			0.80000	
Summer CPP Non-Event Credit				
On-Peak Energy Credit - \$/kWh			(0.15170)	
Maximum Available Credit - \$/kWh****				
Summer Season			(0.54821) (R)	

* Represents 100% of the discount percentage as shown in the applicable Special Condition of this Schedule.

** The ongoing Competition Transition Charge (CTC) of (\$0.00058) per kWh is recovered in the UG component of Generation.

**** The Maximum Available Credit is the capped credit amount for CPP Customers dual participating in other demand response programs.

1 Total = Total Delivery Service rates are applicable to Bundled Service, Direct Access (DA) and Community Choice Aggregation Service (CCA Service) Customers, except DA and CCA Service Customers are not subject to the DWRBC rate component of this Schedule but instead pay the DWRBC as provided by Schedule DA-CRS or Schedule CCA-CRS.

2 Generation = The Gen rates are applicable only to Bundled Service Customers. See Special Condition below for PCIA recovery.

3 DWREC = Department of Water Resources (DWR) Energy Credit – For more information on the DWR Energy Credit, see the Billing Calculation Special Condition of this Schedule.

4 Applied on an equal basis, per household, semi-annually. See the Special Conditions of this Schedule for more information.

5 The Modified Cost Allocation Mechanism (MCAM) charge recovers the net cost associated with system reliability procurement ordered by the CPUC that SCE has procured on behalf of customers whose generation services are provided by certain Electric Service Providers or Community Choice Aggregators.

(Continued)

(To be inserted by utility)

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Southern California Edison
Rosemead, California (U 338-E)

Revised Cal. PUC Sheet No. 89277-E
Cancelling Revised Cal. PUC Sheet No. 88502-E

Schedule D-CARE
CALIFORNIA ALTERNATE RATES FOR ENERGY
DOMESTIC SERVICE

Sheet 1

APPLICABILITY

Applicable to domestic service to California Alternate Rates for Energy (CARE) households residing in a permanent Single-Family Accommodation or Multifamily Accommodation where the customer meets all the Special Conditions of this Schedule. Customers enrolled in the CARE program are not eligible for the Family Electric Rate Assistance (FERA) program.

Pursuant to Special Condition 12 herein, customers receiving service under this Schedule are eligible to receive the California Climate Credit as shown in the Rates section below.

TERRITORY

Within the entire territory served.

RATES

The applicable charges set forth in Schedule D shall apply to Customers served under this Schedule.

CARE Discount:

A 32.5 percent discount is applied to a CARE Customer's bill prior to the application of the Public Utilities Commission Reimbursement Fee (PUCRF) and any applicable user fees, taxes, and late payment charges. CARE Customers are required to pay the PUCRF and any applicable user fees, taxes, and late payment charges in full. In addition, CARE Customers are exempt from paying the CARE Surcharge of \$0.01435 per kWh, the Wildfire Fund Non-Bypassable Charge of \$0.00595 per kWh, and the Fixed Recovery Charge of \$0.00198 per kWh.. (l)
(l)
(l)

(Continued)

(To be inserted by utility)

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Michael Backstrom
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6.3.3 Southern California Gas

Following are the SoCalGas natural gas tariffs applied in this study. Table 37 describes the baseline territories that were assumed for each climate zone.

Table 37. SoCalGas Baseline Territory by Climate Zone

Climate Zone	Baseline Territory
CZ05	2
CZ06	1
CZ08	1
CZ09	1
CZ10	1
CZ14	2
CZ15	1

The SoCalGas monthly gas rate in \$/therm applied in this analysis is shown in Table 38. The gas rates were developed based on the latest available gas rate for January 2025 and a curve to reflect how natural gas prices fluctuate with seasonal supply and demand. The seasonal curve was estimated from SoCalGas’s monthly residential tariffs between 2015 and 2024. 12-month curves were created from monthly gas rates for each of the ten years. The ten annual curves were then averaged to arrive at an average normalized annual curve. Long-term historical natural gas rate data was only available for SoCalGas’ procurement charges.⁸ The baseline and excess transmission charges were found to be consistent over the course of a year and applied for the entire year based on January 2025 rates. The costs presented in Table 38 were then derived by establishing the baseline and excess rates from the latest January 2025 tariff as a reference point, and then using the normalized curve to estimate the cost for the remaining months relative to the January rates. CARE tariffs reflect the 20 percent discount per the GR tariff.

