

**DOCKETED**

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<b>Project Title:</b>	Local Ordinance Applications Exceeding the 2022 Energy Code
<b>TN #:</b>	266558
<b>Document Title:</b>	City of Ojai – CEC Submittal (09-18-2025)
<b>Description:</b>	Plain text of City of Ojai – CEC Submittal (09-18-2025)
<b>Filer:</b>	Anushka Raut
<b>Organization:</b>	California Energy Commission
<b>Submitter Role:</b>	Commission Staff
<b>Submission Date:</b>	10/13/2025 2:58:07 PM
<b>Docketed Date:</b>	10/13/2025



## CITY OF OJAI

### Community Development Department – Building Division

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September 18, 2025

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Cc: [Mvega@trccompanies.com](mailto:Mvega@trccompanies.com)

#### **TITLE 24 PART 6 AMENDMENTS**

**RE: APPLICATION FOR LOCALLY ADOPTED ENERGY STANDARDS BY THE CITY OF OJAI'S CITY COUNCIL IN ACCORDANCE WITH THE 2022 CALIFORNIA ENERGY CODE, TITLE 24, PART 6, OF THE CALIFORNIA CODE OF REGULATIONS**

Dear CEC Executive Director Drew Bohan,

Please be advised that the City of Ojai – City Council has adopted amendments to the 2022 Edition of the California's 2022 Energy Code, Title 24, Part 6 – via Ordinance No. 968, enclosed.

In accordance with California Health and Safety Code Sections 17958.5, 17958.7 and 18941.5, Public Resources Code Section 25402.1 (h)(2), and California Code of Regulations, Title 24, Part 1, §10-106, the package of materials demonstrates the City of Ojai's City Council determined the local ordinance:

- Contains standards that are cost effective, and these standards were adopted at a public City Council meeting on August 26, 2025; and
- Will result in buildings designed to consume less energy than permitted by the 2022 California Energy Code.

The ordinance and cost-effectiveness studies were presented to the City of Ojai City Council on August 26, 2025. The ordinance will become effective following approval by the California Energy Commission.

Please find the following materials enclosed:

- **Attachment 1:** Staff report to the City of Ojai's City Council, outlining the goals of the updated building standards. The report clearly identifies the City of Ojai – City Council made an express finding that amendments to the building standards in the 2022 California

Energy Code are reasonably necessary because of local climatic, geological, topographical or environmental conditions.

- **Attachment 2:** Signed Ordinance No. 968, which adopts local amendments to the 2022 California Energy Code and Green Building Standards Code baseline for single-family residential buildings.
- **Attachment 3:** Cost effectiveness studies demonstrating the expected energy savings and the cost effectiveness of the ordinance in the City of Ojai, Climate Zone No. 9.
- **Attachment 4:** Demonstration of cost effectiveness summarizing how cost effectiveness study results informed the ordinance parameters.
- **Attachment 5:** Evidence of California Environmental Quality Act (CEQA) compliance through the attached Notice of Exemption. The City of Ojai's City Council found that under CEQA pursuant to Section 15308 and Section 15061(b)(3) of the CEQA Guidelines, there is no possibility the implementation of this ordinance will have a significant negative impact on the environment, and this is exempt from the requirements of CEQA.

Please consider and accept enclosed Ordinance No. 968 pursuant to California Code of Regulations, Title 24 Part 1, Section 10-106. If you have any questions, please contact Lucas Seibert, Community Development Director at (805) 646-5581 x113 or via email at [Lucas.Seibert@ojai.ca.gov](mailto:Lucas.Seibert@ojai.ca.gov).

Sincerely,  
**Lucas Seibert**  
**Community Development Director**  
**City of Ojai**

**Attachments:**

- Attachment 1 – August 12 & August 26, 2025 City of Ojai's City Council Staff Reports
- Attachment 2 – City Council Adopted Ordinance No. 968
- Attachment 3 – Cost Effective Studies Within Climate Zone No. 9
- Attachment 4 – Cost Effective Study Demonstration
- Attachment 5 – CEQA Notice of Exemption



# Administrative Report

## Discussion Item

**TO:** HONORABLE CITY COUNCIL  
**FROM:** Lucas Seibert, Community Development Director  
**DATE PREPARED:** July 29, 2025  
**MEETING DATE:** August 12, 2025  
**SUBJECT:** First reading and introduction of an ordinance amending and restating Section 9-1.1001 and adding Section 9-1.701(g) of the Ojai Municipal Code to establish efficiency requirements for single-family homeowners for major renovations and additions to reduce greenhouse gas emissions in the City of Ojai

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### Recommendation

That the City Council introduce an ordinance amending and restating Section 9-1.1001 and adding Section 9-1.701(g) of the Ojai Municipal Code to establish efficiency requirements for single-family homeowners for major renovations and additions to reduce greenhouse gas emissions in the City of Ojai.

### Background

In 2024, the City registered for the existing building efficiency and electrification code pilot program through the Clean Power Alliance (CPA). As part of the pilot program, CPA helped the City identify opportunities to require homeowners to implement energy efficiency measures when renovating or adding to existing single-family homes to reduce greenhouse gas emissions within the City.

Adopting a local energy code for renovations to existing buildings is one way for the City to continue its efforts to increase energy efficiency and reduce emissions. The majority of the City building stock is residential with single-family homes making up approximately 88% of all residential buildings. Medium to large renovations to existing single-family properties were identified as an effective opportunity to make improvements that can result in reduced energy use and greenhouse gas emissions.

At the December 10, 2024 City Council meeting, the City Council requested staff to return with an ordinance that requires homeowners of existing single-family homes to include energy efficiency measures when they make major renovations or additions to their home to reduce greenhouse gas emissions, improve comfort, improve air quality and improve safety within the City. Pursuant to the City Council's direction, this ordinance was brought before the City Council for the first time at the January 28, 2025 City Council meeting where it did not advance.

On April 7, 2025, staff were notified that Assembly Bill 306 (“AB 306”) was pending before the California State Legislature. The initial version of AB 306 would have imposed a moratorium on local building standard modifications for residential units, effectively preempting the City's ability to adopt the proposed California Energy Code changes through June 1, 2031 (“Moratorium”). As a result, the proposed ordinance was placed on hold.

On June 30, 2025, Governor Newsom signed budget trailer bill Assembly Bill 130 (“AB 130”) into law, which fully incorporated an amended version of AB 306. The changes to AB 306 adopted by AB 130 allow the City to adopt the proposed ordinance notwithstanding the moratorium if both of the following occur on or before September 30, 2025:

- The proposed ordinance is adopted; and
- The City files the changes and modifications to the California Energy Code set forth in the proposed ordinance with the California Building Standards Commission; and
- The California Building Standards Commission approves the proposed ordinance for filing

The City needs to adopt the proposed ordinance by its August 26, 2025 Council meeting for the proposed ordinance to be effective prior to September 30, 2025. Because denial by the California Building Standards Commission could prevent implementation and require ordinance revisions, filing the proposed changes at the earliest opportunity is recommended.

The changes to AB 306 adopted by AB 130 also created another exception to the Moratorium, which allows the City to adopt the proposed ordinance as necessary to implement a local code amendment to that is adopted to align with the City's general plan (which was approved before June 10, 2025), because the proposed ordinance permits mixed-fuel residential construction consistent with federal law (e.g., EPCA) while still incentivizing all-electric construction as part of the City's adopted greenhouse gas emissions reduction strategy. However, given the novelty of these ordinances under California law, it is recommended that the proposed ordinance be passed consistent with the exception described in the above paragraph.

The first and second readings of the ordinance must occur at the August 12, 2025 and August 26, 2025 meetings, and the ordinance must be submitted to the California Building Standards Commission before September 30, 2025 to meet the deadline imposed by AB 130.

If adopted at the August 26, 2025 Council meeting, the ordinance would take effect on September 26, 2025. However, the ordinance would apply to applications submitted to the City on or after January 31, 2026 to allow for staff and CPA/TRC to launch an education campaign to the community and contractors about these changes.

## **Discussion**

The California Energy Commission (CEC) requires any local energy standards that exceed the California Energy Code to be (1) cost-effective and (2) use less energy than the state's requirements. CPA's consultant, TRC, is creating recommendations tailored to Ojai by using a State tool that shows the most cost-effective ways for the City to require energy efficient upgrades that uses less energy than the state minimum requirements.

### *Flexpath Approach*

This ordinance uses a flexible compliance framework, known as "flexpath." A flexpath approach allows property owners to meet energy performance goals through a variety of energy efficiency strategies, rather than following one method (i.e., replacing all gas appliances with electric appliances). This approach provides flexibility by enabling homeowners to meet City requirements by selecting from a range of cost-effective energy efficiency options that best suit their specific circumstances, without the requirement to fully electrify their homes.

Under the Energy Policy and Conservation Act (EPCA), the federal government has sole authority to set efficiency standards for certain appliances and local governments cannot prohibit consumers from using those appliances (i.e., banning all gas appliances). By allowing homeowners to select energy efficiency measures from a menu of options without requiring them to forego any EPCA-covered appliance to achieve compliance, local jurisdictions can adopt local energy efficiency policies (e.g., duct replacements, duct sealing, added insulation) without preempting EPCA. TRC is following the EPCA regulations in developing recommendations for an Ojai energy efficiency code.

This ordinance does not apply to small projects, repairs (including plumbing and electrical repairs), cosmetics changes, (e.g., carpet, paint), appliance replacements (e.g., kitchen appliances or gas stoves), window projects, roof projects, work that does not require a permit, and any accessory dwelling units, junior accessory dwelling, and tiny houses. This ordinance also includes exemptions for pre-compliance, incompatibility with historical building status, seismic retrofits, fire hardening, temporary structures, and when upgrades present a significant cost burden.

A flexpath approach has been adopted by several other cities to achieve energy efficiency goals and climate commitments including Santa Cruz, San Luis Obispo, and Piedmont. The cities of West Hollywood and Santa Monica are also currently pursuing flexpath approaches.

### *Proposed Policy Applicability*

Based on a review of Ojai's building stock, the CEC cost-effectiveness tool, and examples from other cities energy codes, the draft ordinance proposed by CPA and TRC requires energy efficiency measures when any of these situations occurs for single-family projects:

- Major Addition - Any change to an existing building that increases conditioned floor area by 300 or more square feet in a one-year period.
- Major Alteration - Any construction or renovation to an existing structure other than a repair whose altered floor area covers 300 or more square feet in a one-year period.
- Major Addition and Alteration – Any project whose combined addition and alteration has a floor area equal to or greater than 300 square feet in a one-year period.

The proposed ordinance does not apply to multifamily or commercial projects. Projects that meet the above definitions and for which building permit applications were submitted to the City on or after December 29, 2025 would need to choose from a list of measures for increasing energy performance. The total points would need to meet or exceed an established target for the project

to be issued a building permit. As required by the CEC, there must be at least one cost-effective, non-electrification pathway to achieve the established target.

Homeowners will have the option of installing from a list of efficiency and electrification measures and will not be prohibited from using appliances covered by EPCA. Each measure is assigned a point value based on its associated energy savings, as determined by the California Energy Commission. Strategies with higher values are projected to have a greater energy efficiency benefit.

The proposed target for Ojai is 8 points for projects that are between 300 and 999 square feet and 19 points for projects 1,000 square feet and larger.

Table 1 below shows the proposed energy efficiency strategies and associated points value.

<b>Climate Zone 9</b>			
<b>Measures</b>	<b>Table 150.0-J ID</b>	<b>Points</b>	
Water Heating Package	E1	1	
Induction Cooktop	E2	1	
Heat Pump Clothes Dryer	E3	1	
Air Sealing	E4	1	
Duct Sealing	E5	3	
R-49 Attic Insulation	E6	5	
 Windows	E7	5	
 R-13 Wall Insulation	E8	3	
New Ducts + Duct Sealing	E9	6	
 R-19 Floor Insulation	E10	1	
 R-30 Floor Insulation	E11	2	
Heat Pump Water Heater (HPWH)	E12	12	
Solar PV + Electric Ready Pre-Wire	E13	17	
Heat Pump Space Heater	E14	7	
Utility Room, Kitchen & Laundry-Related Electric Ready Pre-Wire	M1	Mandatory	
Panel-Related Electric Ready Pre-Wire	M2	Mandatory	
Lighting Measures	M3	Mandatory	

*Table 1 Ojai Flexpath Measures Table*

Note:  in addition to energy efficiency, these strategies provide direct fire hardening benefits

#### *Exemptions*

To accommodate the wide variability in existing buildings, the proposed ordinance includes these exceptions:

1. Repairs are expressly exempt in the ordinance.
2. Projects with a hardship, meaning either that (a) compliance costs are more than 20 percent of total project valuation, or (b) building-specific conditions make compliance technically infeasible. In these cases, homeowners may request a hardship exemption. Approvals and denials of a hardship exemption request will be made by the Chief Building Official, in consultation with the Director of Community Development. As with all building code determinations and interpretations, decisions are appealable to the Building Appeals Board.
3. Projects that can demonstrate that they have previously installed compliance measures will be given credit for those measures.
4. Historic buildings that could not comply without impairing its historic integrity.
5. Alterations completed solely for seismic and fire hardening safety upgrades.
6. Temporary buildings, such as construction trailers.
7. Alterations that consist solely of roof and/or window projects.
8. Mobile, manufactured, or factory-built housing as defined in Division 13 of the California Health and Safety Code.
9. Properties located outside of climate zone 9. Climate zone 9 captures the overwhelming majority of Ojai properties, and this was done to simplify the ordinance.
10. Statewide exempt ADUs and JADUs, and Tiny Houses.
11. In instances where the installation of an EPCA covered appliance is prohibited, portions of the ordinance may be waived.
12. If an applicant can demonstrate compliance with alternate measures using California Energy Commission-certified compliance software.
13. Homes built after December 31, 1991.

As the projects applicable to the flexpath are major alteration and/or additions that require permitted work, applicants will likely already be working with designers and contractors that are familiar with the type of measures included in this ordinance along with energy modeling and the permit application process. These renovations typically cost on the order of tens to over hundreds of thousands of dollars and are typically done once in a lifetime. If missed now, it is unlikely to have an opportunity to make major energy efficiency improvements in these buildings for many years, and the opportunity to reduce greenhouse gas emissions at a small incremental cost may be missed.

#### *Available Resources for Lower Cost Renovations*

Many of the compliance measures have rebates, incentives, and tax credits associated with them which could substantially reduce the cost of compliance. Financial resources and technical assistance include tax credits through the Inflation Reduction Act for heat pump hot water heaters and HVAC equipment and rooftop solar generation systems.

#### *General Plan Consistency*

The Housing Element of the Ojai General Plan provides that the City strives to promote energy conservation through the use of building codes.

The Air Quality Element of the Ojai General Plan includes these goals within the Energy Conservation goals and objectives, which are part of Ojai's greenhouse gas emissions reduction strategy:

- Reduce energy consumption and promote energy efficiency programs.
- Encourage the incorporation of energy conservation features in the design of all new construction and the installation of conservation devices in existing developments.
- Implement planning and building regulations that take advantage of solar heating and natural cooling and require weatherization.

#### *Community Outreach*

CPA and TRC conducted outreach on this topic in the fall of 2024. This consisted of conducting a virtual meeting with environmental advocates and facilitating an in-person roundtable discussion with members of the Ojai business community. An information item was included in the October 22nd City Council meeting followed by a concept review item at the December 10th City Council meeting. Issues raised included potential costs to property owners, need for clear standards for compliance, and the potential impact on City staff workload.

On August 5, 2025 at a special meeting of the City Council, the community was invited to a workshop that included an educational presentation by CPA and TRC. The workshop provided a platform for the community and City Council members to ask questions associated with the proposed ordinance. A frequently asked questions (FAQ) document will be generated based on the questions received and together with the presentation materials, will be provided on the City landing page for Single-Family Energy Efficient Ordinance "Flexpath".

#### *Education First*

While the proposed ordinance must become effective by September 30, 2025 to qualify for one of the exemptions to the Moratorium, due to the complexity of this ordinance, the ordinance is structured so that it will only apply to building permit applications submitted to the City of Ojai on or after December 29, 2025. This will allow for community and staff education on the ordinance. TRC and CPA will be available to provide checklists and other implementation resources.

#### *Environmental Review*

The ordinance is exempt from CEQA under the general rule, 15061(b)(3), because it can be seen with certainty that the provisions contained herein would not have the potential to cause a significant effect on the environment. Further, this ordinance is exempt per CEQA Guidelines

Section 15308, Class 8, Actions by Regulatory Agencies for Protection of Natural Resources, since the proposed ordinance would institute regulatory requirements intended to protect the environment and natural resources.

**Alternative Options**

1. Take no action; or
2. Provide direction to return with recommendations.

**Fiscal Impact**

This recommendation has a staffing impact beyond the normal budgeted scope of duties. All Community Development Department (CDD) Staff will require initial education and training beyond the grant acquired for the program effort in partnership with CPA and TRC.

Additionally, for the first six months of operation, CDD would rely on CPA and TRC to address any significant issues related to the launch of this program. For example, a unique situation which is not specifically addressed or covered within the flexpath program. These additional staffing impacts equate to approximately \$30,000 to ensure adequate support during initial implementation.

**Council Goals**

The City Council has adopted a goal of Climate Resiliency. This flexpath ordinance was acknowledged as a priority by the City Council but was not adopted as supporting tactic.

**Submitted by:**

Lucas Seibert, Community Development Director

Attachment: Draft Energy Efficient Code Ordinance



# Administrative Report

## DISCUSSION ITEM

**TO:** HONORABLE CITY COUNCIL  
**FROM:** Lucas Seibert, Community Development Director

**DATE PREPARED:** July 29, 2025

**MEETING DATE:** August 26, 2025

**SUBJECT:** Adoption of Ordinance [Second Reading] Amending and Restating Section 9-1.1001 and adding Section 9-1.701(g) of the Ojai Municipal Code | Establish efficiency requirements for single-family homeowners for major renovations and additions to reduce greenhouse gas emissions in the City of Ojai

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### **Recommendation**

That the City Council adopt the proposed ordinance (Attachment A) amending and restating Section 9-1.1001 and adding Section 9-1.701(g) of the Ojai Municipal Code to establish efficiency requirements for single-family homeowners for major renovations and additions to reduce greenhouse gas emissions in the City of Ojai.

### **Discussion**

At the August 12, 2025 meeting, the City Council introduced an ordinance amending and restating sections of the Energy Code, with a minor revision for appeal(s) filed having no fee. The effort aligns with opportunities identified by City Council to require homeowners to implement energy efficiency measures when renovating or adding to existing single-family homes to reduce greenhouse gas emissions within the City.

Adopting a local energy code for renovations to existing buildings is one way for the City to continue its efforts to increase energy efficiency and reduce emissions. The majority of the City building stock is residential with single-family homes making up approximately 88% of all residential buildings. Medium to large renovations to existing single-family properties were identified as an effective opportunity to make improvements that can result in reduced energy use and greenhouse gas emissions.

On June 30, 2025, Governor Newsom signed budget trailer bill Assembly Bill 130 (“AB 130”) into law, which fully incorporated an amended version of AB 306. The changes to AB 306 adopted by AB 130 allow the City to adopt the proposed ordinance notwithstanding the moratorium if both of the following occur on or before September 30, 2025:

- The proposed ordinance is adopted; and

- The City files the changes and modifications to the California Energy Code set forth in the proposed ordinance with the California Building Standards Commission; and
- The California Building Standards Commission approves the proposed ordinance for filing

The City needs to adopt the proposed ordinance at this meeting for the proposed ordinance to be effective prior to September 30, 2025. The changes to AB 306 adopted by AB 130 also created another exception to the Moratorium, which allows the City to adopt the proposed ordinance as necessary to implement a local code amendment to that is adopted to align with the City's general plan (which was approved before June 10, 2025), because the proposed ordinance permits mixed-fuel residential construction consistent with federal law (e.g., EPCA) while still incentivizing all-electric construction as part of the City's adopted greenhouse gas emissions reduction strategy. However, given the novelty of these ordinances under California law, it is recommended that the proposed ordinance be passed consistent with the exception described in the above paragraph.

At its August 12, 2025 meeting, the City Council introduced this ordinance, received public comment on the matter, and considered the administrative report. This ordinance is now before Council for adoption.

The second readings of the ordinance must occur at the August 26, 2025 meeting, and the ordinance must be submitted to the California Building Standards Commission before September 30, 2025 to meet the deadline imposed by AB 130.

If adopted at the August 26, 2025 Council meeting, the ordinance would take effect on September 26, 2025. However, the ordinance would apply to applications submitted to the City on or after January 31, 2026 to allow for staff and CPA/TRC to launch an education campaign to the community and contractors regarding these changes.

The August 12, 2025 agenda report covers the flexpath approach in more detail and is included as Attachment B.

#### *Environmental Review*

The ordinance is exempt from the California Environmental Quality Act (CEQA) under the general rule, 15061(b)(3), because it can be seen with certainty that the provisions contained herein would not have the potential to cause a significant effect on the environment. Further, this ordinance is exempt per CEQA Guidelines Section 15308, Class 8, Actions by Regulatory Agencies for Protection of Natural Resources, since the proposed ordinance would institute regulatory requirements intended to protect the environment and natural resources.

#### **Alternative Options**

1. Take no action; or
2. Provide direction to return with recommendations.

### **Fiscal Impact**

This recommendation has a staffing impact beyond the normal budgeted scope of duties. All Community Development Department (CDD) Staff will require initial education and training beyond the grant acquired for the program effort in partnership with CPA and TRC.

Additionally, for the first six months of operation, CDD would rely on CPA and TRC to address any significant issues related to the launch of this program. For example, a unique situation which is not specifically addressed or covered within the flexpath program. These additional staffing impacts could equate to approximately \$30,000 to ensure adequate support during initial implementation. Staff will monitor the situation, and if appropriate, return to the City Council with a requested future budget amendment to reflect this potential impact.

### **Council Goals**

The City Council has adopted a goal of Climate Resiliency. This flexpath ordinance was acknowledged as a priority by the City Council but was not adopted as supporting tactic.

### **Submitted by:**

Lucas Seibert, Community Development Director

Attachments:

- A – Energy Efficient Code Ordinance
- B – August 12, 2025 Staff Report

**CITY OF OJAI**

**ORDINANCE NO. 968**

**AN ORDINANCE OF THE CITY COUNCIL  
OF THE CITY OF OJAI, CALIFORNIA  
AMENDING AND RESTATING SECTION 9-1.1001  
AND ADDING 9-1.701(g)  
OF THE OJAI MUNICIPAL CODE ESTABLISHING ENERGY  
EFFICIENCY MEASURES FOR SINGLE-FAMILY HOMEOWNERS  
FOR CERTAIN RENOVATIONS AND ADDITIONS TO REDUCE  
GREENHOUSE GAS EMISSIONS IN THE CITY OF OJAI**

**WHEREAS**, California Health and Safety Code section 17958 requires that cities adopt building regulations that are substantially the same as those adopted by the California Building Standards Commission and contained in the 2025 California Building Standards Code; and

**WHEREAS**, the 2025 California Energy Code is Part 6 of the 2025 California Building Standards Code which implements minimum energy efficiency standards in buildings through mandatory requirements, prescriptive standards, and performance standards; and

**WHEREAS**, California Health and Safety Code Sections 17958.5, 17958.7 and 18941.5 provide that the City of Ojai may make changes or modifications to the building standards contained in the 2025 California Building Standards Code based upon express findings that such changes or modifications are reasonably necessary because of local climatic, geological or topographical conditions and such changes support the City of Ojai's General Plan; and

**WHEREAS**, local governments may adopt energy conservation or energy insulation standards that differ from the California Energy Code with California Energy Commission approval, provided that local governments demonstrate, pursuant to Public Resources Code section 25402.1 (h)(2) that the requirements of their proposed standards are cost effective and do not result in buildings that consume more energy than is permitted by Title 24; and

**WHEREAS**, the proposed local amendments to the 2022 California Energy Code are necessary to implement a local code amendment that is adopted to align with the City of Ojai's General Plan, permit mixed-fuel residential construction consistent with federal law, and incentivize all-electric construction as part of an adopted greenhouse gas emissions reduction strategy.