⁸ The SoCalGas procurement and transmission charges were obtained from the following site:
<https://www.socalgas.com/for-your-business/energy-market-services/gas-prices/RES2023.xlsx> (live.com)

Table 38. SoCalGas Monthly Gas Rate (\$/therm)

Month	Procurement Charge	Transportation Charge		Total Charge	
		Baseline	Excess	Baseline	Excess
January	\$0.45	\$0.98	\$1.40	\$1.43	\$1.85
February	\$0.31	\$0.98	\$1.40	\$1.29	\$1.71
March	\$0.26	\$0.98	\$1.40	\$1.24	\$1.66
April	\$0.21	\$0.98	\$1.40	\$1.19	\$1.62
May	\$0.22	\$0.98	\$1.40	\$1.20	\$1.62
June	\$0.25	\$0.98	\$1.40	\$1.23	\$1.65
July	\$0.26	\$0.98	\$1.40	\$1.24	\$1.66
August	\$0.29	\$0.98	\$1.40	\$1.27	\$1.70
September	\$0.27	\$0.98	\$1.40	\$1.25	\$1.67
October	\$0.26	\$0.98	\$1.40	\$1.24	\$1.66
November	\$0.29	\$0.98	\$1.40	\$1.27	\$1.69
December	\$0.33	\$0.98	\$1.40	\$1.31	\$1.73

6.3.4 San Diego Gas & Electric

Following are the SDG&E electricity and natural gas tariffs applied in this study. Table 39 describes the baseline territories that were assumed for each climate zone. A net surplus compensation rate of \$ 0.01837/ kWh was applied to any net annual electricity generation based on a one-year average of the rates between February 2024 and January 2025.

Table 39. SDG&E Baseline Territory by Climate Zone

Climate Zone	Baseline Territory
CZ07	Coastal
CZ10	Inland
CZ14	Mountain

The SDG&E monthly gas rate in \$/therm was applied on a monthly basis according to the rates shown in Table 40. The gas rates were developed based on the latest available gas rate for January 2025 and a curve to reflect how natural gas prices fluctuate with seasonal supply and demand. The seasonal curve was estimated from SDG&E's monthly residential tariffs between 2015 and 2024. 12-month curves were created from monthly gas rates for each of the ten years. The ten annual curves were then averaged to arrive at an average normalized annual curve. The baseline and excess transmission charges were found to be consistent over the course of a year and applied for the entire year based on January 2025 rates. The costs presented in Table 40 were then derived by establishing the baseline and excess rates from the latest January 2025 tariff as a reference point, and then using the normalized curve to estimate the cost for the remaining months relative to the January rates. CARE tariffs reflect the 20 percent discount per the G-CARE tariff.

Table 40. SDG&E Monthly Gas Rate (\$/therm)

Month	Total Charge	
	Baseline	Excess
January	\$2.07	\$2.36
February	\$2.01	\$2.30
March	\$1.93	\$2.22
April	\$1.86	\$2.16
May	\$1.88	\$2.18
June	\$1.94	\$2.24
July	\$1.95	\$2.25
August	\$2.02	\$2.32
September	\$1.97	\$2.27
October	\$1.94	\$2.24
November	\$1.97	\$2.27
December	\$2.07	\$2.37

Baseline Usage: The following quantities of gas used in individually metered residences are to be billed at the baseline rates:

<u>All Customers:</u>	<u>Daily Therm Allowance</u>
Summer (May to Oct)	0.359
Winter On-Peak (Dec, Jan & Feb)	1.233
Winter Off-Peak (Nov, Mar, & Apr)	0.692



San Diego Gas & Electric Company
San Diego, California

Revised Cal. P.U.C. Sheet No. 62556-E
Canceling Revised Cal. P.U.C. Sheet No. 62360-E

SCHEDULE TOU-DR1
RESIDENTIAL TIME-OF-USE

Sheet 2

RATES

Total Rates:

Description – TOU DR1	UDC Total Rate	DWR BC + WF-NBC	EECC Rate	Total Rate
Summer:				
On-Peak	0.28222	0.00561	0.41736	0.70519
Off-Peak	0.28222	0.00561	0.18792	0.47575
Super Off-Peak	0.28222	0.00561	0.06741	0.35524
Winter:				
On-Peak	0.41439	0.00561	0.14115	0.56115
Off-Peak	0.41439	0.00561	0.07928	0.49928
Super Off-Peak	0.41439	0.00561	0.06133	0.48133
Summer Baseline Adjustment Credit up to 130% of Baseline	(0.10543)			(0.10543)
Winter Baseline Adjustment Credit up to 130% of Baseline	(0.10543)			(0.10543)
Minimum Bill (\$/day)	0.392			0.392

Description – TOU DR1-CARE	UDC Total Rate	DWR BC + WF-NBC	EECC Rate	Total Rate	Total Effective Care Rate
Summer – CARE Rates:					
On-Peak	0.28222	0.00000	0.41736	0.69958	0.46249 R
Off-Peak	0.28222	0.00000	0.18792	0.47014	0.30762 R
Super Off-Peak	0.28222	0.00000	0.06741	0.34963	0.22627 R
Winter – CARE Rates:					
On-Peak	0.41439	0.00000	0.14115	0.55554	0.36526 R
Off-Peak	0.41439	0.00000	0.07928	0.49367	0.32350 R
Super Off-Peak	0.41439	0.00000	0.06133	0.47572	0.31138 R
Summer Baseline Adjustment Credit up to 130% of Baseline	(0.10543)			(0.10543)	(0.07117) I
Winter Baseline Adjustment Credit up to 130% of Baseline	(0.10543)			(0.10543)	(0.07117) I
Minimum Bill (\$/day)	0.196			0.196	0.196

Note:

- (1) Total Rates consist of UDC, Schedule DWR-BC (Department of Water Resources Bond Charge), Schedule WF-NBC (CA Wildfire Fund charge) and Schedule EECC (Electric Energy Commodity Cost) rates. EECC rates are applicable to bundled customers only. See Special Condition 16 for PCIA (Power Charge Indifference Adjustment) recovery.
- (2) Total Rates presented are for customers that receive commodity supply and delivery service from Utility.
- (3) DWR-BC and WF-NBC charges do not apply to CARE customers.
- (4) As identified in the rates tables, customer bills will also include line-item summer and winter credits for usage up to 130% of baseline to provide the rate capping benefits adopted by Assembly Bill 1X and Senate Bill 695.
- (5) WF-NBC rate is 0.00561 + DWR-BC Bond Charge is 0.00000.

(Continued)

2H10

Advice Ltr. No. 4582-E

Decision No. D 24-05-028

Issued by
Dan Skopec
Senior Vice President
Regulatory Affairs

Submitted Dec 30, 2024

Effective Jan 1, 2025

Resolution No.

SCHEDULE TOU-DR1
RESIDENTIAL TIME-OF-USE

Sheet 5

Minimum Bill

The minimum bill to recover Distribution and TRAC costs is calculated as the minimum bill charge of \$0.402 per day times the number of days in the billing cycle with a 50% discount applied for CARE or Family Electric Rate Assistance Program (FERA) customers resulting in a minimum bill charge of \$0.201 per day.

Rate Components

The Utility Distribution Company Total Rates (UDC Total) shown above are comprised of the following components (if applicable): (1) Transmission (Trans) Charges, (2) Distribution (Distr) Charges, (3) Public Purpose Program (PPP) Charges, (4) Nuclear Decommissioning (ND) Charge, (5) Ongoing Competition Transition Charges (CTC), (6) Local Generation Charge (LGC), (7) Reliability Services (RS), and (8) the Total Rate Adjustment Component (TRAC).

Customers taking service under this Schedule may be eligible for a California Alternate Rates for Energy (CARE) discount on their bill, if they qualify to receive service under the terms and conditions of Schedule E-CARE. In addition, qualified CARE customers are exempt from paying the CARE surcharge of \$0.01230 Per kWh. Customers that are eligible and receive both CARE and medical baseline will be given the additional medical baseline allotment for which they qualify and will receive the total effective CARE and medical baseline discounts identified in Schedule E-CARE.

Franchise Fee Differential

A Franchise Fee Differential of 5.78% will be applied to the monthly billings calculated under this Schedule for all customers within the corporate limits of the City of San Diego. Such Franchise Fee Differential shall be so indicated and added as a separate item to bills rendered to such customers.

Time Periods

All time periods listed are applicable to local time. The definition of time will be based upon the date service is rendered.