**WHEREAS**, greenhouse gas accumulation in the atmosphere as the result of human activity is the primary cause of the global climate crisis; and

**WHEREAS**, in California alone, the initial impacts of climate change have resulted in unprecedented disasters with tremendous human, economic, and environmental costs and;

**WHEREAS**, the Intergovernmental Panel on Climate Change estimates that global emissions need to be reduced by 45 percent from 2010 levels by 2030, and 100 percent by 2050 to prevent global catastrophe; and

**WHEREAS**, the State of California enacted Assembly Bill (AB) 1279 to require statewide carbon neutrality "as soon as possible," but no later than 2045; and

**WHEREAS**, residents and businesses have repeatedly identified climate action as a top community priority; and

**WHEREAS**, the City of Ojai strives to be a leader in combatting climate change, and committed to support the principles the Paris Climate agreement and supports a transition to 100% clean energy; and

**WHEREAS**, Resolution No. 19-30 directed the City to initiate a just global emergency mobilization effort to reverse global warming by reducing greenhouse gas emissions and safely draw down carbon from the atmosphere as quickly as possible; and

**WHEREAS**, the City formed a Climate Emergency Mobilization Committee which identified energy efficiency measures and electrification as key ways to reduce fossil fuel emissions in Ojai; and

**WHEREAS**, the inventoried greenhouse gas emissions in the City come primarily from energy use in buildings and transportation; and

**WHEREAS**, in order to achieve carbon neutrality, existing sources of greenhouse gas emissions need to be substantially reduced or eliminated; and

**WHEREAS**, the energy efficiency requirements established in this ordinance—including air sealing, duct sealing, window upgrades, R-13 wall insulation, R-19 floor insulation, and R-30 wall/ceiling insulation—provide direct fire hardening benefits by creating thermal barriers that slow fire spread, preventing ember intrusion through building envelope penetrations, reducing pathways for fire and smoke propagation through HVAC and structural systems, enhance window resistance to thermal shock and radiant heat exposure, and improve overall building compartmentalization that extends egress time and reduces structural fire damage; and

**WHEREAS**, these improvements create multiple layers of fire protection, improve community wildfire resilience, and support broader public safety goals while providing cost-effective dual benefits for both energy performance and fire resistance; and

**WHEREAS**, Public Resources Code Section 25402.1 (h)(2) and Section 10-106 of the 2025 California Administration Code establish a process which allows local agencies to adopt local amendments that are cost-effective and that require greater energy reduction/conservation than the California Energy Code 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 2025 California Energy Code; and

**WHEREAS**, the California Energy Codes and Standards Statewide Utility Program, has determined specific modifications to the 2022 State Energy Code for each climate zone that are cost-effective; and that such modifications will result in designs that consume less energy than they would under the 2022 State Energy Code; and

**WHEREAS**, staff has reviewed the “2022 Existing Building Cost-Effectiveness Study” and associated data, and find them sufficient to illustrate compliance with the requirements set forth under California Administrative Code Chapter 10-106; and

**WHEREAS**, based on these studies, the City finds the proposed local amendments to the 2022 California Energy Code to be cost-effective and buildings will be designed to consume less energy than permitted by Title 24, Part 6; and

**WHEREAS**, the 2022 California Energy Code offers compliance options that were established through the public rulemaking process of the code update; and

**WHEREAS**, the Council expressly declares that the proposed amendments to the Energy Code are reasonably necessary because of local climatic, topological, and geological conditions; and

**WHEREAS**, Government Code Section 36937 requires an ordinance to take effect 30 days after its passage; and

**WHEREAS**, This ordinance shall be enforced 90 days after the effective date to allow City staff adequate time to educate themselves and the public on this ordinance and its impacts to projects; and

**WHEREAS**, the requirements specified in this Ordinance were reviewed via public comment and through a publicly noticed public hearing process.

**NOW THEREFORE, THE CITY COUNCIL OF THE CITY OF OJAI, CALIFORNIA, DOES HEREBY ORDAIN, AS FOLLOWS:**

**SECTION 1. Recitals.** The above set forth recitals and findings are true and correct and incorporated herein by reference, as if set forth in full.

**SECTION 2. Findings.**

1. 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 the City, and the City Council adopts the following findings in support of local necessity for the changes or modifications:

- a. Ojai is situated along a wildland-urban interface, which is an area where urban development meets undeveloped lands at risk of wildfires and where residences and other structures are adjacent to or intermixed with open space and wildland vegetation. Ojai has been identified as a Community at Risk from wildfire and is extremely vulnerable to wildfires and firestorms. Human activities releasing greenhouse gasses into the atmosphere cause increases in worldwide average temperature, drought conditions, vegetative fuel, and length of fire seasons that contribute to the likelihood and consequences of fire.
- b. Seasonal climatic conditions during the late summer and fall create numerous serious difficulties in the control and protection against fire situations in the City. The hot, dry weather in combination with the Santa Ana winds frequently results in wildfires in the vegetation-covered slopes surrounding the Ojai Valley. When a fire occurs in said areas, like the 2017 Thomas Fire that surrounded the Ojai Valley, resulted in all Ojai Valley residents being under mandatory or voluntary evacuation orders, and entered the City and damaged property, most, if not all, local fire department personnel are required to control, monitor, fight, and protect against such fire situations in an effort to protect life and preserve property and watershed land. The same conditions may result in the concurrent occurrence of one or more fires in the more populated areas of the City without adequate fire department personnel to protect against and control such a situation. Accordingly, the above-described findings support the imposition of measures to increase the efficiency of existing buildings in the City to reduce greenhouse gas emissions.
- c. The city of Ojai is at risk of/experiencing the effects of higher intensity storms, which put at risk the jurisdiction's homes, businesses, public facilities, roads, and highways.
- d. Failure to address and substantially reduce greenhouse gas emissions creates an increased risk to the health, safety, and welfare of City residents.
- e. The standards imposed by this Ordinance are necessary because of local climatic, geological, or topographical conditions evidenced above and are cost-effective, as supported by the 2024 Single Family Cost Effectiveness Report prepared by the California Energy Codes and Standards Statewide Utility Program, including the study and associated cost-effectiveness data.

2. The City Council finds that each of the changes or modifications to measures referred to therein:

- a. Are necessary to implement a local code amendment that is adopted to align with the City of Ojai's General Plan, including, without limitation, the following aspects of the City of Ojai's General Plan:
  - i. The Housing Element, which provides that the City of Ojai strives to promote energy conservation through the use of building codes.

- ii. The Air Quality Element, which sets forth the City of Ojai's adopted greenhouse gas emissions reduction strategy including, without limitation, the City of Ojai's goals to limit greenhouse gas emissions through the reduction of energy consumption, promotion of energy efficiency programs, and implementation of planning and building regulations that take advantage of solar heating and natural cooling and require weatherization.
- b. Permit mixed-fuel residential construction consistent with federal law, including, without limitation, the Energy Policy and Conservation Act ("EPCA").
- c. Incentivize all-electric construction as part of an adopted greenhouse gas emissions reduction strategy.

**SECTION 3. Code Amendment.** Section 9-1.1001 of the Ojai Municipal Code is hereby amended and restated to read as follows:

**Section 9-1.1001 -Adoption.**

The City hereby adopts the "2022 California Energy Code" except as otherwise provided herein, or as later amended in Section 9-1.701 shall be as published in the California Energy Code, 2022 Edition, and as copyrighted by the California Building Standards Commission, California Code of Regulations, Title 24, Part 6, including all of its tables, indices, appendices, addenda and footnotes. Said California Energy Code is hereby referred to and by such reference is incorporated herein as if fully set forth.

**SECTION 3. Code Amendment.** Section 9-1.701(g) of the Ojai Municipal Code is hereby added to read as follows:

*(g) Energy Efficiency Code.*

It is the purpose and intent of this section to establish standards for residential retrofits including major additions and alterations that exceed minimum 2022 California Code of Regulations Title 24 Part 6 requirements. In furtherance of this purpose, these changes shall be made to the 2022 California Energy Code and shall apply to building permit applications submitted to the City of Ojai on or after January 31, 2026:

- (1) Add the following definitions to Subchapter 1, Section 100.1(b):

**MAJOR ADDITION** is any change to an existing building that increases conditioned floor area by 300 or more square feet in a one-year period.

**MAJOR ALTERATION** is any construction or renovation to an existing structure other than a repair whose altered components cover 300 or more square feet in a one-year period. A project that consists only of roof and/or window replacement is not considered a major alteration.

(2) Amend Section 150.0 SINGLE-FAMILY RESIDENTIAL BUILDINGS – MANDATORY FEATURES AND DEVICES to read as follows:

Single-family residential buildings shall comply with the applicable requirements of Sections 150.0(a) through 150.0(w).

(3) Add new Section 150(w) to read as follows:

**(w) Mandatory Requirements for Existing Building Additions and Alterations.** Existing Building Additions and Alterations shall meet the requirements of Items 1 through 3 below, as applicable:

1. **Major addition.** Any Major Addition shall install a set of measures from the Measure Menu Table, Table 150.0-I to achieve a total score that is equal to or greater than 8. Any Major Addition 1,000 square feet or greater must achieve a total score that is equal to or greater than 19. In addition, all mandatory measures listed in Table 150.0-I shall be installed. Measure verification shall be explicitly included as an addendum to the Title 24 Part 6 Certificate of Compliance to be filed pursuant to 2022 Title 24 Section 10-103. Installed measures shall meet the specifications in Table 150.0-J.
2. **Major alteration.** Any Major Alteration shall install a set of measures from the Measure Menu Table, Table 150.0-I to achieve a total score that is equal to or greater than 8. Any Major Alteration 1,000 square feet or greater must achieve a total score that is equal to or greater than 19. In addition, all mandatory measures listed in Table 150.0-I shall be installed. Measure verification shall be explicitly included as an addendum to the Certificate of Compliance to be filed pursuant to 2022 Title 24 Section 10-103. Installed measures shall meet the specifications in Table 150.0-J.
3. **Combination alterations and additions.** Any project that includes an addition and alteration whose altered components cover equal to or greater than 300 square feet shall install a set of measures from the Measure Menu Table, Table 150.0-I to achieve a total score that is equal to or greater than 8. Any project that includes an addition and alteration whose altered components cover equal to or greater than 1,000 square feet shall achieve a total score that is equal to or greater than 19. In addition, all mandatory measures listed in Table 150.0-I shall be installed. Measure verification shall be explicitly included as an addendum to the Certificate of Compliance to be filed pursuant to 2022 Title 24 Section 10-103. Installed measures shall meet the specifications in Table 150.0-J.

**Exception 1 to Section 150.0(w):** The project is the result of a repair as defined by Title 24 Part 2 Section 202.

**Exception 2 to Section 150.0(w):** If compliance costs exceed 20% of total project valuation or due to conditions specific to the project, it is technically infeasible to achieve compliance through any available set of measures, the applicant may request an exemption as set forth below. In applying for an exemption, the burden is on the applicant to show hardship or infeasibility.

- (1) Application. Based on the following, the applicant shall identify in writing the specific requirements of the standards for compliance that the project is unable to achieve and the circumstances that make it a hardship or infeasible for the project to comply with this chapter. The applicant may not petition for relief from any requirement of the 2022 California Energy Code (Title 24, Part 6) and referenced standards, or the 2022 California Green Building Standards (Title 24, Part 11) of the California Building Standards Code. Circumstances that constitute hardship or infeasibility shall include one of the following:
  - i. That the cost of achieving compliance is disproportionate to the overall cost of the project;
  - ii. That it is technically infeasible to achieve compliance through all packages due to conditions specific to the project; That strict compliance with these standards would create or maintain a hazardous condition(s) and present a life safety risk to the occupants.
- (2) Granting of exemption. If the chief building official, in consultation with the Director of Community Development, determines that it is a hardship or infeasible for the applicant to fully meet the requirements of this chapter and that granting the requested exemption will not cause the building to fail to comply with the 2022 California Energy Code (Title 24, Part 6) and referenced standards, or the 2022 California Green Building Standards (Title 24, Part 11) of the California Building Standards Code, the chief building official, in consultation with the Director of Community Development, shall determine the minimum feasible threshold of compliance reasonably achievable for the project. If an exemption is granted, the applicant shall be required to comply with this chapter in all other respects and shall be required to achieve the threshold of compliance determined to be achievable by the chief building official, in consultation with the Director of Community Development.
- (3) Denial of exemption. If the chief building official, in consultation with the Director of Community Development, determines that it is reasonably possible for the applicant to fully meet the requirements of this chapter, the request shall be denied, and the applicant shall be notified of the decision in writing. The project and compliance documentation shall be modified to comply with the standards for compliance.
- (4) Appeal. Any aggrieved applicant or person may appeal, at no fee, the determination of the chief building official, in consultation with the Director of

Community Development, regarding the granting or denial of an exemption or compliance with any other provision of this chapter. An appeal of a determination of the chief building official shall be filed in writing with the Building Appeals Board.

**Exception 3 to Section 150.0(w):** If the dwelling unit has previously installed measures from the Measure Menu, Table 150.0-I, and compliance can be demonstrated to the chief building official, in consultation with the Director of Community Development, then these measures shall not be required to be newly installed, and appropriate credit shall be included in the applicable compliance calculations.

**Exception 4 to Section 150.0(w):** The applicant for alterations or additions to a City landmark or contributing structure to a City-designated historic district may request an exemption to any requirements of this chapter which would impair the any City landmark or contributing structure to a City-designated historic district shall be exempt from the requirements of this section/chapter if the energy efficiency improvements would impair any character-defining element of the landmark or historic district, as determined by the Director of Community Development and as regulated by the California Historic Building Code (Title 24, Part 8). In making a determination of exemption, the Director of Community Development, or their designee, may require the submittal of an evaluation by an architectural historian or similar expert.

**Exception 5 to Section 150.0(w):** An alteration that consists solely of seismic and fire hardening improvements.

**Exception 6 to Section 150.0(w):** Buildings which are temporary (such as construction trailers).

**Exception 7 to Section 150.0(w):** An alteration that consists solely of roof and/or window projects.

**Exception 8 to Section 150.0(w):** Mobile Homes, Manufactured Housing, or Factory-built Housing as defined in Division 13 of the California Health and Safety 12 Code (commencing with Section 17000 of the Health and Safety Code).

**Exception 9 to Section 150.0(w):** Properties located outside of climate zone 9.

**Exception 10 to Section 150.0(w):** Any accessory dwelling unit or junior accessory dwelling unit allowed per state law, and/or tiny house permitted per Section 10-2.1712 of this Code.

**Exception 11 to Section 150.0(w):** Where the project includes an accessory dwelling unit or junior accessory dwelling unit that is attached to the primary dwelling unit, either as a new addition or converted from within the space of the primary dwelling unit, and there is not an additional combination alteration/addition to the primary dwelling unit of at least 300 square feet, then the primary dwelling unit is exempt from the requirements.

**Exception 12 to Section 150.0(w):** Nothing in this ordinance shall be construed so as to prohibit any one appliance covered by the Energy Policy and Conservation Act (EPCA) (42 U.S.C. § 6292). Should an applicant establish that this ordinance, as applied, prohibits a covered appliance in applicant's project, the chief building official, in consultation with the Director of Community Development, shall waive that portion of the ordinance causing such prohibition.

**Exception 13 to Section 150.0(w):** If the applicant demonstrates, using Commission-certified compliance software as specified by Section 10-109(c) and Section 10-116, that the Energy Budget of the Proposed Building Design would be less than or equal to the Energy Budget of the building under the project if it included any set of measures that would achieve compliance under this Section 150.0(w).

**Exception 14 to Section 150.0(w):** Single-family homes built after December 31, 1991.

(4) Add new Section 150(x) to read as follows:

**150.0(x) Electric vehicle (EV) Charging for additions and alterations.** Parking additions or electrical panel upgrades must have reserved breaker spaces and electrical capacity to accommodate one Level 2 EV Charging Receptacle in one parking space as defined in the California Green Building Standards Code Section 202. If a second parking space is provided, it shall be provided with a Level 1 EV Charging Receptacle as defined in the California Green Building Standards Code Section 202.

**Exception to 150.0(x):** Accessory Dwelling Units (ADU) and Junior Accessory Dwelling Units (JADU) without additional parking facilities and without electrical panel upgrade or new panel installation. Detached ADUs, attached ADUs, and JADUs without additional parking but with electrical panel upgrades or new panels must have reserved breakers and electrical capacity according to the requirements of Section 4.106.4.1 in the California Green Building Standards Code.

(5) Add new Table 150.0-I to read as follows:

**Table 150.0-I: Measure Menu**

Climate Zone 9				
Measures		Table 150.0-J	ID	Points
Water Heating Package		E1		1
Induction Cooktop		E2		1
Heat Pump Clothes Dryer		E3		1
Air Sealing		E4		1
Duct Sealing		E5		3

R-49 Attic Insulation	E6	5
Windows	E7	5
R-13 Wall Insulation	E8	3
New Ducts + Duct Sealing	E9	6
R-19 Floor Insulation	E10	1
R-30 Floor Insulation	E11	2
Heat Pump Water Heater (HPWH)	E12	12
Solar PV + Electric Ready Pre-Wire	E13	17
Heat Pump Space Heater	E14	7
Utility Room, Kitchen & Laundry-Related Electric Ready Pre-Wire	M1	Mandatory
Panel-Related Electric Ready Pre-Wire	M2	Mandatory
Lighting Measures	M3	Mandatory

Note 1: the measures in the Measure Menu table shall conform to the specifications in Table 150.0-J

Note 2:  in addition to energy efficiency, these strategies provide direct fire hardening benefits

(6) Add new Table 150.0-J to read as follows:

**Table 150.0-J: Measure Specifications**

ID	Measure Specification	
<b>General Measures</b>		
E1	<p><b>Water Heating Package:</b> Add exterior insulation meeting a minimum of R-6 to existing storage water heaters. Insulate all accessible hot water pipes with pipe insulation a minimum of <math>\frac{3}{4}</math> inch thick. This includes insulating the supply pipe leaving the water heater, piping to faucets underneath sinks, and accessible pipes in attic spaces or crawlspaces. Upgrade fittings in sinks and showers to meet current California Green Building Standards Code (Title 24, Part 11) Section 4.303 water efficiency requirements.</p> <p>Water heaters 20 gallons or less, or water heaters that are not able to add exterior insulation may not take credit for this measure.</p> <p>Exception 1: Water heater blanket is not required on water heaters less than 20 gallons.</p> <p>Exception 2: Water heater blanket not required if application of a water heater blanket voids the warranty on the water heater.</p> <p>Exception 3: Upgraded fixtures are not required if existing fixtures have rated or measured flow rates of no more than ten percent greater than 2022 California Green Building Standards Code (Title 24, Part 11) Section 4.303 water efficiency requirements.</p> <p>Exception 4: Water heaters with factory installed insulation of R-24 or greater</p>	
E2	<b>Induction Cooktop:</b> Replace existing gas and electric resistance stove top with inductive stove top and cap the gas line.	
E3	<b>Heat Pump Clothes Dryer:</b> Replace all existing gas and electric clothes dryers with heat pump clothes dryers.	
E4	<p><b>Air Sealing:</b> Seal all accessible cracks, holes, and gaps in the building envelope at walls, floors, and ceilings. Pay special attention to penetrations including plumbing, electrical, and mechanical vents, recessed can light luminaires, and windows. Weather-strip doors if not already present. Verification shall be conducted by a certified HERS Rater that either: a) shows at least a 30 percent reduction from pre-retrofit conditions; or b) shows that the number of air changes per hour at 50 Pascals pressure difference (ACH50) does not exceed ten for Pre-1978 vintage buildings, seven for 1978 to 1991 vintage buildings and five for 1992-2010 vintage buildings. Compliance can also be demonstrated with blower door testing conducted by a certified HERS Rater no more than three years prior to the permit application date showing compliance with condition (a) or (b).</p> <p>If combustion appliances are located within the pressure boundary of the building, conduct a combustion safety test by a professional certified by the Building Performance Institute in accordance with the ANSI/BPI-1200-S-2017 Standard</p>	

<p>Practice for Basic Analysis of Buildings, the Whole House Combustion Appliance Safety Test Procedure for the Comfortable Home Rebates Program 2020 or the California Community Services and Development Combustion Appliance Safety Testing Protocol.</p> <p>Reducing the air leakage of a building can reduce the building's drying potential. When improving the air sealing of a building, consider if there is a need to add continuous ventilation to the building (if not already present).</p>	<p><b>E5 Duct Sealing:</b> Air seal all space conditioning ductwork to meet the requirements of the 2022 Title 24 Section 150.2(b)1E. The duct system must be tested by a HERS Rater no more than three years prior to the alteration or addition permit application date to verify the duct sealing and confirm that the requirements have been met. This measure may not be combined with the New Ducts and Duct Sealing measure in this Table. Buildings without ductwork or where the ducts are in conditioned space may not take credit for this measure.</p>	<p><b>E6 R-49 Attic Insulation:</b> Attic insulation shall be installed to achieve a weighted assembly U-factor of 0.020 or insulation installed at the ceiling level shall have a thermal resistance of R-49 or greater for the insulation alone. Recessed downlight luminaires in the ceiling shall be covered with insulation to the same depth as the rest of the ceiling. Luminaires not rated for insulation contact must be replaced or fitted with a fire-proof cover that allows for insulation to be installed directly over the cover.</p> <p>Exception: In buildings where existing R-30 is present and existing recessed downlight luminaires are not rated for insulation contact, insulation is not required to be installed over the luminaires.</p>	<p><b>E7 Windows:</b> Replace at least 50% of existing windows with high performance windows with an area-weighted average U-factor no greater than 0.30.</p>	<p><b>E8 R-13 Wall Insulation:</b> Install wall insulation in all exterior walls to achieve a weighted U-factor of 0.102 or install wall insulation in all exterior wall cavities that shall result in an installed thermal resistance of R-13 or greater for the insulation alone.</p>	<p><b>E9 New Ducts + Duct Sealing:</b> Replace existing space conditioning ductwork with new R-8 ducts that meet the requirements of 2022 Title 24 Section 150.0(m)11. This measure may not be combined with the Duct Sealing measure in this Table. To qualify, a preexisting measure must have been installed no more than three years before the alteration or addition permit application date.</p>	<p><b>E10 R-19 Floor Insulation:</b> Raised-floors shall be insulated such that the floor assembly has an assembly U-factor equal to or less than U-0.037, or shall be insulated between wood framing with insulation having an R-value equal to or greater than R-19. This measure cannot be combined with measure R-30 Floor insulation.</p>
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E11	<b>R-30 Floor Insulation:</b> Raised-floors shall be insulated such that the floor assembly has an assembly U-factor equal to or less than U-0.028, or shall be insulated between wood framing with insulation having an R-value equal to or greater than R-30. This measure cannot be combined with measure R-19 Floor insulation.
E12	<b>Heat Pump Water Heater (HPWH):</b> Replace existing electric resistance or natural gas storage water heater with a heat pump water heater.
E13	<b>PV and Electric Ready Pre-Wire:</b> Install a solar PV system that meets the requirements of 2022 Title 24 Section 150.1(c)14. In addition to the solar PV system, comply with the electric readiness components per Section 150.0(n)1 and 150.0(t) and one of: <ul style="list-style-type: none"> <li>A. Energy Storage Systems (ESS) Ready, as specified in Section 150.0(s), or</li> <li>B. EV Charger Ready as specified in the California Green Building Code, Title 24, Part 11, Section A4.106.8.1, which otherwise applies to new construction.</li> </ul> Exception 1: In buildings where the designated space requirement specified in Section 150.0(n)1 can be demonstrated to the chief building official, in consultation with the Director of Community Development, as infeasible, the electric readiness components per Section 150.0(n)1 are not required.
E14	<b>Heat Pump Space Heater:</b> Replace all existing gas and electric resistance space heating systems with a heat pump system.
<b>Mandatory Measures</b>	
M1	<b>Utility Room, Kitchen &amp; Laundry-Related Electric Ready Pre-Wire:</b> If the project includes a kitchen remodel, comply with the Electric Cooktop Ready requirement, as specified in Section 150.0(u). If the project includes a laundry room remodel, comply with the Electric Clothes Dryer Ready requirement, as specified in Section 150.0(v). If the project includes a utility room remodel, comply with the electric readiness components per Section 150.0(n)1 and 150.0(t): <ul style="list-style-type: none"> <li>Exception 1: If an electrical permit is not otherwise required for the project other than compliance with this measure.</li> <li>Exception 2: If a utility service upgrade is not otherwise required for the project other than compliance with this measure.</li> <li>Exception 3: In buildings where the designated space requirement specified in Section 150.0(n)1 can be demonstrated to the chief building official, in consultation with the Director of Community Development, as infeasible, the electric readiness components per Section 150.0(n)1 are not required.</li> </ul> <b>Panel-Related Electric Ready Pre-Wire:</b> If the project includes a new electrical panel and electrical service upgrade to 200A or more, comply with the Water Heating Ready requirements, as specified in Section 150.0(n)1 and the Space Heating Ready Requirement 150.0(t).