TOU Periods – Weekdays	Summer	Winter
On-Peak	4:00 p.m. – 9:00 p.m.	4:00 p.m. – 9:00 p.m.
Off-Peak	6:00 a.m. – 4:00 p.m.; 9:00 p.m. - midnight	6:00 a.m. – 4:00 p.m. Excluding 10:00 a.m. – 2:00 p.m. in March and April; 9:00 p.m. - midnight
Super Off-Peak	Midnight – 6:00 a.m.	Midnight – 6:00 a.m. 10:00 a.m. – 2:00 p.m. in March and April
TOU Period – Weekends and Holidays	Summer	Winter
On-Peak	4:00 p.m. – 9:00 p.m.	4:00 p.m. – 9:00 p.m.
Off-Peak	2:00 p.m. – 4:00 p.m.; 9:00 p.m. - midnight	2:00 p.m. – 4:00 p.m.; 9:00 p.m. - midnight
Super Off-Peak	Midnight – 2:00 p.m.	Midnight – 2:00 p.m.

Seasons: Summer June 1 – October 31
 Winter November 1 – May 31

Cost-effectiveness Analysis: Single Family AC to Heat Pump Replacement

Schedule EV-TOU-5 - DOMESTIC TIME-OF-USE FOR HOUSEHOLDS WITH ELECTRIC VEHICLES provides domestic residential service for customers who own qualifying electric vehicles. Effective 10/1/2024

SCHEDULE EV-TOU-5										Schedule WF-NBC + DWR-BC Rate	Schedule EECC Rate	Total Electric Rate
Energy Charges (\$/kWh)	Transm	Distr	PPP	ND	CTC	LGC	RS	TRAC	UDC Total			
Summer												
On-Peak	0.05840	0.18330	0.01654	0.00007	0.00054	0.02516	0.00001	0.00000	0.28402	0.00561	0.38826	0.67789
Off-Peak	0.05840	0.18330	0.01654	0.00007	0.00054	0.02516	0.00001	0.00000	0.28402	0.00561	0.14305	0.43268
Super Off-Peak	0.00000	0.01496	0.01654	0.00007	0.00054	0.02516	0.00001	0.00000	0.05728	0.00561	0.06741	0.13030
Winter												
On-Peak	0.05840	0.18330	0.01654	0.00007	0.00054	0.02516	0.00001	0.00000	0.28402	0.00561	0.16516	0.45479
Off-Peak	0.05840	0.18330	0.01654	0.00007	0.00054	0.02516	0.00001	0.00000	0.28402	0.00561	0.11850	0.40813
Super Off-Peak	0.00000	0.01496	0.01654	0.00007	0.00054	0.02516	0.00001	0.00000	0.05728	0.00561	0.06133	0.12422
Other Charges/Discounts												
Basic Service Fee (\$/month)	0.00	16.00	0.00	0.00	0.00	0.00	0.00	0.00	16.00			16.00
Notes: 1) The total rates presented reflect the UDC rates associated with service under Schedule EV-TOU-5 and the generation rates associated with Schedule EECC, in addition to the rates associated with Schedules DWR-BC and WF-NBC. The UDC rate-by-rate components presented are associated with service under Schedule EV-TOU-5 as presented in the utility's tariff book. 2) Unbundled customers are those who take generation from other providers, such as Direct Access (DA) or Community Choice Aggregation (CCA). Unbundled customers do not pay SDG&E's commodity rates. The Total Energy Charge for an unbundled customer includes UDC, WF-NBC, DWR-BC and Power Charge Indifference Adjustment (PCIA) rates. PCIA rates by vintage are included below. Please see Schedules DA-CRS or CCA-CRS for more information regarding PCIA rates.												

SCHEDULE EV-TOU-5

Sheet 4

COST-BASED DOMESTIC TIME-OF-USE FOR HOUSEHOLDS WITH ELECTRIC VEHICLES

Notes: Transmission Energy charges include the Transmission Revenue Balancing Account Adjustment (TRBAA) of \$(0.00289) per kWh and the Transmission Access Charge Balancing Account Adjustment (TACBAA) of \$(0.01656) per kWh. PPP Energy charges includes Low Income PPP rate (LI-PPP) \$0.01515/kWh, Non-low Income PPP rate (Non-LI-PPP) \$0.00031/kWh (pursuant to PU Code Section 399.8, the Non-LI-PPP rate may not exceed January 1, 2000 levels), and California Solar Initiative rate (CSI) of \$(0.00075)/kWh and Self-Generation Incentive Program rate (SGIP) \$0.00149/kWh. The basic service fee of \$16 per month is applied to a customer's bill and a 50% discount is applied for CARE, Medical Baseline, or Family Electric Rate Assistance Program (FERA) customers resulting in their basic service fees to be \$8 per month.

Rate Components

The Utility Distribution Company Total Rates (UDC Total) shown above are comprised of the following components (if applicable): (1) Transmission (Trans) Charges, (2) Distribution (Distr) Charges, (3) Public Purpose Program (PPP) Charges, (4) Nuclear Decommissioning (ND) Charge, (5) Ongoing Competition Transition Charges (CTC), (6) Local Generation Charge (LGC), (7) Reliability Services (RS), and (8) the Total Rate Adjustment Component (TRAC).

Certain Direct Access customers are exempt from the TRAC, as defined in Rule 1 – Definitions.

Franchise Fee Differential

A Franchise Fee Differential of 5.78% will be applied to the monthly billings calculated under this schedule for all customers within the corporate limits of the City of San Diego. Such Franchise Fee Differential shall be so indicated and added as a separate item to bills rendered to such customers.

Time Periods:

All time periods listed are applicable to actual "clock" time)

TOU Period – Weekdays	Summer	Winter
On-Peak	4:00 p.m. – 9:00 p.m.	4:00 p.m. – 9:00 p.m.
Off-Peak	6:00 a.m. – 4:00 p.m.; 9:00 p.m. – midnight	6:00 a.m. – 4:00 p.m. Excluding 10:00 a.m.–2:00 p.m.in March and April; 9:00 p.m. - midnight
Super-Off-Peak	Midnight – 6:00 a.m.	Midnight – 6:00 a.m. 10:00 a.m. – 2:00 p.m. in March and April

TOU Period – Weekends and Holidays	Summer	Winter
On-Peak	4:00 p.m. – 9:00 p.m.	4:00 p.m. – 9:00 p.m.
Off-Peak	2:00 p.m. – 4:00 p.m.; 9:00 p.m. – midnight	2:00 p.m. – 4:00 p.m. 9:00 p.m. - midnight
Super-Off-Peak	Midnight – 2:00 p.m.	Midnight – 2:00 p.m.

Seasons:

Summer June 1 – October 31

Winter November 1 – May 31



San Diego Gas & Electric Company
San Diego, California

Revised Cal. P.U.C. Sheet No. 62755-E
Canceling Revised Cal. P.U.C. Sheet No. 35718-E

SCHEDULE E-CARE

Sheet 1

CALIFORNIA ALTERNATE RATES FOR ENERGY

APPLICABILITY

This schedule provides a California Alternate Rates for Energy (CARE) discount to each of the following types of customers listed below that meet the requirements for CARE eligibility as defined in Rule 1, Definitions, and herein, and is taken in conjunction with the customer's otherwise applicable service schedule.

- 1) Customers residing in a permanent single-family accommodation, separately metered by the Utility.
- 2) Multi-family dwelling units and mobile home parks supplied through one meter on a single premises where the individual unit is submetered.
- 3) Non-profit group living facilities.
- 4) Agricultural employee housing facilities.

TERRITORY

Within the entire territory served by the Utility.

DISCOUNT

1) Residential CARE:

Pursuant to D.24-05-028, the applicable CARE discount rate is to be between 30% and 35%, with the intended CARE discount rate to be 35% for SDG&E, specifically, applied as a fixed CARE line-item discount.

In addition to the CARE line-item discount, the total effective CARE discount consists of: (a) exemptions from paying the CARE Surcharge, Department of Water Resources Bond Charge (DWR-BC), California Wildfire Fund Charge (WF-NBC), Vehicle-Grid Integration (VGI) costs, and California Solar Initiative (CSI) and (b) a 50% minimum bill relative to Non-CARE.

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(Continued)

1H6

Advice Ltr. No. 4572-E-A

Decision No. D.24-05-028

Issued by

Dan Skopec

Senior Vice President
Regulatory Affairs

Submitted Jan 24, 2025

Effective Jan 1, 2025

Resolution No.

6.3.5 City of Palo Alto Utilities

Following are the CPAU electricity and natural gas tariffs applied in this study. The CPAU monthly gas rate in \$/therm was applied on a monthly basis according to the rates shown in Table 41. The gas rates were developed based on the latest available gas rate for January 2025 and a curve to reflect how natural gas prices fluctuate with seasonal supply and demand. The seasonal curve was estimated from CPAU's monthly residential tariffs between 2018 and 2024. 12-month curves were created from monthly gas rates for each of the seven years. The seven annual curves were then averaged to arrive at an average normalized annual curve. The baseline and excess transmission charges were found to be consistent over the course of a year and applied for the entire year based on January 2025 rates. The costs presented in Table 41 were then derived by establishing the baseline and excess rates from the latest January 2025 tariff as a reference point and then using the normalized curve to estimate the cost for the remaining months relative to the January rates. The monthly service charge applied was \$16.93 per month per the January 2025 G-1 tariff.