	Exception 1: In buildings where the designated space requirement specified in Section 150.0(n)1 can be demonstrated to the chief building official, in consultation with the Director of Community Development, as infeasible, the electric readiness components per Section 150.0(n)1 are not required.
M3	Lighting Measures – Install lighting with an efficiency of 45 lumens per watt or greater in all interior and exterior screw-in fixtures. Install photocell, occupancy sensor or energy management system controls that meet the requirements of 150.0(k)3 in all outdoor lighting permanently mounted to a residential building or to other buildings on the same lot.

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(7) Modify Section 150.2(a) ENERGY EFFICIENCY STANDARDS FOR ADDITIONS AND ALTERATIONS TO EXISTING SINGLE FAMILY RESIDENTIAL BUILDINGS to read as follows:

**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.

(8) Modify Section 150.2(b) ENERGY EFFICIENCY STANDARDS FOR ADDITIONS AND ALTERATIONS TO EXISTING SINGLE FAMILY RESIDENTIAL BUILDINGS to read as follows:

**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 either Item 1 or 2 below.

1. Prescriptive approach. The altered component and any newly installed equipment serving the alteration shall meet the applicable requirements of Sections 110.0 through 110.9 and all applicable requirements of Sections 150.0(a) through (l), 150.0(m)1 through 150.0 (m)10, 150.0(p) through (q), and 150.0 (w); and

- i. Performance approach. 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 Sections 110.0 through 110.9, Sections 150.0(a) through (l), Sections 150.0(m)1 through 150.0 (m)10, Sections 150.0(p) through (q), and Section 150.0(w). 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.

**SECTION 4. Severability.** If any section, subsection, sentence, clause, phrase or portion of this Ordinance is for any reason held to be invalid or unconstitutional by the final decision of any court of competent jurisdiction, such decision shall not affect the validity of the remaining portions of this Ordinance. The City Council declares that it would have adopted this Ordinance, and each section, subsection, sentence, clause, phrase or portion thereof, irrespective of the fact that any one or more sections, subsections, phrases or portions might be declared invalid or unconstitutional.

**SECTION 5. Environmental Determination.** This ordinance is categorically exempt from CEQA because it is an action taken by a regulatory agency for the purpose of protecting the environment (CEQA Guidelines Section 15308). In addition, this ordinance is exempt from CEQA under the general rule, 15061(b)(3), on the grounds that these standards are more stringent than the

City of Ojai  
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State energy standards, there are no reasonably foreseeable adverse impacts, and there is no possibility that the activity in question may have a significant effect on the environment. The following findings are made in support of these determinations:

1. The purpose of the implementation of a Reach Code is to reduce the amount of greenhouse gas emissions in the City that are produced from buildings.
2. The Reach Code approval process requires that the City determines that the local standards will require buildings to use no more energy than current statewide requirements. Furthermore, the California Energy Commission approval process requires that the City make the findings as part of its approval process. Therefore, the Reach Code standards can only go into effect if they protect the environment by making buildings more efficient.
3. The City recognizes that this ordinance shall not be enforced unless and until approved by the California Energy Commission.

**SECTION 8. Effective Date.** This Ordinance shall take effect 30 days after its passage.

**SECTION 9. Certification.** The City Clerk shall cause this Ordinance to be published as required by law, and shall cause a copy of this Ordinance and its certification, together with proof of publication, to be entered in the Book of Ordinances of the City.

**PASSED, APPROVED and ADOPTED** this 26 day of August, 2025 by the following vote:

AYES: **Gilman, Lang, Whitman, Lang**

NOES:

ABSENT:

ABSTAIN: **Rule**

CITY OF OJAI, CALIFORNIA

Andy Gilman, Mayor

8/26/25

Date

ATTEST:

Weston Montgomery, Chief Deputy City Clerk

APPROVED AS TO FORM:

Matthew Summers, City Attorney



City of Ojai  
Ordinance No. 24-

I, Weston Montgomery, Chief Deputy City Clerk of the City of Ojai do hereby certify that the foregoing Ordinance was introduced at a regular meeting of the City Council of the City of Ojai held on August 12, 2025 and adopted at a regular meeting held on 08-26-25 by the following vote:

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the official seal of the City of Ojai on this 26 day of August, 2025.



Weston Montgomery, Chief Deputy City Clerk



## Cost-Effectiveness Evidence

# City of Ojai

## Ojai



Generated September 02, 2025 by the Cost-Effectiveness Explorer  
<https://explorer.localenergycodes.com/policies/4975/documents>



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Attachment 3

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## Single Family Built before 1978 in Climate Zone 9

 Study Source: Existing Single Family Building Upgrades (2025)<sup>1</sup> | Release Date: August 15, 2025 | Newest Version | Code Cycle: 2022

### Maximum Cost-Effective Target Score Calculation

Cost-Effective Measures and Packages	Energy Savings site MMBtu/year	Flexible Score
Solar PV	17.25	17
New Ducts, R-8 Insulation + Duct Sealing	6.71	7
R-49 Attic Insulation	5.10	5
Windows (0.27 U-factor, 0.23 SHGC)	4.56	5
R-15 Wall Insulation	3.24	3
Water Heating Package	1.67	2
Exterior Lighting Controls/Photosensor+LED	0.05	--
<b>Maximum using available flexible measures (On-Bill (2022))</b>	<b>38.58</b>	<b>39</b>

The maximum cost-effective score is the highest flexible score that can be met cost-effectively, based on the energy savings of measures for your policy. Any required flexible score that falls below or is equal to this maximum score has a cost-effective pathway available to permit applicants.

## Single Family Built from 1978 to 1991 in Climate Zone 9

Study Source: Existing Single Family Building Upgrades (2025)<sup>1</sup> | Release Date: August 15, 2025 | Newest Version | Code Cycle: 2022

### Maximum Cost-Effective Target Score Calculation

Cost-Effective Measures and Packages	Energy Savings site MMBtu/year	Flexible Score
Solar PV	17.25	17
New Ducts, R-8 Insulation + Duct Sealing	4.71	5
R-49 Attic Insulation	2.32	2
Water Heating Package	1.67	2
Exterior Lighting Controls/Photosensor+LED	0.05	--
<b>Maximum using available flexible measures (On-Bill (2022))</b>	<b>26.00</b>	<b>26</b>

The maximum cost-effective score is the highest flexible score that can be met cost-effectively, based on the energy savings of measures for your policy. Any required flexible score that falls below or is equal to this maximum score has a cost-effective pathway available to permit applicants.

## Sources

- 1 Existing Single Family Building Upgrades (August 15, 2025)



Generated September 02, 2025 by the Cost-Effectiveness Explorer  
<https://explorer.localenergycodes.com/policies/4975/documents>



A STATEWIDE UTILITY PROGRAM

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Attachment 3

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

**Prepared by:**  
Frontier Energy, Inc  
Misti Bruceri & Associates, LLC

**Prepared for:**  
Kelly Cunningham, Codes and Standards Program, Pacific Gas and Electric

**Revision: 1.0**  
Last modified: 2025/08/15

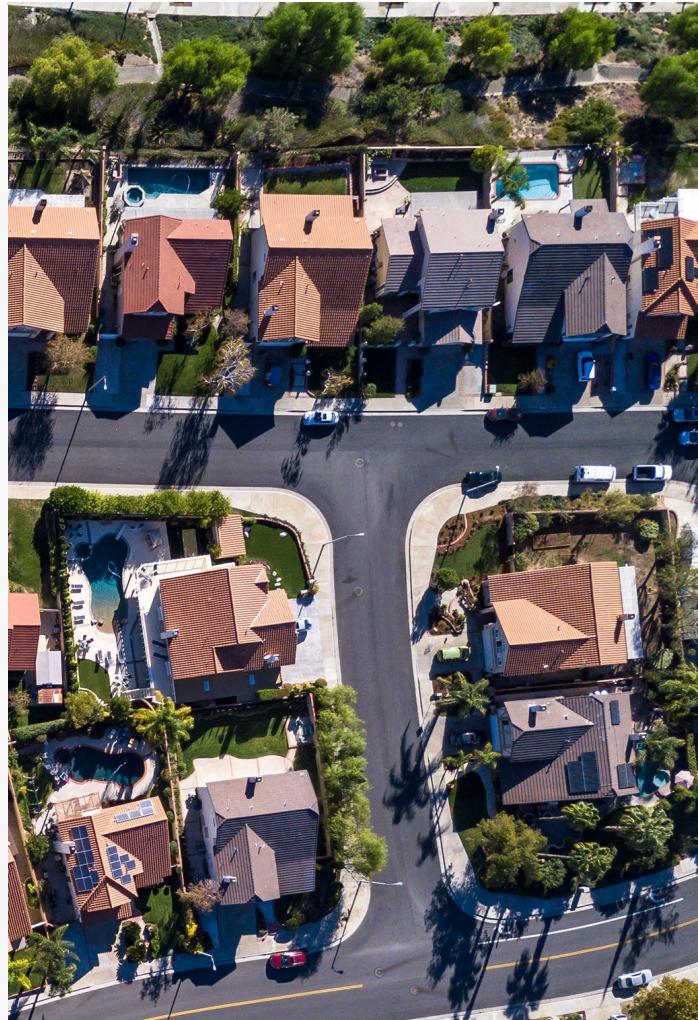


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**Table 1 Summary of Revisions**

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

## Acronym List

B/C – Lifecycle Benefit-to-Cost Ratio

CASE – Codes and Standards Enhancement

CFL – Compact Fluorescent Lamps

CPAU – City of Palo Alto Utilities

CPUC – California Public Utilities Commission

CZ – California Climate Zone

kWh – Kilowatt Hour

NPV – Net Present Value

PG&E – Pacific Gas and Electric Company

PV – Photovoltaic

SCE – Southern California Edison

SDG&E – San Diego Gas and Electric

SMUD – Sacramento Municipal Utility District

SoCalGas – Southern California Gas Company

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

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# 1 Summary

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

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

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

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

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

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

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

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

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

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

The 2022 report, model ordinance language and other resources are posted on the C&S Reach Codes Program website at [LocalEnergyCodes.com](#). Local jurisdictions that are considering adopting an ordinance may contact the program for further technical support at [info@localenergycodes.com](mailto:info@localenergycodes.com).

## 2 Air Sealing at the Ceiling

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## 3 Lighting Measures

LED lighting and exterior lighting control measures were previously evaluated in the [2019 Cost-Effectiveness Study: Existing Single Family Residential Building Upgrades](#) study.

These measures are not included in the [2022 Cost-Effectiveness Study: Existing Single Family Building Upgrades](#) study, but have been re-evaluated and included in this memo.

The updated analysis follows the same methodology as the 2019 study, but with updated costs for equipment and updated utility rates.

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

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

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

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

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

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

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

**Table 9. [All Vintages] Exterior Photosensor**

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

**Table 10. [All Vintages] LED and Photosensor**

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

## 4 Water Heating Package

This package includes the following:

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

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

**Table 11. [All Vintages] Water Heating Package**

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

## 5 PV

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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# 2022 Cost-Effectiveness Study: Existing Single Family Building Upgrades

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## Acronym List

2023 PV\$ – Present value costs in 2023

ACH50 – Air Changes per Hour at 50 pascals pressure differential

ACM – Alternative Calculation Method

ADU – Accessory Dwelling Unit

AFUE – Annual Fuel Utilization Efficiency

B/C – Lifecycle Benefit-to-Cost Ratio

BEnvOpt – Building Energy Optimization Tool

BSC – Building Standards Commission

CA IOUs – California Investor-Owned Utilities

CASE – Codes and Standards Enhancement

CBECC-Res – Computer program developed by the California Energy Commission for use in demonstrating compliance with the California Residential Building Energy Efficiency Standards

CEER – Combined Energy Efficiency Rating

CFI – California Flexible Installation

CFM – Cubic Feet per Minute

CO<sub>2</sub> – Carbon Dioxide

CPAU – City of Palo Alto Utilities

CPUC – California Public Utilities Commission

CZ – California Climate Zone

DFHP – Dual Fuel Heat Pump

DHW – Domestic Hot Water

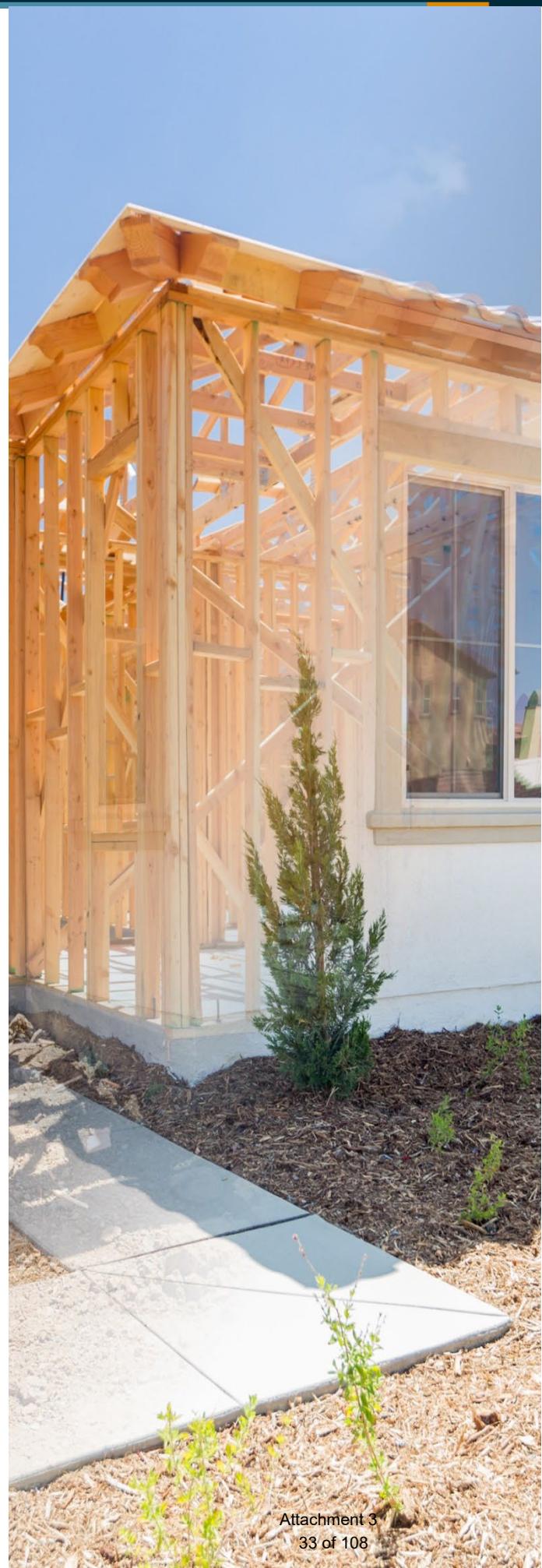
DOE – Department of Energy

DWHR – Drain Water Heat Recovery

EDR – Energy Design Rating

EER – Energy Efficiency Ratio

EF – Energy Factor



GHG – Greenhouse Gas  
HERS Rater – Home Energy Rating System Rater  
HPA – High Performance Attic  
HPSH – Heat Pump Space Heater  
HPWH – Heat Pump Water Heater  
HSPF – Heating Seasonal Performance Factor  
HVAC – Heating, Ventilation, and Air Conditioning  
IECC – International Energy Conservation Code  
IOU – Investor Owned Utility  
kBtu – British thermal unit (x1000)  
kWh – Kilowatt Hour  
LBNL – *Lawrence Berkeley National Laboratory*  
LCC – Life Cycle Cost  
LLAHU – Low Leakage Air Handler Unit  
VLLDCS – Verified Low Leakage Ducts in Conditioned Space  
LSC – Long-term Systemwide Cost  
MF – Multifamily  
MSHP – Mini-Split Heat Pump  
NEEA – Northwest Energy Efficiency Alliance  
NEM – Net Energy Metering  
NPV – Net Present Value  
NREL – *National Renewable Energy Laboratory*  
PG&E – Pacific Gas and Electric Company  
POU – Publicly-Owned-Utilities  
PV – Photovoltaic  
SCE – Southern California Edison  
SDG&E – San Diego Gas and Electric  
SEER – Seasonal Energy Efficiency Ratio  
SF – Single Family  
SMUD – Sacramento Municipal Utility District  
SoCalGas – Southern California Gas Company  
TDV – Time Dependent Valuation  
Therm – Unit for quantity of heat that equals 100,000 British thermal units  
Title 24 – Title 24, Part 6  
TOU – Time-Of-Use  
UEF – Uniform Energy Factor  
VCHP – Variable Capacity Heat Pump, Title 24 compliance credit  
ZNE – Zero-net Energy

**Summary of Revisions**

<b>Date</b>	<b>Description</b>	<b>Reference (page or section)</b>
4/25/2024	Original Release	N/A

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## Executive Summary

The California Codes and Standards (C&S) Reach Codes program provides technical support to local governments considering adopting a local ordinance (reach code) intended to support meeting local and/or statewide energy efficiency and greenhouse gas (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.

This report documents cost-effective measure upgrades in existing single family buildings that exceed the minimum state requirements. It evaluates efficiency measures such as adding insulation, replacing windows, and duct upgrades, fuel substitution measures that upgrade space heating and water heating to heat pumps, and solar photovoltaics (PV) across all 16 California climate zones. A 1,665 square foot single family home prototype with an attached garage was evaluated in this study.

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 over a 30-year analysis period. On-Bill cost-effectiveness is a customer-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. Long-term Systemwide Cost (LSC) is the California Energy Commission's LCC methodology for the 2025 Title 24, Part 6 (Title 24) code cycle (previously referred to as Time Dependent Valuation (TDV)), which 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. This is the methodology used by the Energy Commission in evaluating cost-effectiveness for efficiency measures in Title 24 code development.

The following summarizes key results from the study:

### Conclusions and Discussion:

1. Envelope measures. Improving envelope performance is very cost-effective in many older homes. In addition to reducing utility costs, these measures provide many other benefits such as improving occupant comfort and satisfaction and increasing a home's ability to maintain temperatures during extreme weather events and power outages. Below is a discussion of the results of specific measures.
  - a. Adding attic insulation is cost-effective based on both LSC and On-Bill in many climate zones in homes with no more than R-19 existing attic insulation levels. Increasing attic insulation from R-30 to R-49 was still found to be cost-effective based on at least one metric in the colder and hotter climates of Climate Zone 10 (SDG&E territory only) through 16.
  - b. Insulating existing uninsulated walls is very cost-effective based on both metrics everywhere except Climate Zones 6 and 7 (in Climate Zone 8 it's only cost-effective based on LSC).
  - c. Adding R-19 or R-30 floor insulation is cost-effective based on LSC in the older two vintages (Pre-1978 and 1978-1991) in all CZ except CZ 6-10.
  - d. Replacing old single pane windows with new high-performance windows has a very high cost and is typically not done for energy savings alone. However, energy savings are substantial and justify cost-effectiveness of this measure based on at least one metric in Climate Zones 4, 8 through 12 (PG&E territory only), and 13 through 16.
  - e. At time of roof replacement, a cool roof with an aged solar reflectance of 0.25 was found to be cost-effective in Climate Zones 4, 6 through 12 (PG&E territory only), and 13 through 15. When the roof deck is replaced during a roof replacement, adding a radiant barrier is low cost and provides substantial cooling energy savings, and was found to be cost-effective in almost all climate zones and homes.
2. Duct measures: Many older homes have old, leaky duct systems that should be replaced when they reach the end of life, typically 20-30 years. In this case, installing new ducts was found to be cost-effective based on at least one metric (both in most cases) everywhere except mild Climate Zone 7 and Climate Zones 5 and 6 in

the 1978-1991 vintage. If duct systems still have remaining life they should be sealed and tested to meet 10% leakage or lower; however, duct upgrades alone were only found to be cost-effective for newer homes in Climate Zones 10 (SDG&E territory only), 11, and 13 through 16. Duct upgrades may be able to be coupled with other measures to reduce the cost.