Table 41. CPAU Monthly Gas Rate (\$/therm)

Month	G1 Volumetric Total Baseline	G1 Volumetric Total Excess
January	\$1.74	\$3.02
February	\$1.33	\$2.53
March	\$1.24	\$2.43
April	\$1.21	\$2.39
May	\$1.21	\$2.39
June	\$1.23	\$2.42
July	\$1.31	\$2.64
August	\$1.37	\$2.71
September	\$1.36	\$2.71
October	\$1.38	\$2.72
November	\$1.45	\$2.80
December	\$1.57	\$2.96

RESIDENTIAL ELECTRIC SERVICE

UTILITY RATE SCHEDULE E-1

A. APPLICABILITY:

This Rate Schedule applies to separately metered single-family residential dwellings receiving Electric Service from the City of Palo Alto Utilities.

B. TERRITORY:

This rate schedule applies everywhere the City of Palo Alto provides Electric Service.

C. UNBUNDLED RATES:

<u>Per kilowatt-hour (kWh)</u>	<u>Commodity</u>	<u>Distribution</u>	<u>Public Benefits</u>	<u>Total</u>
Tier 1 usage	\$ 0.10270	\$ 0.08642	\$ 0.00549	\$ 0.19461
Tier 2 usage	0.13240	0.08079	0.00549	0.21868
Any usage over Tier 1				
<u>Customer Charge</u> <u>(\$/month)</u>				4.64

D. SPECIAL NOTES:

1. Calculation of Cost Components

The actual bill amount is calculated based on the applicable rates in Section C above and adjusted for any applicable discounts, surcharges and/or taxes. On a Customer's bill statement, the bill amount may be broken down into appropriate components as calculated under Section C.

2. Calculation of Usage Tiers

Tier 1 Electricity usage shall be calculated and billed based upon a level of 15 kWh per day, prorated by Meter reading days of Service. As an example, for a 30-day bill, the Tier 1 level would be 450 kWh. For further discussion of bill calculation and proration, refer to Rule and Regulation 11.

{End}

CITY OF PALO ALTO UTILITIES

Issued by the City Council

*Supersedes Sheet No E-1-1
dated 7-1-2023*



**CITY OF
PALO ALTO
UTILITIES**

Sheet No **E-1-1**
Effective 7-1-2024

Cost-effectiveness Analysis: Single Family AC to Heat Pump Replacement

6.3.6 Sacramento Municipal Utilities District (Electric Only)

Following are the SMUD electricity tariffs applied in this study. The rates effective January 2025 were used.

Residential Time-of-Day Service Rate Schedule R-TOD

II. Firm Service Rates

A. Time-of-Day (5-8 p.m.) Rate

	Effective as of January 1, 2023	Effective as of January 1, 2024	Effective as of May 1, 2024	Effective as of January 1, 2025	Effective as of May 1, 2025
Time-of-Day (5-8 p.m.) Rate (RT02)					
Non-Summer Season (October - May)					
System Infrastructure Fixed Charge <i>per month per meter</i>	\$23.50	\$24.15	\$24.80	\$25.50	\$26.20
Electricity Usage Charge					
Peak \$/kWh	\$0.1547	\$0.1590	\$0.1633	\$0.1678	\$0.1724
Off-Peak \$/kWh	\$0.1120	\$0.1151	\$0.1183	\$0.1215	\$0.1248
Summer Season (June - September)					
System Infrastructure Fixed Charge <i>per month per meter</i>	\$23.50	\$24.15	\$24.80	\$25.50	\$26.20
Electricity Usage Charge					
Peak \$/kWh	\$0.3279	\$0.3369	\$0.3462	\$0.3557	\$0.3655
Mid-Peak \$/kWh	\$0.1864	\$0.1914	\$0.1967	\$0.2021	\$0.2077
Off-Peak \$/kWh	\$0.1350	\$0.1387	\$0.1425	\$0.1464	\$0.1505

B. Optional Critical Peak Pricing Rate

- The CPP Rate base prices per time-of-day period are the same as the prices per time-of-day period for TOD (5-8 p.m.).
- The CPP Rate provides a discount per kWh on the Mid-Peak and Off-Peak prices during summer months.
- During CPP Events, customers will be charged for energy used at the applicable time-of-day period rate plus the CPP Rate Event Price per kWh as shown on www.smud.org.
- During CPP Events, energy exported to the grid will be compensated at the CPP Rate Event Price per kWh as shown on www.smud.org.
- The CPP Rate Event Price and discount will be updated annually at SMUD's discretion and posted on www.smud.org.

C. Plug-In Electric Vehicle Credit (rate categories RT02 and RTC1)

This credit is for residential customers who have a licensed passenger battery electric plug-in or plug-in hybrid electric vehicle. Credit applies to all electricity usage charges from midnight to 6:00 a.m. daily.

Electric Vehicle Credit..... **-\$0.0150/kWh**

III. Electricity Usage Surcharges

Refer to the following rate schedules for details on these surcharges.

A. Hydro Generation Adjustment (HGA). Refer to Rate Schedule HGA.

IV. Rate Option Menu

- Energy Assistance Program Rate.** Refer to Rate Schedule EAPR.
- Medical Equipment Discount Program.** Refer to Rate Schedule MED.
- Joint Participation in Medical Equipment Discount and Energy Assistance Program Rate.** Refer to Rate Schedule MED.



6.3.7 Fuel Escalation Assumptions

The average annual escalation rates in Table 42 and Table 43 were used in this study. Table 42 rates are based on assumptions from the CPUC 2021 En Banc hearings on utility costs through 2030 (California Public Utilities Commission, 2021a). Escalation rates through the remainder of the 30-year evaluation period are based on the escalation rate assumptions within the 2022 TDV factors. No data was available to estimate electricity escalation rates for CPAU and SMUD, therefore electricity escalation rates for PG&E and statewide natural gas escalation rates were applied. Table 43 rates are based on the escalation rate assumptions within the 2025 LSC factors from 2026 through 2055.⁹ These rates were developed for electricity use statewide (not utility-specific) and assume steep increases in gas rates in the latter half of the analysis period. Data was not available for the year 2026 and so the CPUC En Banc assumptions were applied for those years using the average rate across the three IOUs for statewide electricity escalation.

⁹<https://www.energy.ca.gov/files/2025-energy-code-hourly-factors>. (California Energy Commission, 2023). Actual escalation factors were provided by consultants E3.

Table 42. Real Utility Rate Escalation Rate Assumptions, CPUC En Banc and 2022 TDV Basis

	Statewide Natural Gas Residential Average Rate (%/year, real)	Electric Residential Average Rate (%/year, real)		
		PG&E	SCE	SDG&E
2026	4.6%	1.8%	1.6%	2.8%
2027	4.6%	1.8%	1.6%	2.8%
2028	4.6%	1.8%	1.6%	2.8%
2029	4.6%	1.8%	1.6%	2.8%
2030	4.6%	1.8%	1.6%	2.8%
2031	2.0%	0.6%	0.6%	0.6%
2032	2.4%	0.6%	0.6%	0.6%
2033	2.1%	0.6%	0.6%	0.6%
2034	1.9%	0.6%	0.6%	0.6%
2035	1.9%	0.6%	0.6%	0.6%
2036	1.8%	0.6%	0.6%	0.6%
2037	1.7%	0.6%	0.6%	0.6%
2038	1.6%	0.6%	0.6%	0.6%
2039	2.1%	0.6%	0.6%	0.6%
2040	1.6%	0.6%	0.6%	0.6%
2041	2.2%	0.6%	0.6%	0.6%
2042	2.2%	0.6%	0.6%	0.6%
2043	2.3%	0.6%	0.6%	0.6%
2044	2.4%	0.6%	0.6%	0.6%
2045	2.5%	0.6%	0.6%	0.6%
2046	1.5%	0.6%	0.6%	0.6%
2047	1.3%	0.6%	0.6%	0.6%
2048	1.6%	0.6%	0.6%	0.6%
2049	1.3%	0.6%	0.6%	0.6%
2050	1.5%	0.6%	0.6%	0.6%
2051	1.8%	0.6%	0.6%	0.6%
2052	1.8%	0.6%	0.6%	0.6%
2053	1.8%	0.6%	0.6%	0.6%
2054	1.8%	0.6%	0.6%	0.6%
2055	1.8%	0.6%	0.6%	0.6%