3. Heat pump space heating: HPSHs were found to be LSC cost-effective in many cases. The Dual Fuel Heat Pump (existing furnace) was LSC cost-effective everywhere except Climate Zone 15. The HPSH was LSC cost-effective everywhere except Climate Zones 8 and 15.
  - a. Challenges to On-Bill cost-effectiveness include higher first costs and higher first-year utility costs due to higher electricity tariffs relative to gas tariffs. SMUD and CPAU are two exceptions where first year utility costs are lower for heat pumps than for gas equipment. Table 11 shows the impact of utility rates on cost-effectiveness of HPSH where the standard and high efficiency HPSH and the HPSH + PV measures are cost-effective under SMUD but not PG&E. Even with higher first year utility bills, there were some cases that still proved On-Bill cost-effective including the DFHP with an existing furnace in the central valley and northern coastal PG&E territories, the ducted MSHP in the central valley as well as Climate Zone 14 in SDG&E territory, and the HPSH + PV measure in CZ 3-5 (PGE), 7-11, and 12 (SMUD) – 15.
  - b. The ductless MSHPs were only found to be cost-effective based on either metric in Climate Zones 1 and 16. Ductless MSHPs have a high incremental cost because it is a more sophisticated system than the base model of a wall furnace with a window AC unit. However, the ductless MSHP would provide greater comfort benefits if properly installed to directly condition all habitable spaces (as is required under the VCHP compliance credit as evaluated in this study) which may be an incentive for a homeowner to upgrade their system.
  - c. Higher efficiency equipment lowered utility costs in all cases and improved cost-effectiveness in many cases, particularly with a ducted MSHP.
4. Heat pump water heating: All the HPWH measures were LSC cost-effective in all climate zones. Most measures were not On-Bill cost-effective with the exception of the HPWH + PV which was cost-effective On-Bill in CPAU, SMUD, and SDG&E territories in addition to Climate Zones 11, 13, 14, and 15. The HPWH measures share many of the same challenges as the HPSH measures to achieving cost-effectiveness including high first costs and utility rates and assumptions. Table 13 shows the impact of utility rates on cost-effectiveness where some HPWH measures are cost-effective under SMUD utility rates but are not cost-effective anywhere under PG&E rates in Climate Zone 12.
  - a. Various HPWH locations were also explored, however there are some factors outside of cost-effectiveness that should also be considered.
    - i. HPWHs in the conditioned space can provide benefits such as free-cooling during the summer, reduced tank losses, and shorter pipe lengths, and in some cases show improved cost-effectiveness over garage located HPWHs. However, there are various design considerations such as noise, comfort concerns, an additional heating load in the winter, and condensate removal. Ducting the inlet and exhaust air resolves comfort concerns but adds costs and complexity. Split heat pump water heaters address these concerns, but currently there are limited products on the market and there is a cost premium relative to the packaged products.
    - ii. Since HPWHs extract heat from the air and transfer it to water in the storage tank, they must have adequate ventilation to operate properly. Otherwise, the space cools down over time, impacting the HPWH operating efficiency. This is not a problem with garage installations but needs to be considered for water heaters located in interior or exterior closets. For the 2025 Title 24 code the CEC is proposing that all HPWH installations meet mandatory ventilation requirements (California Energy Commission, 2023).
5. The contractor surveys revealed overall higher heat pump costs than what has been found in previous analyses. This could be due to incentive availability raising demand for heat pumps and thereby increasing the price. This price increase may be temporary and may come down once the market stabilizes. There are also

new initiatives to obtain current costs including the TECH Clean California program<sup>1</sup> that publishes heat pump data and costs; however, at the time of this analysis, the TECH data did not contain incremental costs because it only had the heat pump costs but not the gas base case costs.

6. Table 18 shows how CARE rates and escalation rate assumptions will impact cost-effectiveness.
  - a. Applying CARE rates in the IOU territories has the overall impact to increase utility cost savings for an all-electric building compared to a code compliant mixed fuel building, improving On-Bill cost-effectiveness. This is due to the CARE discount on electricity being higher than that on gas. The reverse occurs with efficiency measures where lower utility rates reduce savings and subsequently reduce cost-effectiveness.
  - b. If gas tariffs are assumed to increase substantially over time, in-line with the escalation assumption from the 2025 LSC development, cost-effectiveness substantially improves for the heat pump measures over the 30-year analysis period and many cases become cost-effective that were not found to be cost-effective under the CPUC / 2022 TDV escalation scenario. There is much uncertainty surrounding future tariff structures as well as escalation values. While it's clear that gas rates will increase, how much and how quickly is not known. Future electricity tariff structures are expected to evolve over time, and the CPUC has an active proceeding to adopt an income-graduated fixed charge that benefits low-income customers and supports electrification measures for all customers.<sup>2</sup> The CPUC will make a decision in mid-2024 and the new rates are expected to be in place later that year or in 2025. While the anticipated impact of this rate change is lower volumetric electricity rates, the rate design is not finalized. While lower volumetric electricity rates provide many benefits, it also will make building efficiency measures harder to justify as cost-effective due to lower utility bill cost savings.
7. Under NBT, utility cost savings for PV are substantially less than what they were under prior net energy metering rules (NEM 2.0); however, savings are sufficient to be On-Bill cost-effective in all climate zones except Climate Zones 1 through 3, 5, and 6.
  - a. Combining a heat pump with PV allows the additional electricity required by the heat pump to be offset by the PV system while also increasing on-site utilization of PV generation rather than exporting the electricity back to the grid at a low rate.
  - b. While not evaluated in this study, coupling PV with battery systems can be very advantageous under NBT increasing utility cost savings because of improved on-site utilization of PV generation and fewer exports to the grid.

#### Recommendations:

1. There are various approaches for jurisdictions who are interested in reach codes for existing buildings. Some potential approaches are listed below along with key considerations.
  - a. Prescriptive measures: Non-preempted measures that are found to be cost-effective may be prescriptively required in a reach code. One example of this type of ordinance is a cool roof requirement at time of roof replacement. Another example is requiring specific cost-effective measures for larger remodels, such as high-performance windows when new windows are installed or duct sealing and testing when ducts are in an unconditioned space.
  - b. Replacement equipment: This flavor of reach code sets certain requirements at time of equipment replacement. This study evaluated space heating and water heating equipment. Where a heat pump measure was found to be cost-effective based on either LSC or On-Bill, this may serve as the basis of a reach code given the following considerations.
    - i. Where reach codes reduce energy usage and are not just fuel switching, cost-effectiveness calculations are required and must be based on equipment that does not exceed the federal minimum efficiency requirements.
    - ii. Where reach codes are established using cost-effectiveness based on LSC, utility bill impacts and the owner's first cost should also be reviewed and considered.

<sup>1</sup> TECH Public Reporting Home Page ([techcleanca.com](http://techcleanca.com))

<sup>2</sup> <https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/electric-costs/demand-response-dr/demand-flexibility-rulemaking>

- iii. A gas path should also be prescriptively allowed to safely satisfy federal preemption requirements considering the CRA v. Berkeley case.<sup>3</sup> Additional requirements may apply to the gas path, as described in Section 3.3, as long as the paths are reasonably energy or cost equivalent.
- c. “Flexible Path”, minimum energy savings target: This flexible approach establishes a target for required energy savings based on a measure or a set of measures that were found to be cost-effective based on either LSC or On-Bill. A points menu compares various potential upgrades ranging from efficiency, PV, and fuel substitution measures, based on site or source energy savings. The applicant must select upgrades that individually or in combination meet the minimum energy savings target. The maximum target value shown in the Cost-effectiveness Explorer is based on a combination of cost-effective, non-preempted measures.

2. Equipment replacement ordinances should consider appropriate exceptions for scenarios where it will be challenging to meet the requirements, such as location of the HPWH, total project cost limitations, or the need for service panel upgrades that wouldn't have been required as part of the proposed scope of work in absence of the reach code.

3. Consider extending relevant proposals made by the CEC for the 2025 Title 24 code (California Energy Commission, 2023) in ordinances that apply under the 2022 Title 24 code, such as the following:

- a. Mandatory ventilation requirements for HPWH installations (Section 110.3(c)7). The cost-effectiveness analysis can be found in the Multifamily Domestic Hot Water CASE report (Statewide Team, 2023).
- b. Requirement for HERS verified refrigerant charge verification for heat pumps in all climate zones (Table 150.1-A<sup>4</sup>). The cost-effectiveness analysis can be found in the Residential HVAC Performance CASE report (Statewide Team, 2023).

4. When evaluating reach code strategies, the Reach Codes Team recommends that jurisdictions consider combined benefits of energy efficiency alongside electrification. Efficiency and electrification have symbiotic benefits and are both critical for decarbonization of buildings. As demand on the electric grid is increased through electrification, efficiency can reduce the negative impacts of additional electricity demand on the grid, reducing the need for increased generation and storage capacity, as well as the need to upgrade upstream transmission and distribution equipment.

5. Education and training can play a critical role in ensuring that heat pumps are installed, commissioned, and controlled properly to mitigate grid impacts and maximize occupant satisfaction. Below are select recommended strategies.

- a. The Quality Residential HVAC Services Program<sup>5</sup> is an incentive program to train California contractors in providing quality installation and maintenance while advancing energy-efficient technologies in the residential HVAC industry. Jurisdictions can market this to local contractors to increase the penetration of contractors skilled in heat pump design and installation.
- b. Educate residents and contractors of available incentives, tax credits, and financing opportunities.
- c. Educate contractors on code requirements. Energy Code Ace provides free tools, training, and resources to help Californians comply with the energy code. Contractors can access interactive compliance forms, fact sheets, and live and recorded trainings, among other things, on the website: <https://energycodeace.com/>. Jurisdictions can reach out to Energy Code Ace directly to discuss offerings.

6. Health and safety

- a. Combustion Appliance Safety and Indoor Air Quality: Implementation of some of the recommended measures will affect the pressure balance of the home which can subsequently impact the safe operation of existing combustion appliances as well as indoor air quality. Buildings with older gas appliances can present serious health and safety problems which may not be addressed in a remodel

<sup>3</sup> <https://www.publichealthlawcenter.org/sites/default/files/2024-01/CRA-v-Berkeley-Ninth-Circuit-Opinion-Jan2024.pdf>

<sup>4</sup> This requirement does not show up in the Express Terms for alterations in Section 150.2(b)1F, but the Statewide Reach Codes Team expects that it will be added to the next release of the proposed code language in the 45-day language as it aligns with the proposal made by the Codes and Standards Enhancement Team (Statewide CASE Team, 2023).

<sup>5</sup> <https://qualityhvac.frontierenergy.com/>

if the appliances are not being replaced. It is recommended that the building department require inspection and testing of all combustion appliances located within the pressure boundary of the building after completion of retrofit work that involves air sealing or insulation measures.

- b. Jurisdictions may consider requiring mechanical ventilation in homes where air sealing has been conducted. In older buildings, outdoor air is typically introduced through leaks in the building envelope. After air sealing a building, it may be necessary to forcefully bring in fresh outdoor air using supply and/or exhaust fans to minimize potential issues associated with indoor air quality.

Local jurisdictions may also adopt ordinances that amend different Parts of the California Building Standards Code or may elect to amend other state or municipal codes. The decision regarding which code to amend will determine the specific requirements that must be followed for an ordinance to be legally enforceable. For example, reach codes that amend Part 6 of the CA Building Code and require energy performance beyond state code minimums must demonstrate the proposed changes are cost-effective and obtain approval from the 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. Although a cost-effectiveness study is only required to amend Part 6 of the CA Building Code, this study provides valuable context for jurisdictions pursuing other ordinance paths 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 residents, local leadership, and other stakeholders make informed policy decisions.

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](https://LocalEnergyCodes.com). Local jurisdictions that are considering adopting an ordinance may contact the program for further technical support at [info@localenergycodes.com](mailto:info@localenergycodes.com).

## 1 Introduction

This report documents cost-effective measure upgrades in existing single family buildings that exceed the minimum state requirements, the 2022 Building Energy Efficiency Standards, effective January 1, 2023. 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. This report was developed in coordination with the California Statewide Investor-Owned Utilities (IOUs) Codes and Standards Program, key consultants, and engaged cities—collectively known as the Statewide Reach Codes Team.

The focus of this study is on existing single family buildings and does not apply to low or high-rise multifamily buildings. Each jurisdiction must establish the appropriate structure and threshold for triggering the proposed requirements. Some common jurisdictional structures include triggering the requirements at major remodels, additions, or date-certain (upgrades must be completed by a specific date). Some of these measures could be triggered with a permit for another specific measure, such as a re-roofing project. The analysis includes scenarios of individual measures and identifies cost-effective options based on the existing conditions of the building in all 16 California Climate Zones (CZ) (see Cost-Effectiveness Results for a graphical depiction of climate zone locations).

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/>.

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

The California Building Energy Efficiency Standards Title 24, Part 6 (Title 24) (CEC, 2019) is maintained and updated every three years by two state agencies: the California Energy Commission (the Energy Commission) and the Building Standards Commission (BSC). In addition to enforcing the code, local jurisdictions have the authority to adopt local energy efficiency ordinances—or reach codes—that exceed the minimum standards defined by Title 24 (as established by Public Resources Code Section 25402.1(h)2 and Section 10-106 of the Building Energy Efficiency Standards). Local jurisdictions must demonstrate that the requirements of the proposed ordinance are cost-effective and do not result in buildings consuming more energy than is permitted by Title 24. In addition, the jurisdiction must obtain approval from the Energy Commission and file the ordinance with the BSC for the ordinance to be legally enforceable.

The Department of Energy (DOE) sets minimum efficiency standards for equipment and appliances that are federally regulated under the National Appliance Energy Conservation Act, including heating, cooling, and water heating equipment (E-CFR, 2020). Since state and local governments are prohibited from adopting higher minimum efficiencies than the federal standards require, the focus of this study is to identify and evaluate cost-effective packages that do not include high efficiency heating, cooling, and water heating equipment. High efficiency appliances are often the easiest and most affordable measure to increase energy performance. While federal preemption limits reach code mandatory requirements for covered appliances, in practice, builders may install any package of compliant measures to achieve the performance requirements.

## 2 Methodology and Assumptions

### 2.1 Analysis for Reach Codes

This section describes the approach to calculating cost-effectiveness including benefits, costs, metrics, and utility rate selection.

#### 2.1.1 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 was used instead of the 2022 version to take advantage of updated weather files and metrics. Site energy results are similar between CBECC-Res 2022 and 2025; however, the 2025 compliance metrics applies assumptions reflective of an electrified future, such as high escalation for natural gas retail rates, which favors electric buildings. In addition, in 2025 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.

Three unique building vintages are considered: pre-1978, 1978-1991, and 1992-2010. The vintages were defined based on review of historic Title 24 code requirements and defining periods with distinguishing features. Prospective energy efficiency measures were identified and modeled to determine the projected site energy (therm and kWh), source energy, GHG emissions, and LSC (long-term systemwide cost) impacts. Annual utility costs were calculated using hourly data output from CBECC, and current (as of 11/01/2023) electricity and natural gas tariffs for each of the investor-owned utilities (IOUs) appropriate for that climate zone.

Equivalent CO<sub>2</sub> 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 lbs CO<sub>2</sub>-equivalent (CO<sub>2</sub>e) emissions.

The Statewide Reach Codes Team designed the analysis approach and selected measures for evaluation based on the 2019 existing building single family reach code analysis (Statewide Reach Codes Team, 2021) and work to support the 2025 Title 24 code development cycle as well as from outreach to architects, builders, and engineers.

#### 2.1.2 Prototype Characteristics

The Energy Commission defines building prototypes which it uses to evaluate the cost-effectiveness of proposed changes to Title 24 requirements. Average home size has steadily increased over time,<sup>6</sup> 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 1 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 Title 24, Part 6. The CEC has proposed changes to the 2025 Energy Code that would remove the allowance of gas space heating and water heating equipment for additions and instead require additions to follow the same space heating and water heating equipment requirements as new construction (California Energy Commission, 2023). The proposed prescriptive requirements for single family new construction homes are heat pump space heaters and water heaters, with gas equipment only allowed in the performance approach.

<sup>6</sup> <https://www.census.gov/const/C25Ann/sftotalmedavgsqft.pdf>

**Table 1. Prototype Characteristics**

	Specification
Existing Conditioned Floor Area	1,665 ft <sup>2</sup>
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 Title 24 that were in effect or standard construction practice during that time period. 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 2 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.
  - Scenarios with an existing natural gas wall furnace without AC were also evaluated.
- Small storage natural gas water heater.
  - Scenarios with an existing electric resistance storage water heater were also evaluated.
- Gas cooktop, oven, and clothes dryer.

The methodology applied in the analyses begins with a design that matches the specifications as described in Table 2 for each of the three vintages. Prospective energy efficiency measures were modeled to determine the projected energy performance and utility cost impacts relative to the baseline vintage. In some cases, where logical, measures were packaged together.

Table 2. Efficiency Characteristics for Three Vintage Cases

Building Component Efficiency Feature	Vintage Case		
	Pre-1978	1978-1991	1992-2010
<b>Envelope</b>			
Exterior Walls	2x4, 16-inch on center wood frame, R-0 <sup>a</sup>	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 <sup>b</sup>	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
<b>HVAC Equipment</b>			
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
<b>Water Heating Equipment</b>			
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

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

<sup>b</sup> 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.

## 2.1.3 Cost-Effectiveness Approach

### 2.1.3.1 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 (the numerator in the benefit cost calculation):

**Utility Bill Impacts (On-Bill):** This customer-based lifecycle cost (LCC) approach values energy based upon estimated site energy usage and customer utility bill savings using the latest electricity and natural gas utility tariffs available at the time of writing this report. Total savings are estimated over a 30-year duration and include discounting of future utility costs, as well as assumed energy cost inflation over time.

**Long-term Systemwide Cost (LSC):** Formerly known as Time Dependent Valuation (TDV) energy cost savings, LSC reflects the Energy Commission's current 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 CO<sub>2</sub> emissions (California Energy Commission, 2023). This is the methodology used by the Energy Commission in evaluating cost-effectiveness for efficiency measures in the 2025 Energy Code.

### 2.1.3.2 Costs

The Reach Codes Team assessed the incremental costs of the measures and packages over a 30-year analysis period. Incremental costs represent the equipment, installation, replacement, and maintenance costs of the proposed measure relative to the 2022 Title 24 Standards minimum requirements or standard industry practices. Present value of replacement cost is included only for measures with lifetimes less than the 30-year evaluation period. In cases where at the end of the analysis period the measure has useful life remaining, the value of this remaining life is calculated and credited in the total lifetime cost.

### 2.1.3.3 Metrics

Cost-effectiveness is presented using net present value (NPV) and benefit-to-cost (B/C) ratio metrics.

**NPV:** Equation 1 demonstrates how lifetime NPV is calculated. If the NPV of a measure or package is positive, it is considered cost-effective. A negative value represents a net increase in costs over the 30-year lifetime.

**B/C Ratio:** This is the ratio of the present value of all benefits to the present value of all costs over 30 years (present value benefits divided by present value costs). A value of one indicates the NPV of the savings over the life of the measure is equivalent to the NPV of the lifetime incremental cost of that measure. A value greater than one represents a positive return on investment. The B/C ratio is calculated according to Equation 2.

#### Equation 1

$$NPV = \text{present value of lifetime benefit} - \text{present value of lifetime cost}$$

#### Equation 2

$$\text{Benefit - to - Cost Ratio} = \frac{\text{present value of lifetime benefit}}{\text{present value of lifetime cost}}$$

Improving the efficiency of a project often requires an initial incremental investment. In most cases the benefit is represented by annual On-Bill utility or LSC savings, and the cost is represented by incremental first cost and future replacement costs. Some packages result in initial construction cost savings relative to the assumed base case scenario, 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), B/C ratio cost-effectiveness is represented by ">1".

The lifetime costs or benefits are calculated according to Equation 3.

### Equation 3

$$\text{Present value of lifetime cost or benefit} = \sum_{t=0}^n \frac{(\text{Annual cost or benefit})_t}{(1+r)^t}$$

Where:

1.  $n$  = analysis term in years
2.  $r$  = discount rate

The following summarizes the assumptions applied in this analysis to both methodologies.

3. Analysis term of 30 years
4. Real discount rate of three percent

Both base case measures and alternative energy efficiency measures may have different lifetime assumptions which impact life cycle economics. Future costing of many of the evaluated electrification measures are only based on current cost assumption, which may be overly conservative as the expected growth in heat pump-based technologies is growing rapidly and will likely lead to future cost reductions (at least relative to current fossil fueled equipment) as production volumes increase.

#### 2.1.4 Utility Rates

In coordination with the CA IOU rate 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 Chapter 6.2, were determined based on the appropriate rate for each case in each territory. 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.

For cases with onsite generation (i.e. solar photovoltaics (PV)), the approved NBT tariffs were applied along with monthly service fees and hourly export compensation rates for 2024.<sup>7</sup> In December 2022, the California Public Utilities Commission (CPUC) issued a decision adopting NBT as a successor to NEM 2.0 that went into effect April of 2023<sup>8</sup>.

Utility rates are assumed to escalate over time according to the 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. The Statewide Natural Gas Residential Average Rate for 2023 through 2030 is projected to be 4.6%. The Electric Residential Average Rate for PG&E, SCE and SDG&E for 2023 through 2030 is projected to be 1.8%, 1.6% and 2.8% respectively. A second set of escalation rates were also evaluated to demonstrate the impact that utility cost changes have on cost-effectiveness over time. This utility rate escalation sensitivity analysis, presented in Section 3.2.4, was based on those used within the 2025 LSC factors (LSC replaces TDV in the 2025 code cycle) which assumed steep

<sup>7</sup> Hourly export compensation rates were based on the NBT spreadsheet model created by E3 for the CPUC. <https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/net-energy-metering-nem/nemrevisit/nbt-model--12142022.xlsb>

<sup>8</sup> <https://www.cpuc.ca.gov/nemrevisit>

increases in gas rates in the latter half of the analysis period. See Appendix 6.2.7 Fuel Escalation Assumptions for details.

Future electricity tariff structures are expected to evolve over time, and the CPUC has an active proceeding to adopt an income-graduated fixed charge that benefits low-income customers and supports electrification measures.<sup>10</sup> These were not included in this analysis but may be evaluated later in 2024 once the rates are finalized.

### 2.1.5 Measure Cost Data Collection Approach

To support this effort, a detailed cost study was completed in the summer of 2023 to gather data from a range of contractors to inform actual installed costs in the areas they provide services. These areas include HVAC, plumbing, envelope and air-sealing, and PV installation. Home performance contractors were also approached to collect this data. Collecting this type of data is challenging, both due to contractor reticence to share cost information and due to the timing of the survey which unfortunately coincided with the summer busy season for most contractors, especially HVAC installers. With these known challenges, the outreach effort focused on leveraging existing relationships between the analysis team and contractors to both gain access and provide assurance that all cost data would remain confidential and aggregated. Contractors that provided feedback were nominally compensated for their time.

The collected cost data was intended to represent recent costs for a “typical” retrofit installation. Each home in which a contractor does work has different site-specific issues that will likely affect costs. In addition, different jurisdictions have different levels of building department installation oversight and permit fees. Finally, each contractor typically has a different manufacturer product line they prefer to install. All these factors will influence installed costs<sup>11</sup>.

The most detailed and broad cost request was for the HVAC contractors, as there are a wide range of equipment replacement scenarios available for an existing ducted gas furnace with central split-system air conditioning. Options range from a base case scenario (like for like swap out), split-system heat pump replacement, dual fuel heat pumps (DFHP), ducted mini-split heat pumps, non-ducted mini-splits, etc. For plumbing contractors, a range of scenarios existed for water heater replacements including like-for-like replacement, HPWHs (in different locations- garage, indoor), need for electrical upgrade for HPWH installation, need for HPWH ducting, etc. Envelope measures focused on attic and wall insulation, window replacement, re-roofing (with Cool Roof materials or not), and attic ceiling plane air-sealing. PV costing included different system sizes, panel upgrades costs, and battery costs. Home performance contractors were asked to provide as much data as they could on the different measure options. All costing information requested was intended to represent most recent installations, in an effort to capture current pricing as best as possible.