Table 43. Real Utility Rate Escalation Rate Assumptions, 2025 LSC Basis

Year	Statewide Natural Gas Residential Average Rate (%/year, real)	Statewide Electricity Residential Average Rate (%/year, real)
2026	4.6%	2.1%
2027	4.2%	0.6%
2028	3.2%	1.9%
2029	3.6%	1.6%
2030	6.6%	1.3%
2031	6.7%	1.0%
2032	7.7%	1.2%
2033	8.2%	1.1%
2034	8.2%	1.1%
2035	8.2%	0.9%
2036	8.2%	1.1%
2037	8.2%	1.1%
2038	8.2%	1.0%
2039	8.2%	1.1%
2040	8.2%	1.1%
2041	8.2%	1.1%
2042	8.2%	1.1%
2043	8.2%	1.1%
2044	8.2%	1.1%
2045	8.2%	1.1%
2046	8.2%	1.1%
2047	3.1%	1.1%
2048	-0.5%	1.1%
2049	-0.6%	1.1%
2050	-0.5%	1.1%
2051	-0.6%	1.1%
2052	-0.6%	1.1%
2053	-0.6%	1.1%
2054	-0.6%	1.1%
2055	-0.6%	1.1%

Get In Touch

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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Explore

The [Cost-Effectiveness Explorer](#) is a free resource to help California local governments and stakeholders develop energy policies for buildings.



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Revision: 1.0

Last modified: 2025/06/09

Cost Effectiveness Results Using Standard Tariffs

1992-2010 Dual-Fuel Heat Pump Existing Furnace

Climate Zone	Electric/ Gas Utility	First Incremental Cost	First-year Utility Savings	Lifecycle Net Present Value (NPV) Savings		
				2025 Long-term Systemwide Cost	On-Bill NPV Modest Gas Escalation	On-Bill NPV High Gas Escalation
CZ04	PGE	\$1,670	(\$68)	\$7,322	\$1,880	\$10,049

1992-2010 Standard Efficiency Heat Pump Space Heater

Climate Zone	Electric/ Gas Utility	First Incremental Cost	First-year Utility Savings	Lifecycle Net Present Value (NPV) Savings		
				2025 Long-term Systemwide Cost	On-Bill NPV Modest Gas Escalation	On-Bill NPV High Gas Escalation
CZ04	PGE	\$652	(\$205)	\$8,244	(\$572)	\$11,665

Dual Fuel Heat Pump (DFHP Existing Furnace): Replace the existing ducted furnace with an electric heat pump and install controls to operate the heat pump as the primary space conditioning source and to use the existing gas furnace for backup heat when heating demands cannot be met by the heat pump. In the study (Attachment 1), per the California Energy Code, the existing furnace is required to be disabled when the outdoor temperature reaches 35°F.

Standard Efficiency Heat Pump Space Heater: Replace existing ducted natural gas furnace with an electric heat pump and air handler.

First Incremental Cost: Higher efficiency equipment reduces utility costs in all cases and improves cost-effectiveness in many climate zones (Sunnyvale's climate zone is 4) in the oldest vintage relative to standard efficiency equipment. However, in more efficient newer homes, where cost-effectiveness is generally lower, the savings are insufficient to offset the roughly \$3000 increase in incremental cost.

The authors of the cost-effectiveness study assessed the incremental costs and savings of the packages over the lifecycle of 30 years. Incremental costs represent the equipment, installation, replacement, and maintenance costs of the proposed measure relative to the Energy Code minimum requirements or standard industry practices.

Gas Escalation: The study assumes utility rates escalate over time. Because it is very difficult to predict how the rates will change, the analysis presents two escalation scenarios (modest and high gas escalation) to represent a range of outcomes.

Long-term Systemwide Costs: Long-term systemwide costs are the California Energy Commission's metric for determining cost-effectiveness measures. This metric is intended to capture the long-term projected cost of energy, including costs for providing energy during peak periods of demand, carbon emissions, grid transmission, and distribution impacts.

Note: The Bay Area Air Quality Management District passed Regulation 9 (Inorganic Gaseous Pollutants), Rule 4 (Nitrous Oxide from natural gas-fired furnace) prohibits selling, installing, or offering to sell natural gas-fired furnaces within the district after January 1, 2029. (Amended March 15, 2023)