The contractors that responded with their cost estimates work in different regions of the state, operate in different markets with (potentially) different local efficiency incentives, do varying amounts of work based on the size of their company, target different market demographic sectors, and install different brands of equipment. All these factors will contribute to price variability. The Team considered applying climate zone specific cost adjustments to reflect some of these differences, but ultimately decided not to since a climate zone is not a monolithic entity with uniform customer pricing throughout. The Team recognizes that “zip code” pricing is a reality, but for simplicity, as well as consistency with Title 24, Part 6 code development costing approaches, applied uniform statewide costs to all measures.

## 2.2 Measure Details and Cost

This section describes the details of the measures and documents incremental costs. All measure costs were obtained from the contractor survey unless otherwise noted. All contractor provided costs reflect the cost to the customer and

<sup>10</sup> <https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/electric-costs/demand-response-dr/demand-flexibility-rulemaking>

<sup>11</sup> One HVAC contractor mentioned that equipment brand alone may contribute to a +/-5% variation in the total bid cost.

include equipment, labor, permit fees, and required HERS testing. Additional details of the measures can be found in Appendix Section **Error! Reference source not found.**

All measures are evaluated assuming they are not otherwise required by Title 24. For example, duct sealing is required by code whenever HVAC equipment is altered. For this analysis duct sealing was evaluated for those projects where it is not already triggered by code (i.e., no changes to the heating or cooling equipment). Where appropriate, measure requirements align with those defined in Title 24. In some cases, cost-effective measures were identified that exceed Title 24 requirements, such as attic insulation, cool roofs, and duct sealing.

## 2.2.1 Building Envelope & Duct Measures

The following are descriptions of each of the efficiency upgrade measures applied in this analysis.

**Attic Insulation:** Add attic insulation in buildings with vented attic spaces to meet either R-38 or R-49. The pre-1978 vintage assumes an existing condition of R-11, the 1978-1991 vintage assumes an existing condition of R-19, and the 1992-2010 vintage assumes R-30 as the existing insulation level. For pre-1978 vintage homes this measure was also evaluated to include air sealing of the attic. A 14% leakage reduction was modeled such that 15 ACH50 was reduced to 12.9 ACH50 in this measure. The costs for this measure include removing existing insulation.

**Air Sealing and Weather-stripping:** Apply air sealing practices throughout all accessible areas of the building. For this study, it was assumed that older vintage homes would be leakier than newer buildings and that approximately 30 percent improvement in air leakage is achievable through air sealing of all accessible areas. For modeling purposes, it was assumed that air sealing can reduce infiltration levels from 15 to ten air changes per hour at 50 Pascals pressure difference (ACH50) in the oldest vintages (pre-1978), to ten to seven ACH50 for the 1978-1991 vintage, and seven to five ACH50 in the 1992-2010 vintage.

**Cool Roof:** For steep slope roofs, install a roofing product rated by the Cool Roof Rating Council (CRRC) with an aged solar reflectance of 0.20 or 0.25 and thermal emittance of 0.75 or higher. This measure only applies to buildings that are installing a new roof as part of the scope of the remodel; the cost and energy savings associated with this upgrade reflects the incremental step between a standard roofing product with one that is CRRC rated with an aged solar reflectance of 0.20 or 0.25. This is similar to cool roof requirements in 2022 Title 24 Section 150.2(b)1i but assumes a higher solar reflectance.

**Radiant Barrier:** Add radiant barrier to any existing home vintage. This measure only applies to buildings that are installing a new roof as part of the scope of the remodel; the cost and energy savings associated with this upgrade reflects the incremental step between a standard roofing product with one that includes a laminated radiant barrier.

**Raised Floor Insulation:** In existing homes with raised floors and no insulation (pre-1978 and 1978-1991 vintages), add R-19 insulation. An upgraded R-30 floor insulation, assuming no current insulation, was evaluated in the pre-1978 and 1978-1991 vintages.

**Wall Insulation:** Blow-in R-13 wall insulation in existing homes without wall insulation (pre-1978 vintages).

**Window Replacement:** Replace existing windows with a non-metal dual-pane product, which has a U-factor equal to 0.28 Btu/hour·ft<sup>2</sup>·°F or lower and a Solar Heat Gain Coefficient (SHGC) equal to 0.23 or lower, except in heating dominated climates (Climate Zones 1, 3, 5, and 16) where an SHGC of 0.35 was evaluated.

**Duct Sealing, New Ducts, and Duct Insulation:** Air seal all ductwork to meet the requirements of the 2022 Title 24, Part 6 Section 150.2(b)1E. For this analysis, final duct leakage values of ten percent (proposed revised leakage rate for 2022 Title 24) was evaluated. The pre-1978 and 1978-1992 vintages assume leaky existing ducts (25-30% leakage). The 1992-2010 vintage assumes moderately leaky existing ducts (15-20% leakage).

Replacing existing ductwork with entirely new ductwork to meet Sections 150.2(b)1Di and 150.2(b)1Dii of the 2022 Title 24 was also evaluated. This assumed new ducts meet 5% duct leakage and the option of R-6 and R-8 duct insulation in all climate zones.

Table 3 summarizes the cost assumptions for the building envelope and HVAC duct improvement measures evaluated. All the measures in Table 3 assume a 30-year effective useful life.

**Table 3. Measure Cost Assumptions – Efficiency & Duct Measures**

Measure	Performance Level	Incremental Cost – Single Family Building		
		Pre 1978	1978 – 1991	1992 - 2010
Wall Insulation	R-13	\$2,950	N/A	N/A
Raised Floor Insulation	R-19	\$3,633	\$3,633	N/A
	R-30	\$4,113	\$4,113	\$4,113
Attic Insulation	R-38	\$6,762	\$2,555	\$1,781
	R-49	\$7,446	\$3,612	\$1,827
Air Sealing	10 ACH50	\$4,684	N/A	N/A
	7 ACH50	N/A	\$4,684	N/A
	5 ACH50	N/A	N/A	\$4,684
Cool Roof	0.25 Aged Solar Reflectance CZs 1-3,5-7,16	\$2,407	\$2,407	\$2,407
	0.25 Aged Solar Reflectance CZs 4, 8-15	\$1,203	\$1,203	\$1,203
Window U-factor/SHGC	0.28 U-factor. 0.23 SHGC in CZs 2,4,6-15.	\$11,463	\$11,463	\$11,463
	0.28 U-factor. 0.35 SHGC in CZs 1,3,5,26	\$11,871	\$11,871	\$11,871
Radiant Barrier	Add Radiant Barrier	\$893	\$893	\$893
Duct Sealing	10% nominal airflow	\$2,590	\$2,590	\$1,400
All New Duct System	R-6 ducts; 5% duct leakage	\$4,808	\$4,808	\$4,808
	R-8 ducts; 5% duct leakage	\$6,311	\$6,311	\$6,311

## 2.2.2 PV Measures

Installation of on-site PV is required in the 2022 Title 24 code for new construction homes, but there are no PV requirements for additions or alterations to existing buildings. PV was evaluated in CBECC-Res according to the California Flexible Installation (CFI) 1 assumptions and 98% solar access. To meet CFI eligibility, the requirements of 2022 Reference Appendices JA11.2.2 (California Energy Commission, 2021b) must be met. A 3 kW PV system was modeled both as a standalone measure as well as coupled with heat pump installations.

The costs for installing PV are summarized in Table 4. They include the first cost to purchase and install the system, future inverter replacement costs, and annual maintenance costs. Upfront solar PV system costs are estimated from the contractor surveys to be \$4.58/W<sub>DC</sub> and are reduced by 30 percent to account for the federal income Residential Clean Energy Credit. The solar panels are estimated to have an effective useful life of 30 years and the inverter 25 years. The inverter replacement cost of \$7,000 (future value) is also from the contractor surveys. System maintenance costs are taken from the 2019 PV CASE Report (California Energy Commission, 2017) and are assumed to be

\$0.31/W<sub>DC</sub> present value. These costs do not include costs associated with electrical panel upgrades, which will be necessary in some instances.

**Table 4. Measure Descriptions & Cost Assumptions – PV**

Measure	Performance Level	Incremental Cost		
		Pre 1978	1978 – 1991	1992 - 2010
PV	3 kW			\$9,608

## 2.2.3 Equipment Fuel Substitution Measures – Heat Pump Equipment

The fuel substitution measures are evaluated as replacements at the end of the life of the existing equipment. This means the baseline compared against is usually a like-for-like change-out of the natural gas equipment, and the upgrade is a heat pump.

For most of the space heating and water heating cases, costs for electrical service panel upgrades are not included as it is assumed many existing homes have the service capacity to support converting one appliance from gas to electric. For homes with existing air conditioners, any incremental electric capacity necessary to support a heat pump space heater is marginal. The same applies for homes with existing electric resistance equipment. Section 3.2.4 presents the impacts for select cases where an upgrade to the electric panel is required.

### Heat Pump Space Heating

All the heat pump space heater (HPSH) measures are described below. All were evaluated with HERS verified refrigerant charge aligned with the proposed code requirements for the 2025 Title 24 code. Dual fuel heat pumps (DFHPs) were controlled to lockout furnace operation above 35°F.

DFHP (Existing Furnace): Replace existing ducted air conditioner (AC) with an electric heat pump and install controls to operate the heat pump to use the existing gas furnace for backup heat. 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).

DFHP (New Furnace): Replace existing ducted AC and natural gas furnace with an electric heat pump and new gas furnace plus controls to operate the heat pump and use the new gas furnace for backup heat. A minimum federal efficiency (14.3 SEER2, 11.7 EER2, 7.5 HSPF2) heat pump and furnace (80 AFUE) were evaluated to replace existing equipment. Savings are compared to a new ducted AC and natural gas furnace (14.3 SEER2, 11.7 EER2, 80 AFUE).

Heat Pump Space Heater: Replace existing ducted AC and natural gas furnace with an electric heat pump. Minimum federal efficiency (14.3 SEER2, 11.7 EER2, 7.5 HSPF2) and 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).

Ducted Mini-Split Heat Pump (MSHP): Replace existing ducted AC and natural gas furnace with a ducted high efficiency MSHP (16.5 SEER2, 12.48 EER2, 9.5 HSPF2). Savings are compared to a new ducted AC and natural gas furnace (14.3 SEER2, 11.7 EER2, 80 AFUE).

Ductless MSHP: In a home without AC, replace existing wall furnace with a ductless MSHP. A standard efficiency unit meeting minimum federal efficiency standards (14.3 SEER2, 11.7 EER2, 7.5 HSPF2) was evaluated by modeling the variable capacity heat pump (VCHP) compliance credit in CBECC-Res. A premium, higher efficiency upgrade was also

evaluated using CBECC-Res' detailed VCHP model<sup>12</sup> by simulating the performance of a representative high efficiency product (14.3 SEER2, 11.7 EER2, 7.5 HSPF2). Savings are compared to a new natural gas wall furnace with fan distribution (75% AFUE) and window AC (9 CEER).

Over the 30-year analysis period, certain changes are assumed when the equipment is replaced that impact both lifetime costs and energy use. Table 5 presents the lifetime scenario for the DFHP (existing furnace) measure. 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 AFUE<sup>13</sup>. 5 years later the air conditioner reaches the end of its life and is replaced with a new air conditioner.

For the DFHP upgrade case, after 10 years when the furnace fails it's expected that the furnace will be 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 would be replaced with a new aftermarket unit and would operate another 5 years until the heat pump fails and is replaced with a new heat pump and air handler.

The other ducted heat pump cases similarly apply a 95 AFUE furnace in the baseline when the furnace reaches its EUL after 20 years.

**Table 5. Lifetime Analysis Replacement Assumptions for DFHP (Existing Furnace) Scenario**

Year	Baseline	Upgrade
0	AC fails, install new AC, keep existing furnace	AC fails, install new HP, keep existing furnace
10	Furnace fails, install new 95AFUE furnace	Furnace fails, replace fan motor
15	AC fails, install new AC	HP fails, install new HP and air handler

Costs were applied based on the system capacity from heating and cooling load calculations in CBECC-Res as presented in Table 6. 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 demonstrated that Climate Zones 2 - 15 were cooling-dominated while Climate Zones 1 and 16 were heating-dominated. In the heating dominated climate zones the heat pump needed to be upsized relative to an air conditioner that only provides cooling.

<sup>12</sup> The detailed VCHP option allows for the user to input detailed specifications based on the published National Energy Efficiency Partnership (NEEP) manufacturer specific performance data. It is not currently available for compliance analysis.

<sup>13</sup> <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.>

**Table 6. 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

Table 7 presents estimated first and lifetime costs for the various ducted 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 8 presents estimated first and lifetime costs for the ductless baseline and 2 heat pump scenarios, also for 4-ton heat pump equipment. EULs are based on 20 years for the gas wall furnace, 10 years for the window AC, and 15 years for the heat pump.<sup>14</sup>

<sup>14</sup> The gas wall furnace and heat pump EULs were based on DEER (California Public Utilities Commission, 2021b). Gas wall furnace lifetime was assumed to be the same as for central gas furnace equipment. Room air conditioner EUL was based on the DOE's latest rulemaking for room air conditioned (Department of Energy, 2023). DOE determined an average lifetime of 9.3 years, which was rounded up to 10 years for this analysis.

**Table 7. Ducted HVAC Measure Cost Assumptions – 4-Ton Electric Replacements**

Case	AC + Coil	Gas Furnace /AC	DFHP (Existing Furnace)	DFHP (New Furnace)	Min. Eff. Heat Pump	High Eff. Heat Pump	Ducted MSHP
<b>Base Case</b>	-	-	AC + Coil	Gas Furnace /AC	Gas Furnace /AC	Gas Furnace /AC	Gas Furnace /AC
First Cost	\$10,402	\$16,653	\$12,362	\$20,676	\$17,825	\$20,802	\$18,075
Replacement Cost (Future Value)	\$19,365	\$19,365	\$19,025	\$19,025	\$16,825	\$19,802	\$18,075
Replacement Cost (Present Value)	\$13,346	\$11,639	\$12,334	\$12,897	\$10,800	\$12,710	\$11,601
Remaining Value at Year 30	\$0	(\$1,846)	\$0	(\$1,846)	\$0	\$0	\$0
Total Lifecycle Cost	\$23,748	\$26,446	\$24,696	\$31,727	\$28,625	\$33,512	\$29,676
<b>Incremental Cost</b>	-	-	<b>\$948</b>	<b>\$5,281</b>	<b>\$2,179</b>	<b>\$7,066</b>	<b>\$3,230</b>

**Table 8. Non-Ducted HVAC Measure Cost Assumptions – 4-Ton Electric Replacements**

	Wall Furnace + Window AC	Min. Eff. Ductless MSHP	High Eff. Ductless MSHP
First Cost	\$4,075	\$17,412	\$21,342
Replacement Cost (Future Value)	\$4,075	\$17,412	\$21,342
Replacement Cost (Present Value)	\$3,365	\$11,176	\$13,698
Remaining Value at Year 30	(\$532)	\$0	\$0
Total Lifecycle Cost	\$6,908	\$28,588	\$35,040
<b>Incremental Cost</b>	-	<b>\$21,680</b>	<b>\$28,132</b>

**Heat Pump Water Heating:**

The heat pump water heater (HPWH) measures are described below, and costs are presented in Table 9 and Table 10. The most typical scenario in California is a home with existing natural gas storage tank water heaters. However, there are also many existing homes with existing electric resistance storage tank water heaters and this work considers both baselines. This analysis evaluates the following 65-gallon replacement HPWHs:

1. HPWH that meets the federal minimum efficiency requirements of UEF 2.0
2. HPWH that meets the Northwest Energy Efficiency Alliance (NEEA)<sup>15</sup> Tier 3 rating (3.45 UEF)
3. HPWH that meets the NEEA Tier 4 rating and that has demand response (DR) or load shifting control capability (4.02 UEF)
4. 120V HPWH that meets the NEEA Tier 3 rating (3.3 UEF).

<sup>15</sup> Based on operational challenges experienced in the past, NEEA established rating test criteria to ensure newly installed HPWHs perform adequately, especially in colder climates. The NEEA rating requires an Energy Factor equal to the ENERGY STAR® performance level and includes requirements regarding noise and prioritizing heat pump use over supplemental electric resistance heating.

The four cases above were evaluated with the HPWH located within an attached garage. Additionally, three separate cases for the federal minimum efficiency HPWH were analyzed to consider the impacts of location on performance and cost-effectiveness. These locations included the following:

1. Exterior closet.
2. Interior closet, no ducting.
3. Interior closet, ducted to the outside.

Additional costs for providing electrical wiring to these locations and for providing ductwork were included. Savings are compared to a new 50-gallon natural gas storage water heater (UEF 0.63) or a new 50-gallon electric water heater (UEF 0.92).

For this analysis, a HPWH that just meets the federal minimum efficiency standards of close to 2.0 Uniform Energy Factor (UEF) was evaluated in order to satisfy preemption requirements. However, the Reach Codes Team is not aware of any 2.0 UEF products that are available on the market. The lowest UEF reported for certified products in the Northwest Energy Efficiency Alliance (NEEA)<sup>16</sup> database is 2.73. In fact, of the four certification tiers offered by NEEA for high efficiency HPWHs, those meeting Tier 3 or Tier 4 are the dominant products on the market today. According to NEEA all major HPWH manufacturers are represented in NEEA's qualified product list<sup>17</sup> and there are fewer than 10 integrated products certified as Tier 1 or Tier 2, all of which have UEFs greater than 3.0.<sup>18</sup> Therefore, in this analysis, we refer to the NEEA rated HPWH as the "market standard" HPWH.

The HPWH costs for the 120V and NEEA certified units are based on a larger (60 or 65 gallon) HPWH, as most contractors are upsizing the HPWH tank size relative to an equal volume, but higher capacity gas storage water heater. Costs include all material and installation labor including providing a new 240 V electrical service to the water heater location (not needed for the 120V product). Water heating equipment lifetimes are based on DOE's recent water heater rulemaking (Department of Energy, 2022) and assume 15-year EULs for both the baseline water heaters and the HPWHs.<sup>19</sup> Future replacement costs for 240V HPWHs do not include any initial costs associated with 240V electrical service, condensate disposal, etc.

**Table 9. Water Heating Measure Cost Assumptions – Existing Gas**

	Gas Storage Water Heater	240V Fed. Min. HPWH	240V Market Std. NEEA HPWH	240V Market Std. NEEA HPWH + DR	120V Market Std. NEEA HPWH	240V Fed. Min. HPWH, Exterior Closet	240V Fed. Min. HPWH, Interior Closet, Not Ducted	240V Fed. Min. HPWH, Interior Closet, Ducted
First Cost	\$2,951	\$7,283	\$8,144	\$8,144	\$5,844	\$7,702	\$7,363	\$8,442
Replacement Cost (Future Value)	\$2,951	\$6,413	\$7,274	\$7,274	\$5,101	\$6,413	\$6,413	\$6,413
Replacement Cost (Present Value)	\$1,894	\$4,116	\$4,669	\$4,669	\$3,274	\$4,116	\$4,116	\$4,116
Total Lifecycle Cost	\$4,845	\$11,399	\$12,813	\$12,813	\$9,118	\$11,818	\$11,479	\$12,558
<b>Incremental Cost</b>	<b>-</b>	<b>\$6,554</b>	<b>\$7,968</b>	<b>\$7,968</b>	<b>\$4,273</b>	<b>\$6,973</b>	<b>\$6,634</b>	<b>\$7,713</b>

<sup>16</sup> Based on operational challenges experienced in the past, NEEA established rating test criteria to ensure newly installed HPWHs perform adequately, especially in colder climates. The NEEA rating requires products comply with ENERGY STAR and includes requirements regarding noise and prioritizing heat pump use over supplemental electric resistance heating.

<sup>17</sup> <https://neea.org/success-stories/heat-pump-water-heaters>

<sup>18</sup> As of 12/21/23: <https://neea.org/img/documents/residential-unitary-HPWH-qualified-products-list.pdf>

<sup>19</sup> The recent DOE rulemaking references a lifetime of 14 years for gas storage water heaters and 14.8 years for electric storage water heaters. 15 years for each was used in this analysis for both types for simplification.

Table 10 presents similar costs to Table 9, except that the costs assume replacement of an existing 50-gallon electric storage water heater and does not include the 240 V electrical service cost.

**Table 10. Water Heating Measure Cost Assumptions – Existing Electric Resistance**

	Electric Storage Water Heater	240V Fed. Min. HPWH	240V Market Std. NEEA HPWH	240V Market Std. NEEA HPWH + DR	120V Market Std. NEEA HPWH	240V Fed. Min. HPWH, Exterior Closet	240V Fed. Min. HPWH, Interior Closet, Not Ducted	240V Fed. Min. HPWH, Interior Closet, Ducted
First Cost	\$2,583	\$6,413	\$7,274	\$7,274	\$5,101	\$6,413	\$6,413	\$7,492
Replacement Cost (Future Value)	\$2,583	\$6,413	\$7,274	\$7,274	\$5,101	\$6,413	\$6,413	\$6,413
Replacement Cost (Present Value)	\$1,658	\$4,116	\$4,669	\$4,669	\$3,274	\$4,116	\$4,116	\$4,116
Total Lifecycle Cost	\$4,241	\$10,529	\$11,943	\$11,943	\$8,375	\$10,529	\$10,529	\$11,608
<b>Incremental Cost</b>	-	<b>\$6,288</b>	<b>\$7,702</b>	<b>\$7,702</b>	<b>\$4,134</b>	<b>\$6,288</b>	<b>\$6,288</b>	<b>\$7,367</b>

### 3 Results

The primary objective of the evaluation is to identify cost-effective energy upgrade measures and packages for existing single family buildings, to support the design of local ordinances requiring upgrades, which may be triggered by different events, such as at the time of a significant remodel or at burnout of mechanical equipment. In this report, the 1992-2010 vintage is shown for the equipment measures because it is the most conservative case (lowest loads), while the pre-1978 vintage is shown for the envelope and duct measures because some of those measures only apply to the pre-1978 vintage. 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/>.

### 3.1 Cost-Effectiveness Results

The extensive analysis for this type of report leads to an overwhelming number of scenarios including different base cases, house vintages, replacement options, and climate zones. To simplify the reporting, the Statewide Reach Codes Team has relied on graphical representation of select key cases indicating high level measure cost effectiveness from either an On-Bill perspective, an LSC perspective, both metrics, or neither. Figure 1 through Figure 13 present this reduced set of results of the LSC and On-Bill cost-effectiveness conclusions across the 16 climate zones. In the cases where there are multiple utilities serving a single climate zone, an asterisk "\*" label is added to separately show the alternate utility cases. These graphs provide a general sense of the findings. 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/>.

#### 3.1.1 HPSH Measures

Figure 1 through Figure 5 show the cost-effectiveness of space heating equipment replacement measures for the 1992-2010 vintage including the following cases. The 1992-2010 vintage results are presented here as this is the most conservative scenario for HPSH measures. In general, where a HPSH measure is cost-effective for a new home it was also found to be cost-effective for older homes.

- Dual fuel heat pump with existing furnace as backup.
- Standard efficiency ducted central heat pump replacement.
- High efficiency ducted central heat pump replacement.
- Ducted mini-split heat pump replacement.
- Standard efficiency ducted central heat pump replacement with 3kW PV system.

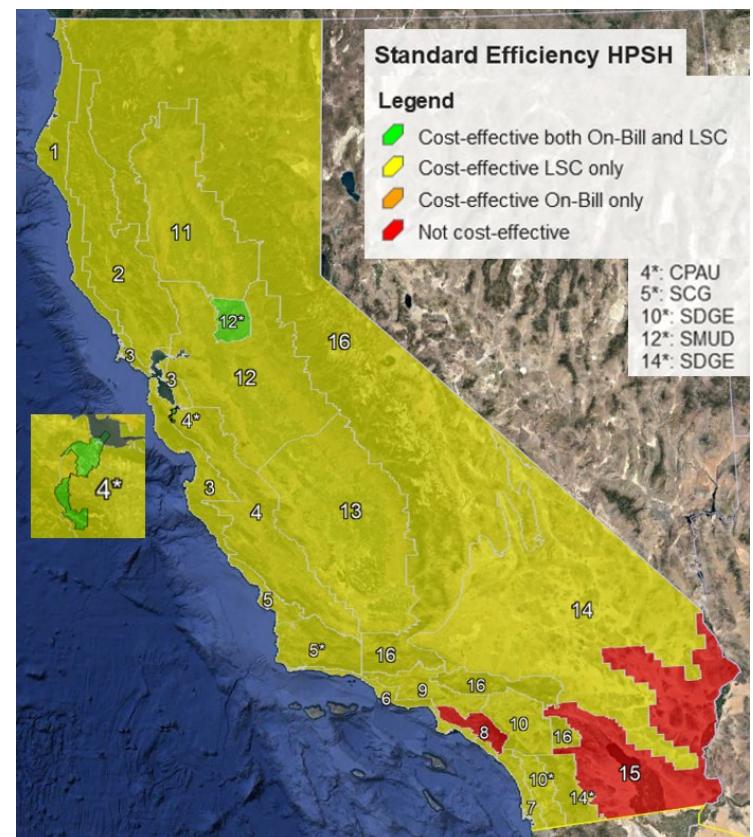
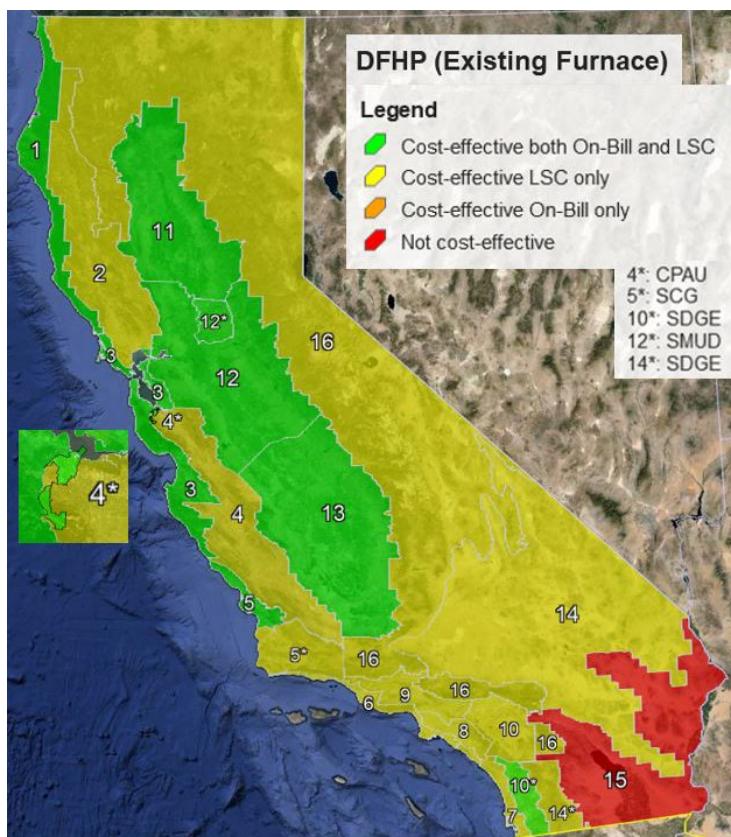


Figure 1: DFHP with Existing Furnace

Figure 2: Standard Efficiency HPSH

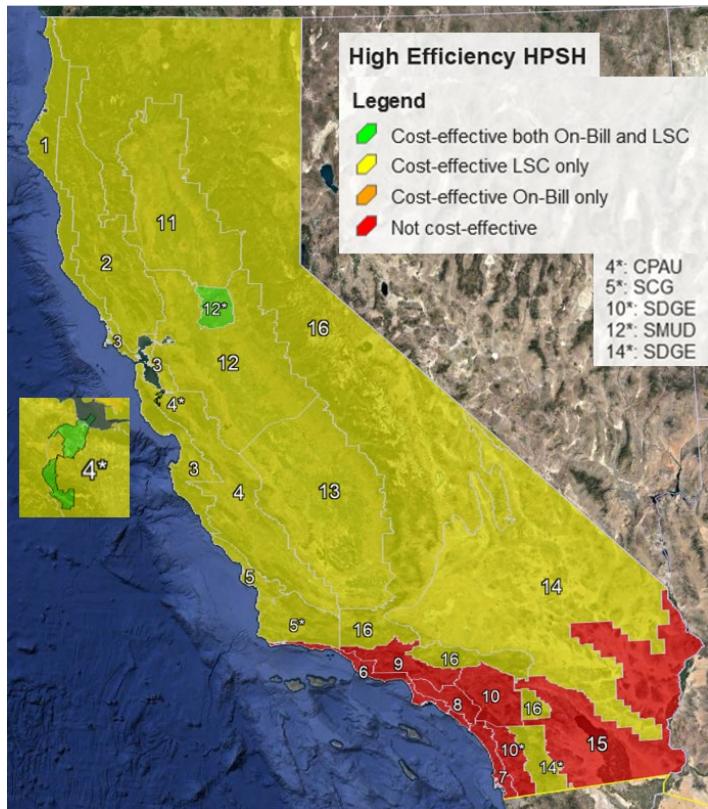


Figure 3: High Efficiency HPSH

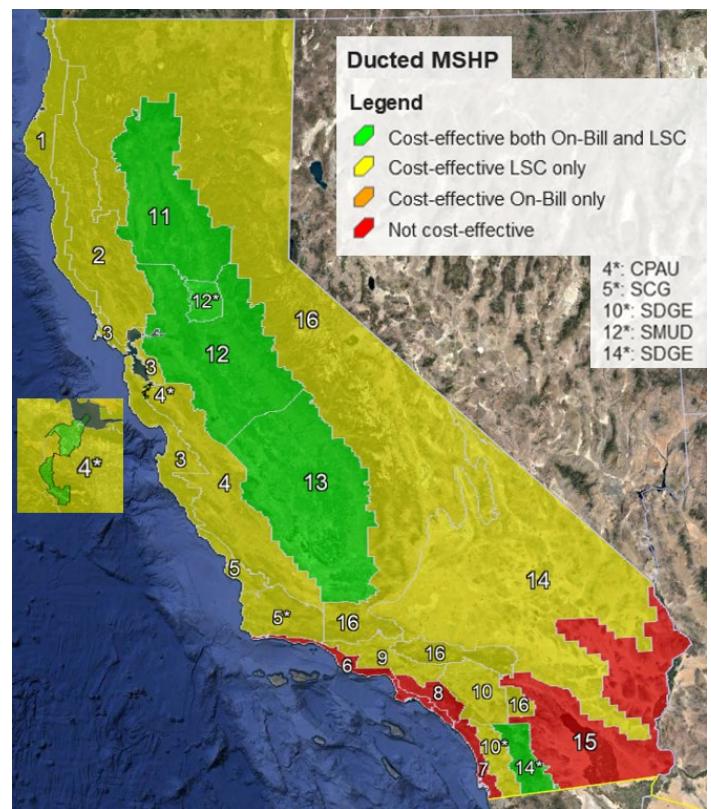


Figure 4: Ducted MSHP

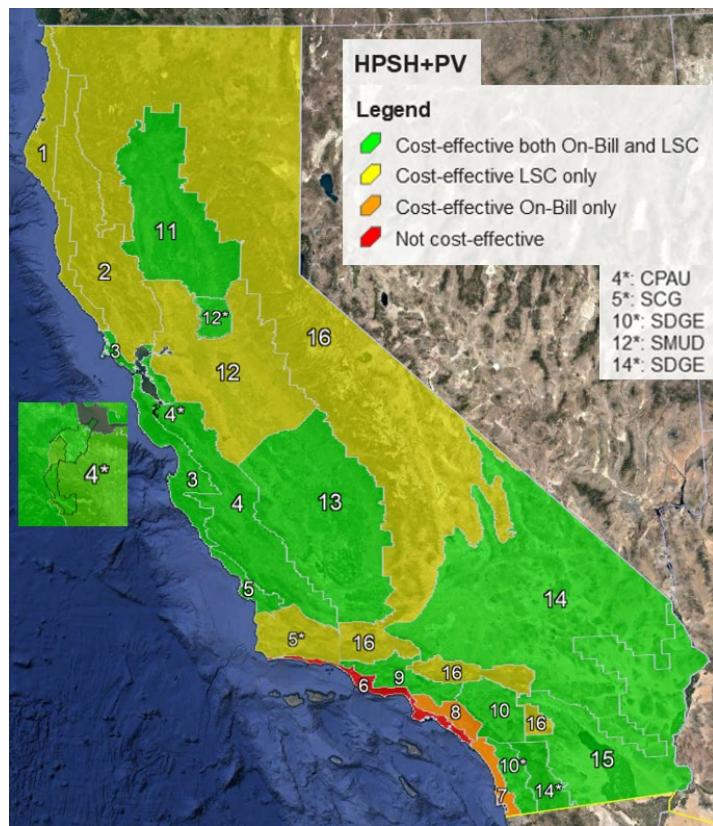


Figure 5: HPSH + PV

### 3.1.2 HPWH Measures

Figure 6 through Table 11 show the cost-effectiveness of water heater measures for the 1992-2010 vintage including the following cases. HPWH energy savings and LSC cost-effectiveness is not sensitive to home vintage but rather depends on the magnitude of hot water loads, which are typically driven by the number of occupants. On-Bill cost-effectiveness does vary slightly by vintage due to the impact of the electrification tariff relative to the load profile of the existing home. The impact is largest for the HPWH + PV case where On-Bill cost-effectiveness improves for older homes or homes with overall higher energy use resulting in less exports to the grid for a fixed size PV system.

- 240V federal minimum HPWH
- 240V market standard NEEA HPWH
- 120V market standard NEEA HPWH
- 240V federal minimum HPWH with 3kW PV

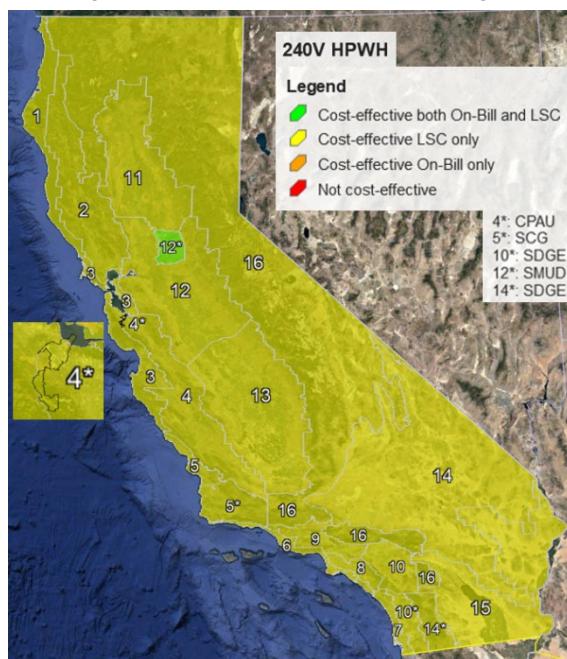


Figure 6: 240V Federal Minimum HPWH

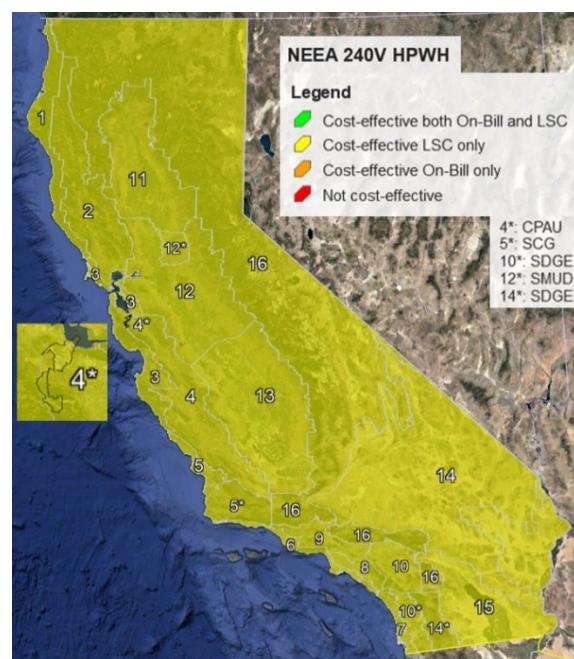


Figure 7: 240V Market Standard NEEA HPWH

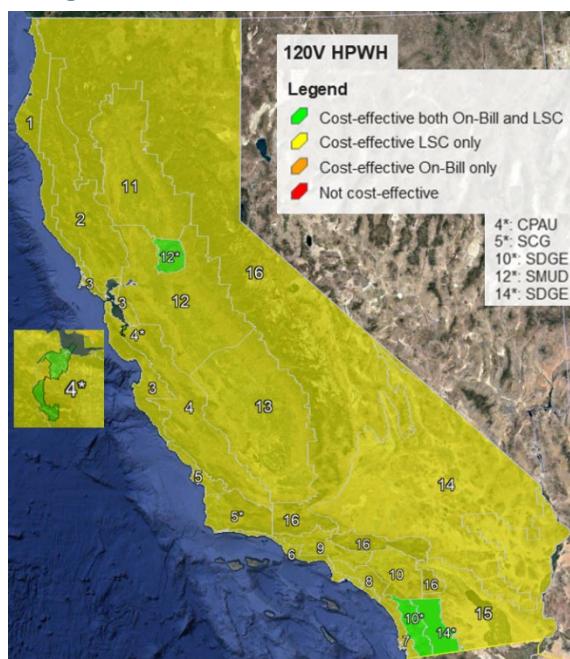


Figure 8: 120V Market Standard NEEA HPWH

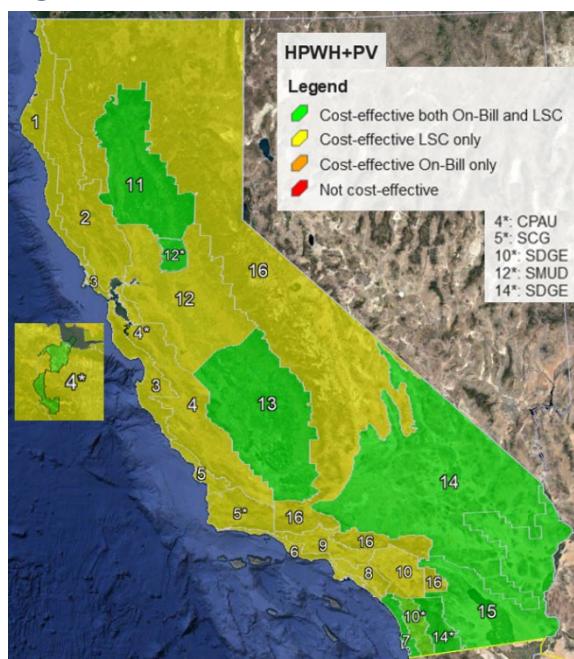
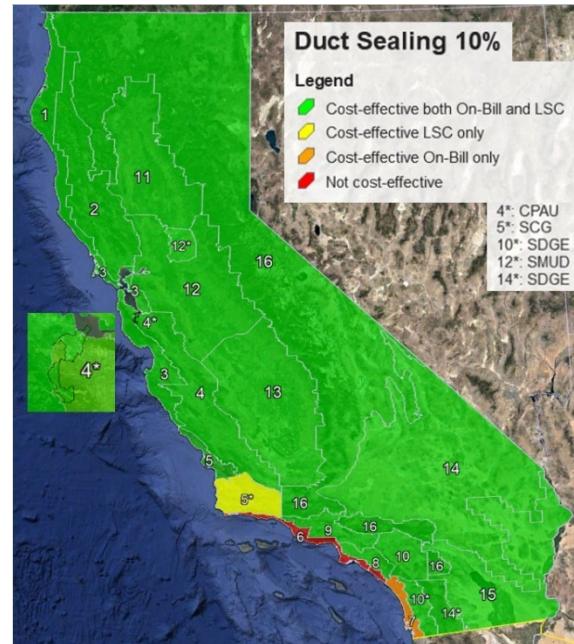
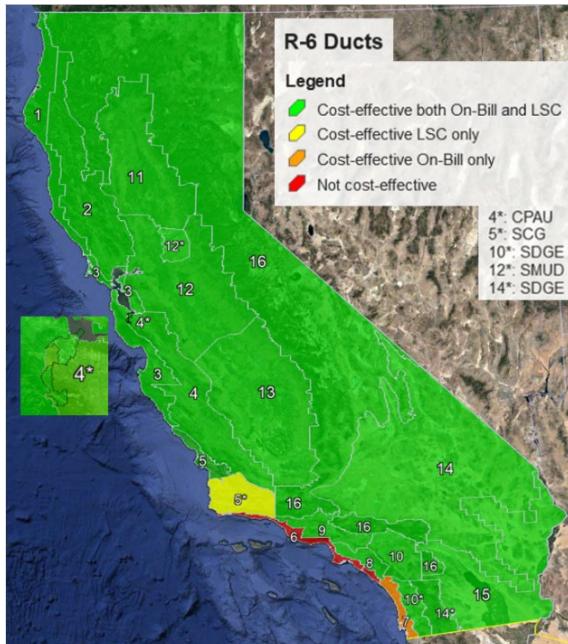


Figure 9: 240V Federal Minimum HPWH + PV

- Envelope and Duct Measures

Figure 10 through Figure 13 show the cost-effectiveness results of envelope and duct measures for the pre-1978 vintage including the following measures. The pre-1978 vintage is presented as representing the most favorable existing conditions for cost-effective upgrades. Newer homes with higher performing envelope may still benefit from these types of upgrade measures, but cost-effectiveness is reduced. Some measures, like R-13 wall insulation, aren't applicable to newer homes which would have been constructed originally with insulated walls.

- New R-6 ducts
- 10% duct leakage
- R-13 wall insulation
- R-49 attic insulation



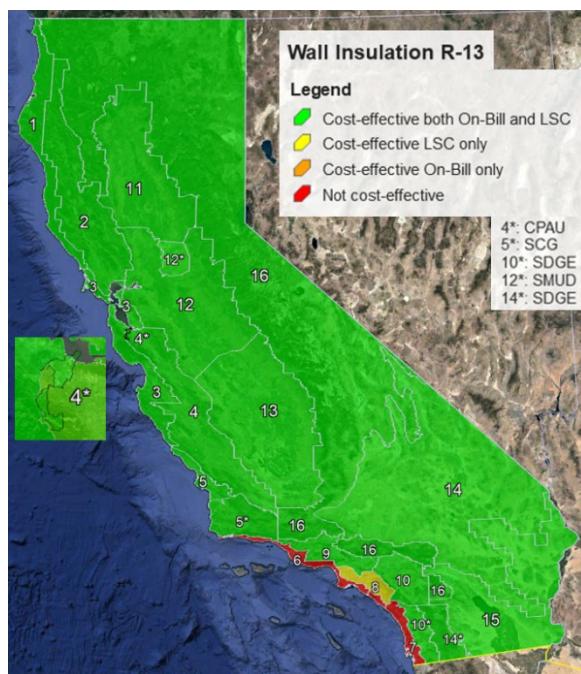


Figure 10: R-6 Ducts

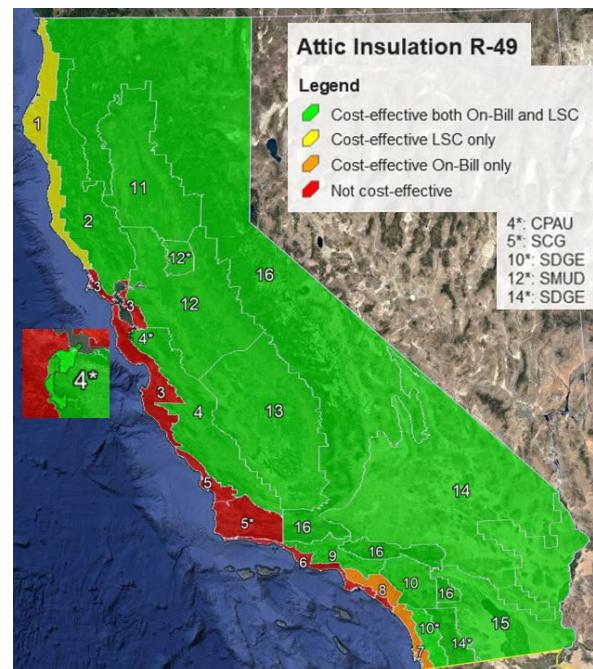


Figure 11: 10% Duct Leakage

Figure 12: R-13 Wall Insulation

Figure 13: R-49 Attic Insulation

### 3.2 Climate Zone Case Studies

To better understand the details of the results, a few climate zones were selected to provide a more detailed presentation of cost-effectiveness results. Section 3.2.1 through 3.2.3 show the first-year incremental cost, first-year utility savings, and NPV for a variety of cases. Section 3.2.4 shows the sensitivity of the cost effectiveness results due to varying utility escalation rates, the impact of CARE rates, future equipment cost assumptions, and the need for electrical panel upgrades. The climate zones were selected to be representative of areas of significant reach code activity. Please refer to the Cost-Effectiveness Explorer (Statewide Reach Codes, 2023) or the source dataset for the full analysis.

### 3.2.1 HPSH Cost-Effectiveness

Cost-effectiveness of heat pump space heating measures for Climate Zones 12 and 16 is summarized in Table 11 and Table 12 below. In Climate Zone 12, HPSH measures are cost-effective based on LSC in all cases except the ductless MSHP cases and are cost-effective On-Bill with SMUD rates in all cases except the DFHP case with a new furnace and the ductless MSHP cases. These measures are cost-effective On-Bill with PGE for the DFHP with an existing furnace and ducted MSHP measures. Climate Zone 16 provides an example of HPSH cost-effectiveness in a cold climate where almost all HPSH measures are cost effective based on LSC but not cost-effective On-Bill.

**Table 11. HPSH CZ 12 [1992-2010]**

Measure	First Incremental Cost	2025 LSC NPV	PGE		SMUD	
			First-year Utility Savings	On-Bill NPV	First-year Utility Savings	On-Bill NPV
DFHP Existing Furnace	\$1,960	\$7,093	(\$19)	\$1,633	\$247	\$7,693
DFHP New Furnace	\$4,023	\$3,915	(\$34)	(\$3,134)	\$234	\$2,979
HPSH (Std Efficiency)	\$1,172	\$6,990	(\$147)	(\$2,151)	\$246	\$6,812
HPSH (High Efficiency)	\$4,149	\$5,366	\$13	(\$3,368)	\$300	\$3,160
Ducted MSHP	\$1,421	\$9,136	\$10	\$378	\$298	\$6,951
Ductless MSHP (Std Efficiency)	\$13,336	(\$9,175)	\$30	(\$18,039)	\$276	(\$12,428)
Ductless MSHP (High Efficiency)	\$17,266	(\$6,753)	\$409	(\$15,853)	\$423	(\$15,532)
HPSH + PV	\$10,780	\$5,289	\$452	(\$59)	\$885	\$9,821

**Table 12. HPSH CZ 16 [1992-2010]**

Measure	First Incremental Cost	2025 LSC NPV	PGE	
			First-year Utility Savings	On-Bill NPV
DFHP Existing Furnace	\$2,397	\$7,289	(\$116)	(\$1,891)
DFHP New Furnace	\$4,757	\$2,457	(\$133)	(\$6,322)
HPSH (Std Efficiency)	\$2,725	\$11,142	(\$480)	(\$8,532)
HPSH (High Efficiency)	\$5,701	\$12,099	(\$204)	(\$7,125)
Ducted MSHP	\$2,155	\$16,554	(\$221)	(\$2,853)
Ductless MSHP (Std Efficiency)	\$13,336	(\$134)	(\$170)	(\$19,742)
Ductless MSHP (High Efficiency)	\$17,266	\$9,397	\$539	(\$10,031)
HPSH + PV	\$12,333	\$10,640	\$316	(\$1,949)

### 3.2.2 HPWH Cost-Effectiveness

Cost-effectiveness of heat pump water heating measures for Climate Zones 12 and 16 is summarized in Table 13 and Table 14 below. This sensitivity study looks at a wider range of HPWH tank locations and whether or not the unit has ducting for supply and exhaust air. All the HPWH measures in Climate Zones 12 and 16 are cost effective based on LSC.

**Table 13. HPWH CZ 12 [1992-2010]**

Measure	First Incremental Cost	2025 LSC NPV	PGE		SMUD	
			First-Year Utility Savings	On-Bill NPV	First-Year Utility Savings	On-Bill NPV
240V Fed. Min. HPWH	\$4,332	\$3,536	(\$213)	(\$8,738)	\$191	\$477
240V Market Std. NEEA HPWH	\$5,193	\$4,304	(\$82)	(\$7,164)	\$230	(\$56)
240V Market Std. NEEA HPWH + DR	\$5,193	\$5,536	(\$21)	(\$5,773)	\$248	\$362
120V Market Std. NEEA HPWH	\$2,893	\$9,730	(\$2)	(\$1,651)	\$254	\$4,203
240V Fed. Min. HPWH (Exterior Closet)	\$4,751	\$2,834	(\$224)	(\$9,431)	\$186	(\$78)
240V Fed. Min. HPWH (Interior Closet)	\$4,413	\$3,123	(\$71)	(\$6,138)	\$188	(\$235)
240V Fed. Min. HPWH (Interior Closet, ducted)	\$5,492	\$3,359	(\$202)	(\$9,505)	\$205	(\$231)
240V Fed. Min. HPWH + PV	\$13,940	\$3,567	\$577	(\$2,300)	\$831	\$3,486

**Table 14. HPWH CZ 16 [1992-2010]**

Measure	First Incremental Cost	2025 LSC NPV	PGE	
			First-Year Utility Savings	On-Bill NPV
240V Fed. Min. HPWH	\$4,332	\$4,186	(\$250)	(\$9,307)
240V Market Std. NEEA HPWH	\$5,193	\$4,088	(\$160)	(\$8,652)
240V Market Std. NEEA HPWH + DR	\$5,193	\$5,653	(\$79)	(\$6,804)
120V Market Std. NEEA HPWH	\$2,893	\$10,646	(\$13)	(\$1,602)
240V Fed. Min. HPWH (Exterior Closet)	\$4,751	\$3,317	(\$268)	(\$10,154)
240V Fed. Min. HPWH (Interior Closet)	\$4,413	\$5,004	(\$18)	(\$4,690)
240V Fed. Min. HPWH (Interior Closet, ducted)	\$5,492	\$4,857	(\$202)	(\$9,174)
240V Fed. Min. HPWH + PV	\$13,940	\$5,049	\$620	(\$1,043)

### 3.2.3 Envelope & Duct Improvement Cost-Effectiveness

Cost-effectiveness of envelope and duct measures for Climate Zones 3, 10, and 12 is summarized in Table 15 through Table 17.

**Table 15. Envelope and Duct Measures CZ 3 [Pre-1978]**

Measure	First Incremental Cost	2025 LSC NPV	PG&E	
			First-year Utility Savings	On-Bill NPV
R-6 Ducts	\$4,808	\$2,851	\$188	\$463
R-8 Ducts	\$6,311	\$1,747	\$198	(\$776)
10% Duct Sealing	\$2,590	\$1,956	\$104	\$397
R-13 Wall Insulation	\$2,950	\$3,476	\$144	\$1,221
R-38 Attic Insulation	\$6,762	(\$1,567)	\$127	(\$3,178)
R-49 Attic Insulation	\$7,446	(\$1,768)	\$139	(\$3,520)
R-30 Raised Floor Insulation	\$4,113	\$9,008	\$224	\$2,975
Cool Roof (0.20 Ref)	\$893	(\$2,419)	(\$18)	(\$1,811)

**Table 16. Envelope and Duct Measures CZ 10 [Pre-1978]**

Measure	First Incremental Cost	2025 LSC NPV	SCE/SCG		SDGE	
			First-year Utility Savings	On-Bill NPV	First-year Utility Savings	On-Bill NPV
R-6 Ducts	\$4,808	\$7,463	\$783	\$13,168	\$1,100	\$22,155
R-8 Ducts	\$6,311	\$6,326	\$800	\$12,076	\$1,125	\$21,268
10% Duct Sealing	\$2,590	\$3,438	\$370	\$5,969	\$518	\$10,166
R-13 Wall Insulation	\$2,950	\$1,795	\$179	\$1,476	\$250	\$3,494
R-38 Attic Insulation	\$6,762	\$664	\$416	\$2,951	\$582	\$7,654
R-49 Attic Insulation	\$7,446	\$796	\$467	\$3,435	\$655	\$8,756
R-30 Raised Floor Insulation	\$4,113	(\$999)	(\$29)	(\$4,235)	(\$46)	(\$4,687)
Cool Roof (0.20 Ref)	\$893	\$428	\$174	\$2,647	\$246	\$4,656

**Table 17. Envelope and Duct Measures CZ 12 [Pre-1978]**

Measure	First Incremental Cost	2025 LSC NPV	PG&E		SMUD	
			First-year Utility Savings	On-Bill NPV	First-year Utility Savings	On-Bill NPV
R-6 Ducts	\$4,808	\$11,609	\$804	\$14,727	\$413	\$5,816
R-8 Ducts	\$6,311	\$10,722	\$828	\$13,849	\$427	\$4,711
10% Duct Sealing	\$2,590	\$6,418	\$397	\$7,280	\$222	\$3,281
R-13 Wall Insulation	\$2,950	\$5,774	\$262	\$4,054	\$187	\$2,342
R-38 Attic Insulation	\$6,762	\$3,727	\$499	\$5,461	\$261	\$19
R-49 Attic Insulation	\$7,446	\$4,092	\$552	\$6,063	\$288	\$33
R-30 Raised Floor Insulation	\$4,113	\$5,245	\$27	(\$1,176)	\$156	\$1,175
Cool Roof (0.20 Ref)	\$893	(\$354)	\$154	\$2,123	\$44	(\$386)

### 3.2.4 Sensitivities

Table 18 shows the On-Bill NPV results of Climate Zone 12 with PG&E utility rates and the impacts of escalation rates, and CARE rates. The “Standard Results” in Table 18 assumes the escalation rates used in the analysis presented elsewhere in this report. Table 19 shows the impact of electrical panel upgrades. The “Standard Results” in Table 19 does not assume a panel upgrade is required.

**Table 18. Sensitivity Analysis Results for On-Bill NPV Cost-Effectiveness in Climate Zone 12, PG&E**

Measure	Vintage	Standard Results	2025 LSC Escalation	CARE
DFHP Existing Furnace	1992-2010	\$1,063	\$8,443	\$1,884
DFHP New Furnace	1992-2010	(\$6,770)	\$383	(\$5,846)
HPSH (Std Efficiency)	1992-2010	(\$2,151)	\$6,011	(\$220)
HPSH (High Efficiency)	1992-2010	(\$3,368)	\$4,987	(\$2,721)
Ducted MSHP	1992-2010	\$378	\$8,729	\$1,057
Ductless MSHP (Std Efficiency)	1992-2010	(\$18,039)	(\$10,732)	(\$17,623)
Ductless MSHP (High Efficiency)	1992-2010	(\$15,853)	(\$8,091)	(\$18,460)
HPSH + PV	1992-2010	(\$59)	\$8,822	(\$1,255)
240V Fed. Min. HPWH	1992-2010	(\$8,738)	(\$2,433)	(\$6,448)
240V Market Std. NEEA HPWH	1992-2010	(\$7,164)	(\$694)	(\$5,918)
240V Market Std. NEEA HPWH + DR	1992-2010	(\$5,773)	\$770	(5,014)
120V Market Std. NEEA HPWH	1992-2010	(\$1,651)	\$4,930	(1,038)
240V Fed. Min. HPWH (Exterior Closet)	1992-2010	(\$9,431)	(\$3,184)	(\$7,055)
240V Fed. Min. HPWH (Interior Closet)	1992-2010	(\$6,138)	(\$1,000)	(\$5,098)
240V Fed. Min. HPWH (Interior Closet, ducted)	1992-2010	(\$9,505)	(\$2,836)	(\$7,271)
240V Fed. Min. HPWH + PV	1992-2010	(\$2,300)	\$4,952	(\$4,858)
R-6 Ducts	Pre-1978	\$14,727	\$18,685	\$8,592
R-8 Ducts	Pre-1978	\$13,849	\$17,990	\$7,532
10% Duct Sealing	Pre-1978	\$7,280	\$9,752	\$4,294
R-13 Wall Insulation	Pre-1978	\$4,054	\$6,898	\$2,196
R-38 Attic Insulation	Pre-1978	\$5,461	\$8,126	\$1,668
R-49 Attic Insulation	Pre-1978	\$6,063	\$8,978	\$1,864
R-30 Raised Floor Insulation	Pre-1978	(\$1,776)	\$2,468	(\$1,602)
Cool Roof (0.20 Ref)	Pre-1978	\$2,123	\$1,848	\$851

**Table 19. Electric Panel Upgrade Sensitivity for CZ 12 [1992-2010]**

Measure	Standard Results		Electric Panel Upgrade	
	On-Bill NPV	LSC NPV	On-Bill NPV	LSC NPV
HPSH (Std Efficiency)	(\$2,151)	\$6,990	(\$4,931)	\$4,210
240V Fed. Min. HPWH	(\$8,738)	\$3,536	(\$11,624)	\$756

### 3.3 Gas Pathways for Heat Pump Replacements

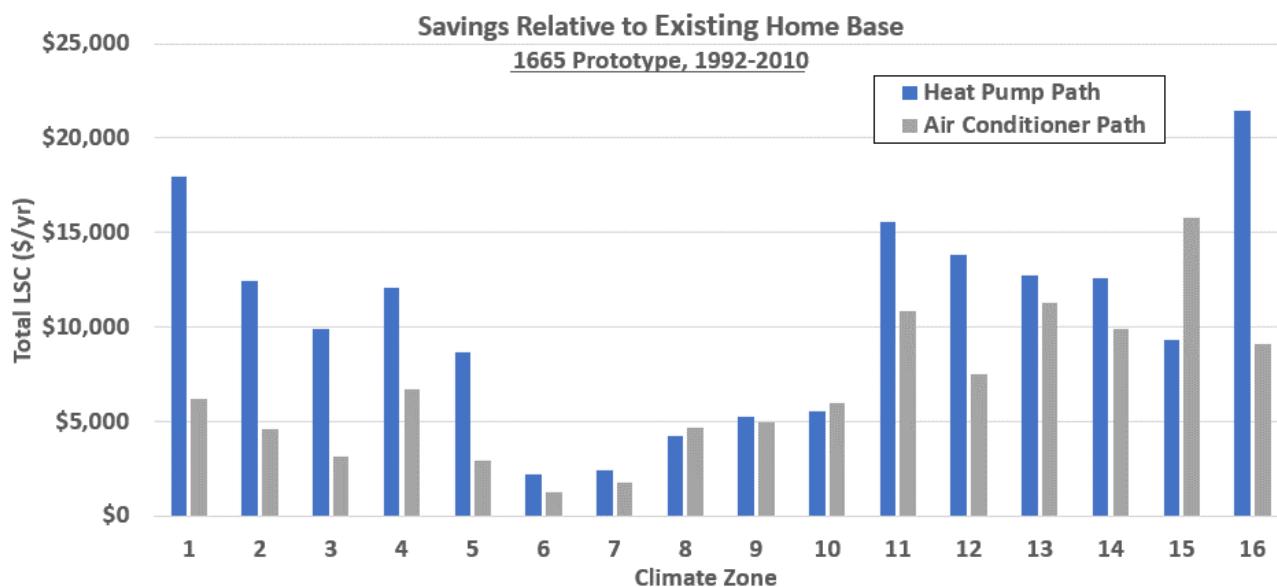
Many jurisdictions are exploring policy options to accelerate the decarbonization of existing homes. A recent Ninth Circuit Court ruling in *California Rest. Ass'n v. City of Berkeley*<sup>20</sup> invalidated Berkeley's ordinance banning the installation of gas infrastructure in new construction. The ruling stated that the ordinance effectively banned covered products and was preempted by the Energy Policy and Conservation Act ("EPCA"), 42 U.S.C. § 6297(c). Given the possible impacts of that ruling, the Reach Codes Team analyzed policy options targeting equipment replacements that allow for the installation of either electric or gas-fueled equipment. These packages include gas equipment combined with additional efficiency measures resulting in options that are reasonably energy or LSC cost equivalent, to the extent feasible.

For space heating, the heat pump path is a DFHP (existing furnace).. The gas pathway is a new air conditioner with the following list of efficiency upgrades:

- 400 cfm/ton system airflow (HERS verified).
- 0.35 W/cfm fan efficacy (HERS verified).
- Refrigerant charge verification (HERS verified).
- R-8 ducts, 5% leakage (HERS verified).
- R-49 (from R-30) attic insulation.
- Air sealing of the ceiling from 7 to 6.5 ACH50.

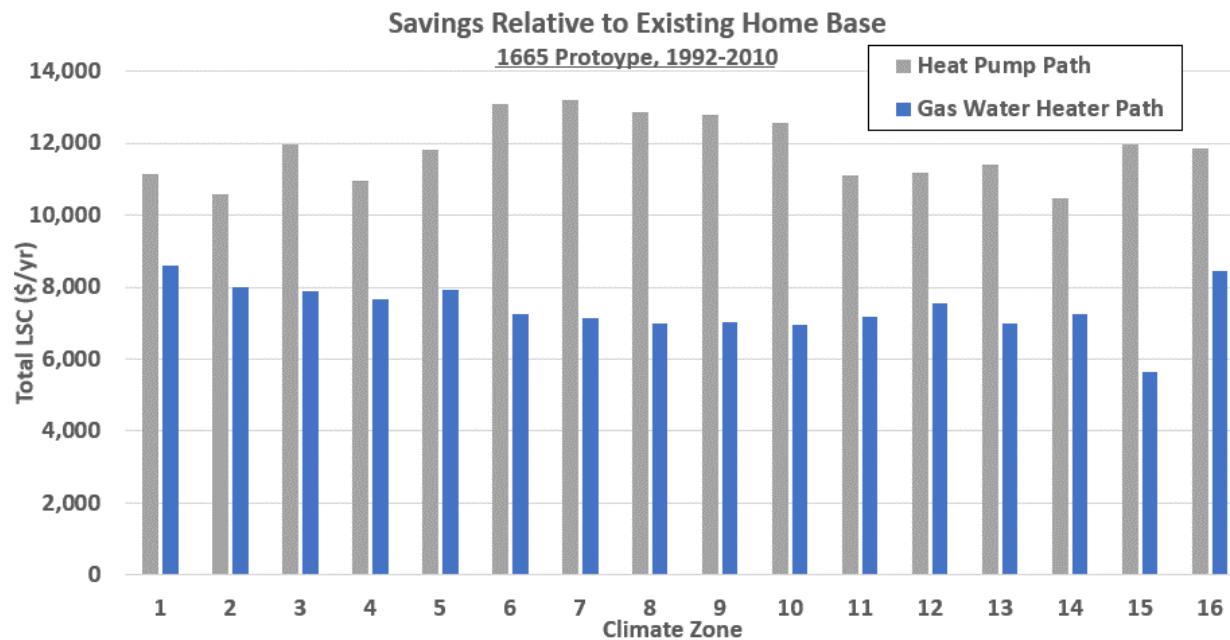
The two pathways are presented in Figure 14 comparing total LSC energy use relative to the existing home for the 1992-2010 vintage. In most climate zones, the DFHP (existing furnace) path results in higher energy savings, in the milder climates the air conditioner path saves marginally more energy. A 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 air conditioner as long as the performance measures listed above are met. Note that in this analysis a DFHP (existing furnace) was used; however, a reach code could require a different heat pump measure for the heat pump path. This approach aligns with the CEC's proposal for the 2025 Title 24 code cycle for heat pump alterations in single family homes (California Energy Commission, 2023).

<sup>20</sup> *California Rest. Ass'n v. City of Berkeley*, 65 F.4th 1045 (9th Cir. 2023) amended by 89 F.4th 1094 (9th Cir. 2024).



**Figure 14. Heat pump space heater path compared to the air conditioner path.**

For water heating, the federal minimum HPWH case was used to develop the package. The HPWH was compared to a new gas storage water heater with a 50% solar thermal backup system.



**Figure 15. Heat pump water path compared to gas with solar thermal.**

The two pathways are presented in Figure 15 comparing total LSC energy use relative to the existing home for the 1992-2010 vintage. In all climate zones, the heat pump path results in higher energy savings than the gas path. A reach code that establishes requirements when a water heater is replaced could allow for either a HPWH to be installed or a gas water heater in combination with a solar thermal system that meets the solar fraction requirements listed above.

## 4 Recommendations and Discussion

This analysis evaluated the feasibility and cost-effectiveness of retrofit measures in California existing homes built before 2010. The Statewide Reach Codes Team used both On-Bill and LSC-based LCC 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. Envelope measures. Improving envelope performance is very cost-effective in many older homes. In addition to reducing utility costs these measures provide many other benefits such as improving occupant comfort and satisfaction and increasing a home's ability to maintain temperatures during extreme weather events and power outages. Below is a discussion of the results of specific measures.
  - a. Adding attic insulation is cost effective based on both LSC and On-Bill in many climate zones in homes with no more than R-19 existing attic insulation levels. Increasing attic insulation from R-30 to R-49 was still found to be cost-effective based on at least one metric in the colder and hotter climates of Climate Zone 10 (SDG&E territory only) through 16.
  - b. Insulating existing uninsulated walls is very cost-effective based on both metrics everywhere except Climate Zones 6 and 7 (in Climate Zone 8 it's only cost-effective based on LSC).
  - c. Adding R-19 or R-30 floor insulation is cost-effective based on LSC in the older two vintages (Pre-1978 and 1978-1991) in all climate zones except Climate Zones 6-10.
  - d. Replacing old single pane windows with new high-performance windows has a very high cost and is typically not done for energy savings alone. However, energy savings are substantial and justify cost-effectiveness of this measure based on at least one metric in Climate Zones 4, 8 through 12 (PG&E territory only), and 13 through 16.
  - e. At time of roof replacement, a cool roof with an aged solar reflectance of 0.25 was found to be cost-effective in Climate Zones 4, 6 through 12 (PG&E territory only), and 13 through 15. When the roof deck is replaced during a roof replacement, adding a radiant barrier is low cost and provides substantial cooling energy savings to be cost-effective in almost all climate zones and homes.
2. Duct measures: Many older homes have old, leaky duct systems that should be replaced when they reach the end of life, typically 20-30 years. In this case, installing new ducts was found to be cost-effective based on at least one metric (both in most cases) everywhere except mild Climate Zone 7 and Climate Zones 5 and 6 in the 1978-1991 vintage. If duct systems still have remaining life they should be sealed and tested to meet 10% leakage or lower; however, duct upgrades alone were only found to be cost-effective for newer homes in Climate Zones 10 (SDG&E territory only), 11, and 13 through 16. Duct upgrades may be able to be coupled with other measures to reduce the cost.
3. Heat pump space heating: HPSHs were found to be LSC cost-effective in many cases. The DFHP (existing furnace) was LSC cost-effective everywhere except Climate Zone 15. The HPSH was LSC cost-effective everywhere except Climate Zones 8 and 15.
  - a. Challenges to On-Bill cost-effectiveness include higher first costs and higher first-year utility costs due to higher electricity tariffs relative to gas tariffs. SMUD and CPAU are two exceptions where first year utility costs are lower for heat pumps than for gas equipment. Table 11 shows the impact of utility rates on cost-effectiveness of HPSH where the standard and high efficiency HPSH and the HPSH + PV measures are cost-effective under SMUD but not PG&E. Even with higher first year utility bills, there were some cases that still proved On-Bill cost-effective including the DFHP with an existing furnace in the central valley and northern coastal PG&E territories, the ducted MSHP in the central valley as well as Climate Zone 14 in SDG&E territory, and the HPSH + PV measure in CZ 3-5 (PGE), 7-11, and 12 (SMUD) – 15.
  - b. The ductless MSHPs, evaluated for homes with existing ductless systems, were only found to be cost-effective based on either metric in Climate Zones 1 and 16. Ductless MSHPs have a high incremental cost because it is a more sophisticated system than the base model of a wall furnace with a window AC unit. However, the ductless MSHP would provide greater comfort benefits if properly installed to

directly condition all habitable spaces (as is required under the VCHP compliance credit as evaluated in this study) which may be an incentive for a homeowner to upgrade their system.

- c. Higher efficiency equipment lowered utility costs in all cases and improved cost-effectiveness in many cases, particularly with a ducted MSHP.

4. Heat pump water heating: All the HPWH measures were LSC cost-effective in all climate zones. Most measures were not On-Bill cost-effective with the exception of the HPWH + PV which was cost-effective On-Bill in CPAU, SMUD, and SDG&E territories in addition to Climate Zones 11, 13, 14, and 15. The HPWH measures share many of the same challenges as the HPSH measures to achieving cost-effectiveness including high first costs and utility rates and assumptions. Table 13 shows the impact of utility rates on cost-effectiveness where some HPWH measures are cost-effective under SMUD utility rates but are not cost-effective anywhere under PG&E rates in Climate Zone 12.

- a. Various HPWH locations were also explored, however there are some factors outside of cost-effectiveness that should also be considered.
  - i. HPWHs in the conditioned space can provide benefits such as free cooling during the summer, reduced tank losses, and shorter pipe lengths, and in some cases show improved cost-effectiveness over garage located HPWHs. However, there are various design considerations such as noise, comfort concerns, and condensate removal. Ducting the inlet and exhaust air resolves comfort concerns but adds costs and complexity. Split heat pump water heaters address these concerns, but currently there are limited products on the market and there is a cost premium relative to the packaged products.
  - ii. Since HPWHs extract heat from the air and transfer it to water in the storage tank, they must have adequate ventilation to operate properly. Otherwise, the space cools down over time, impacting the HPWH operating efficiency. This is not a problem with garage installations but needs to be considered for water heaters located in interior or exterior closets. For the 2025 Title 24 code the CEC is proposing that all HPWH installations meet mandatory ventilation requirements (California Energy Commission, 2023).

5. The contractor surveys revealed overall higher heat pump costs than what has been found in previous analyses. This could be due to incentive availability raising demand for heat pumps and thereby increasing the price. This price increase may be temporary and may come down once the market stabilizes. There are also new initiatives to obtain current costs including the TECH Clean California program<sup>21</sup> that publishes heat pump data and costs; however, at the time of this analysis, the TECH data did not contain incremental costs because it only had the heat pump costs but not the gas base case costs.

6. Table 18 shows how CARE rates and escalation rate assumptions will impact cost-effectiveness.

- a. Applying CARE rates in the IOU territories has the overall impact to increase utility cost savings for an all-electric building compared to a code compliant mixed fuel building, improving On-Bill cost-effectiveness. This is due to the CARE discount on electricity being higher than that on gas. The reverse occurs with efficiency measures where lower utility rates reduce savings and subsequently reduce cost-effectiveness.
- b. If gas tariffs are assumed to increase substantially over time, in-line with the escalation assumption from the 2025 LSC development, cost-effectiveness substantially improves for the heat pump measures over the 30-year analysis period and many cases become cost-effective that were not found to be cost-effective under the CPUC / 2022 TDV escalation scenario. There is much uncertainty surrounding future tariff structures as well as escalation values. While it's clear that gas rates will increase, how much and how quickly is not known. Future electricity tariff structures are expected to evolve over time, and the CPUC has an active proceeding to adopt an income-graduated fixed charge that benefits low-income customers and supports electrification measures for all customers.<sup>22</sup> The CPUC will decide in mid-2024 and the new rates are expected to be in place later that year or in 2025.

<sup>21</sup> TECH Public Reporting Home Page ([techcleanca.com](http://techcleanca.com))

<sup>22</sup> <https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/electric-costs/demand-response-dr/demand-flexibility-rulermaking>

While the anticipated impact of this rate change is lower volumetric electricity rates, the rate design is not finalized. While lower volumetric electricity rates provide many benefits, it also will make building efficiency measures harder to justify as cost-effective due to lower utility bill cost savings.

7. Under NBT, utility cost savings for PV are substantially less than what they were under prior net energy metering rules (NEM 2.0); however, savings are sufficient to be On-Bill cost-effective in all climate zones except Climate Zones 1 through 3 and 5 through 6.
  - a. Combining a heat pump with PV allows the additional electricity required by the heat pump to be offset by the PV system while also increasing on-site utilization of PV generation rather than exporting the electricity back to the grid at a low rate.
  - b. While not evaluated in this study, coupling PV with battery systems can be very advantageous under NBT increasing utility cost savings because of improved on-site utilization of PV generation and fewer exports to the grid.

#### Recommendations:

1. There are various approaches for jurisdictions who are interested in reach codes for existing buildings. Some potential approaches are listed below along with key considerations.
  - a. Prescriptive measures: Non-preempted measures that are found to be cost-effective may be prescriptively required in a reach code. One example of this type of ordinance is a cool roof requirement at time of roof replacement. Another example is requiring specific cost-effective measures for larger remodels, such as high-performance windows when new windows are installed or duct sealing and testing where ducts are in unconditioned space.
  - b. Replacement equipment: This flavor of reach code sets certain requirements at time of equipment replacement. This study evaluated space heating and water heating equipment. Where a heat pump measure was found to be cost-effective based on either LSC or On-Bill, this may serve as the basis of a reach code given the following considerations.
    - i. Where reach codes reduce energy usage and are not just fuel switching, cost-effectiveness calculations are required and must be based on equipment that does not exceed the federal minimum efficiency requirements.
    - ii. Where reach codes are established using cost-effectiveness based on LSC, utility bill impacts and the owner's first cost should also be reviewed and considered.
    - iii. A gas path should also be prescriptively allowed to safely satisfy federal preemption requirements considering the CRA v. Berkeley case.<sup>23</sup> Additional requirements may apply to the gas path, as described in Section 3.3, as long as the paths are reasonably energy or cost equivalent.
  - c. "Flexible Path", minimum energy savings target: This flexible approach establishes a target for required energy savings based on a measure or a set of measures that were found to be cost-effective based on either LSC or On-Bill. A points menu compares various potential upgrades ranging from efficiency, PV, and fuel substitution measures, based on site or source energy savings. The applicant must select upgrades that individually or in combination meet the minimum energy savings target. The measures used to set the target should be non-preempted measures.
2. Equipment replacement ordinances should consider appropriate exceptions for scenarios where it will be challenging to meet the requirements, such as location of the HPWH, total project cost limitations, or the need for service panel upgrades that wouldn't have been required as part of the proposed scope of work in absence of the reach code.
3. Consider extending relevant proposals made by the CEC for the 2025 Title 24 code (California Energy Commission, 2023) in ordinances that apply under the 2022 Title 24 code, such as the following:
  - a. Mandatory ventilation requirements for HPWH installations (Section 110.3(c)7).

<sup>23</sup> <https://www.publichealthlawcenter.org/sites/default/files/2024-01/CRA-v-Berkeley-Ninth-Circuit-Opinion-Jan2024.pdf>

- b. Requirement for HERS verified refrigerant charge verification for heat pumps in all climate zones (Table 150.1-A<sup>24</sup>).
4. When evaluating reach code strategies, the Reach Codes Team recommends that jurisdictions consider combined benefits of energy efficiency alongside electrification. Efficiency and electrification have symbiotic benefits and are both critical for decarbonization of buildings. As demand on the electric grid is increased through electrification, efficiency can reduce the negative impacts of additional electricity demand on the grid, reducing the need for increased generation and storage capacity, as well as the need to upgrade upstream transmission and distribution equipment.
5. Education and training can play a critical role in ensuring that heat pumps are installed, commissioned, and controlled properly to mitigate grid impacts and maximize occupant satisfaction. Below are select recommended strategies.
  - a. The Quality Residential HVAC Services Program<sup>25</sup> is an incentive program to train California contractors in providing quality installation and maintenance while advancing energy-efficient technologies in the residential HVAC industry. Jurisdictions can market this to local contractors to increase the penetration of contractors skilled in heat pump design and installation.
  - b. Educate residents and contractors of available incentives, tax credits, and financing opportunities.
  - c. Educate contractors on code requirements. Energy Code Ace provides free tools, trainings, and resource to help Californians comply with the energy code. Contractors can access interactive compliance forms, fact sheets, and live and recorded trainings, among other things, on the website: <https://energycodeace.com/>. Jurisdictions can reach out to Energy Code Ace directly to discuss offerings.
6. Health and safety
  - a. Combustion Appliance Safety and Indoor Air Quality: Implementation of some of the recommended measures will affect the pressure balance of the home which can subsequently impact the safe operation of existing combustion appliances as well as indoor air quality. Buildings with older gas appliances can present serious health and safety problems which may not be addressed in a remodel if the appliances are not being replaced. It is recommended that the building department require inspection and testing of all combustion appliances located within the pressure boundary of the building after completion of retrofit work that involves air sealing or insulation measures.
  - b. Jurisdictions may consider requiring mechanical ventilation in homes where air sealing has been conducted. In older buildings, outdoor air is typically introduced through leaks in the building envelope. After air sealing a building, it may be necessary to forcefully bring in fresh outdoor air using supply and/or exhaust fans to minimize potential issues associated with indoor air quality.

<sup>24</sup> This requirement does not show up in the Express Terms for alterations in Section 150.2(b)1F, but the Statewide Reach Codes Team expects that it will be added to the next release of the proposed code language in the 45-day language as it aligns with the proposal made by the Codes and Standards Enhancement Team (Statewide CASE Team, 2023).

<sup>25</sup> <https://qualityhvac.frontierenergy.com/>

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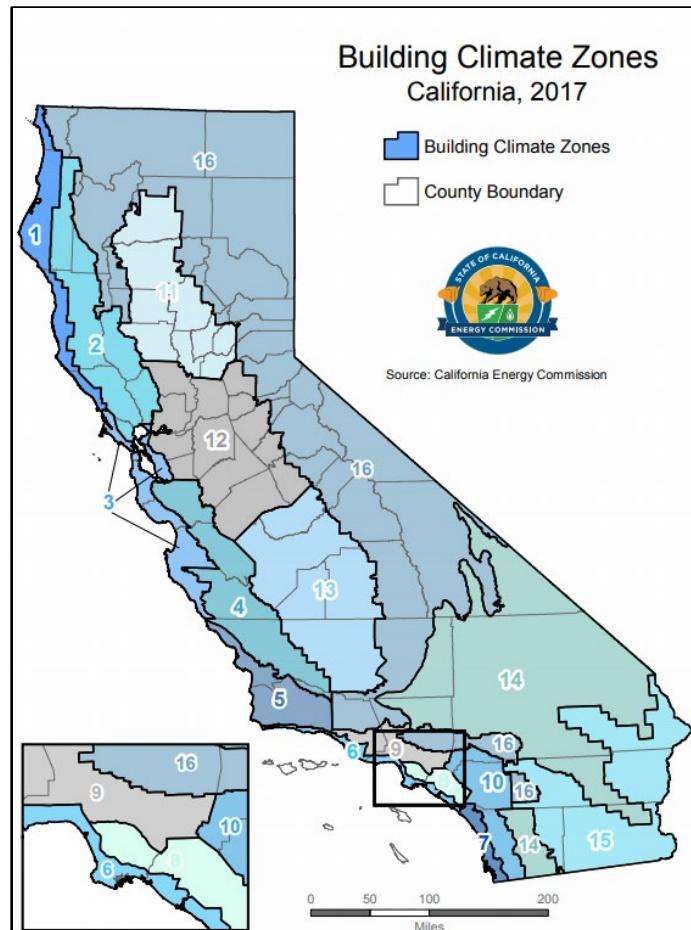
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## 6 Appendices

### 6.1 Map of California Climate Zones

Climate zone geographical boundaries are depicted in Figure 16. The map in Figure 16 along with a zip-code search directory is available at: [https://ww2.energy.ca.gov/maps/renewable/building\\_climate\\_zones.html](https://ww2.energy.ca.gov/maps/renewable/building_climate_zones.html)



**Figure 16. Map of California climate zones.**

## 6.2 Utility Rate Schedules

The Reach Codes Team used the CA IOU and POU rate tariffs detailed below to determine the On-Bill savings for each package. The California Climate Credit was applied for both electricity and natural gas service for the IOUs using the 2023 credits shows below.<sup>26</sup> The credits were applied to reduce the total calculated annual bill, including any fixed fees or minimum bill amounts.

### 2023 Electric California Climate Credit Schedule

	February or March	April	May	June	July	Aug	Sept	Oct
<b>PG&amp;E</b>	\$38.39							\$38.39
<b>SCE</b>	\$71.00							\$71.00
<b>SDG&amp;E</b>	\$60.70							\$60.70

## Residential Natural Gas California Climate Credit

In 2023, the 2023 Natural Gas California Climate Credit will be distributed in February or March instead of April.

	2018‡	2019	2020	2021	2022	2023	Total Value Received Per Household 2018-2023
<b>PG&amp;E</b>	\$30	\$25	\$27	\$25	\$48	\$52.78	<b>\$208</b>
<b>SDG&amp;E</b>	*	\$34	\$21	\$18	\$43	\$43.40	<b>\$162</b>
<b>Southwest Gas</b>	\$22	\$25	\$27	\$28	\$49	\$56.35	<b>\$207</b>
<b>SoCalGas</b>	*	\$50	\$26	\$22	\$44	\$50.77	<b>\$194</b>

Electricity rates reflect the most recently approved tariffs. Monthly gas rates were estimated based on recent gas rates (November 2023) and a curve to reflect how natural gas prices fluctuate with seasonal supply and demand. The seasonal curve was estimated from monthly residential tariffs between 2014 and 2023 (between 2017 and 2023 for CPAU). 12-month curves were created from monthly gas rates for each of the ten years (Seven years for CPAU). These annual curves were then averaged to arrive at an average normalized annual curve. This was conducted separately for baseline and excess energy rates. Costs used in this analysis were then derived by establishing the most recent baseline and excess rate from the latest tariff as a reference point (November 2023), and then using the normalized curve to estimate the cost for the remaining months relative to the reference point rate.

<sup>26</sup> <https://www.cpuc.ca.gov/industries-and-topics/natural-gas/greenhouse-gas-cap-and-trade-program/california-climate-credit>

## 6.2.1 Pacific Gas & Electric

The following pages provide details on the PG&E electricity and natural gas tariffs applied in this study. Table 20 describes the baseline territories that were assumed for each climate zone. A net surplus compensation rate of \$0.07051/ kWh was applied to any net annual electricity generation based on a one-year average of the rates between December 2022 and November 2023.

**Table 20. 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 21. These rates are based on applying a normalization curve to the November 2023 tariff based on ten years of historical gas data. Corresponding CARE rates reflect the 20 percent discount per the GL-1 tariff.

**Table 21. PG&E Monthly Gas Rate (\$/therm)**

Month	Total Charge	
	Baseline	Excess
January	\$2.05	\$2.43
February	\$2.08	\$2.46
March	\$1.92	\$2.31
April	\$1.80	\$2.20
May	\$1.77	\$2.18
June	\$1.78	\$2.18
July	\$1.80	\$2.20
August	\$1.85	\$2.26
September	\$1.92	\$2.33
October	\$1.99	\$2.40
November	\$2.06	\$2.46
December	\$2.05	\$2.44

**Residential  
GAS**

**Baseline Territories and Quantities <sup>1/</sup>**

**Effective April 1, 2022 - Present**

BASELINE QUANTITIES (Therms Per Day Per Dwelling Unit)

Baseline Territories	Individually Metered		
	Summer (April-October)	Winter Off-Peak (Nov, Feb, Mar)	Winter On-Peak (Dec, Jan)
	Effective Apr. 1, 2022	Effective Nov. 1, 2022	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

Baseline Territories	Master Metered		
	Summer (April-October)	Winter Off-Peak (Nov, Feb, Mar)	Winter On-Peak (Dec, Jan)
	Effective Apr. 1, 2022	Effective Nov. 1, 2022	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



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Cancelling Revised Cal. P.U.C. Sheet No. 56550-E  
Revised Cal. P.U.C. Sheet No. 56229-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**

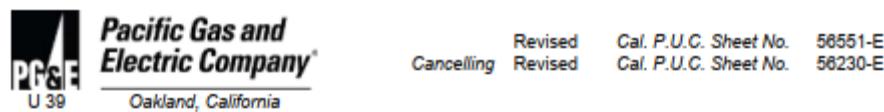
Total Energy Rates (\$ per kWh)	PEAK		OFF-PEAK	
<i>Summer</i>				
Total Usage	\$0.53933	(I)	\$0.45589	(I)
Baseline Credit (Applied to Baseline Usage Only)	(\$0.08851)	(R)	(\$0.08851)	(R)
<i>Winter</i>				
Total Usage	\$0.43662	(I)	\$0.40827	(I)
Baseline Credit (Applied to Baseline Usage Only)	(\$0.08851)	(R)	(\$0.08851)	(R)
Delivery Minimum Bill Amount (\$ per meter per day)	\$0.37612			
California Climate Credit (per household, per semi-annual payment occurring in the March* and October bill cycles)	(\$38.39)			

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.

\* Pursuant to D.23-02-014, disbursement of the April 2023 residential Climate Credit shall begin by March 1, 2023.

(Continued)

Advice Decision	7009-E	Issued by Meredith Allen Vice President, Regulatory Affairs	Submitted Effective Resolution	August 25, 2023 September 1, 2023
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**ELECTRIC SCHEDULE E-TOU-C**  
**RESIDENTIAL TIME-OF-USE (PEAK PRICING 4 - 9 p.m. EVERY DAY)**

RATES: (Cont'd.)	UNBUNDLING OF E-TOU-C TOTAL RATES			
	PEAK	OFF-PEAK		
<b>Generation:</b>				
Summer (all usage)	\$0.19776		\$0.13432	
Winter (all usage)	\$0.14916		\$0.12413	
<b>Distribution**:</b>				
Summer (all usage)	\$0.17029	(I)	\$0.15029	(I)
Winter (all usage)	\$0.11618	(I)	\$0.11286	(I)
<b>Conservation Incentive Adjustment (Baseline Usage)</b>	(\$0.02216)		(I)	
<b>Conservation Incentive Adjustment (Over Baseline Usage)</b>	\$0.06635		(I)	
<b>Transmission* (all usage)</b>	\$0.05254			
<b>Transmission Rate Adjustments* (all usage)</b>	\$0.00059			
<b>Reliability Services* (all usage)</b>	\$0.00069			
<b>Public Purpose Programs (all usage)</b>	\$0.02578			
<b>Nuclear Decommissioning (all usage)</b>	\$0.00135			
<b>Competition Transition Charges (all usage)</b>	\$0.00030			
<b>Energy Cost Recovery Amount (all usage)</b>	(\$0.00071)			
<b>Wildfire Fund Charge (all usage)</b>	\$0.00530			
<b>New System Generation Charge (all usage)**</b>	\$0.00346			
<b>Wildfire Hardening Charge (all usage)</b>	\$0.00254			
<b>Recovery Bond Charge (all usage)</b>	\$0.00528		(R)	
<b>Recovery Bond Credit (all usage)</b>	(\$0.00528)		(I)	
<b>Bundled Power Charge Indifference Adjustment (all usage)***</b>	\$0.01309			

\* 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 Decision	7009-E	Issued by <b>Meredith Allen</b> Vice President, Regulatory Affairs	Submitted Effective Resolution	August 25, 2023 September 1, 2023
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Cancelling Revised  
Cal. P.U.C. Sheet No. 56547-E  
Cal. P.U.C. Sheet No. 56226-E

**ELECTRIC SCHEDULE E-ELEC** Sheet 2  
**RESIDENTIAL TIME-OF-USE (ELECTRIC HOME)**  
**SERVICE FOR CUSTOMERS WITH QUALIFYING ELECTRIC TECHNOLOGIES**

RATES:(Cont'd.)

**TOTAL BUNDLED RATES**

Base Services Charge (\$ per meter per day) **\$0.49281**

Total Energy Rates (\$ per kWh)	PEAK	PART-PEAK	OFF-PEAK
Summer Usage	\$0.56589 (I)	\$0.40401 (I)	\$0.34733 (I)
Winter Usage	\$0.33438 (I)	\$0.31229 (I)	\$0.29843 (I)

California Climate Credit (per household, per semi-annual payment occurring in the March<sup>†</sup> and October bill cycles) **(\$38.39)**

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
<b>Generation:</b>			
Summer Usage	\$0.28164	\$0.18253	\$0.13743
Winter Usage	\$0.11951	\$0.09954	\$0.08619
<b>Distribution**:</b>			
Summer Usage	\$0.17932 (I)	\$0.11655 (I)	\$0.10497 (I)
Winter Usage	\$0.10994 (I)	\$0.10782 (I)	\$0.10731 (I)
<b>Transmission*</b> (all usage)	\$0.05254	\$0.05254	\$0.05254
<b>Transmission Rate Adjustments*</b> (all usage)	\$0.00059	\$0.00059	\$0.00059
<b>Reliability Services*</b> (all usage)	\$0.00069	\$0.00069	\$0.00069
<b>Public Purpose Programs</b> (all usage)	\$0.02578	\$0.02578	\$0.02578
<b>Nuclear Decommissioning</b> (all usage)	\$0.00135	\$0.00135	\$0.00135
<b>Competition Transition Charges</b> (all usage)	\$0.00030	\$0.00030	\$0.00030
<b>Energy Cost Recovery Amount</b> (all usage)	(\$0.00071)	(\$0.00071)	(\$0.00071)
<b>Wildfire Fund Charge</b> (all usage)	\$0.00530	\$0.00530	\$0.00530
<b>New System Generation Charge</b> (all usage)**	\$0.00346	\$0.00346	\$0.00346
<b>Wildfire Hardening Charge</b> (all usage)	\$0.00254	\$0.00254	\$0.00254
<b>Recovery Bond Charge</b> (all usage)	\$0.00528 (R)	\$0.00528 (R)	\$0.00528 (R)
<b>Recovery Bond Credit</b> (all usage)	(\$0.00528) (I)	(\$0.00528) (I)	(\$0.00528) (I)
<b>Bundled Power Charge Indifference Adjustment</b> (all usage)***	\$0.01309	\$0.01309	\$0.01309

\* 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.

† Pursuant to D.23-02-014, disbursement of the April 2023 residential Climate Credit shall begin by March 1, 2023.

(Continued)

<b>Advice Decision</b>	7009-E	<b>Issued by</b> <b>Meredith Allen</b> Vice President, Regulatory Affairs	<b>Submitted Effective Resolution</b>	August 25, 2023 September 1, 2023
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Original

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

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

Sheet 3

(N)  
(N)

**SPECIAL  
CONDITIONS:**

1. **TIME PERIODS:** Times of the year and times of the day are defined as follows:
  - 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)

(Continued)

<b>Advice Decision</b>	6768-E D.21-11-016	<b>Issued by</b> <b>Meredith Allen</b> Vice President, Regulatory Affairs	<b>Submitted Effective Resolution</b>	November 18, 2022 December 1, 2022
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**Pacific Gas and  
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Revised  
Cancelling      Revised      Cal. P.U.C. Sheet No. 54734-E  
Cal. P.U.C. Sheet No. 53424-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-6, E-TOU-B, E-TOU-C, E-TOU-D, EV2, E-ELEC, EM, ES, ESR, ET and EM-TOU. (T)

**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 35.000% 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 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 residual reduction to distribution charges, after D-CARE customers are exempted from the 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. 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. (N)  
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(N)  
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(T)

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. (L)  
|  
(L)

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Revised      Cal. P.U.C. Sheet No. 56020-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:	34.965	% (Percent)	(I)
	B. Delivery Minimum Bill Discount:	50.000	% (Percent)	
	C. Master-Meter D-CARE Discount:	34.965	% (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.

<b>Advice Decision</b>	6968-E	<i>Issued by</i> <b>Meredith Allen</b> Vice President, Regulatory Affairs	<i>Submitted Effective Resolution</i>	June 23, 2023 July 1, 2023
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## 6.2.2 Southern California Edison

The following pages provide details on the SCE electricity tariffs applied in this study. Table 22 describes the baseline territories that were assumed for each climate zone. A net surplus compensation rate of \$ 0.06030/ kWh was applied to any net annual electricity generation based on a one-year average of the rates between December 2022 and November 2023

**Table 22: 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

- 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)

Revised Cal. PUC Sheet No. 85111-E  
Cancelling Revised Cal. PUC Sheet No. 74502-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:

Option 4-9 PM / Option 4-9 PM-CPP	Delivery Service Total <sup>1</sup>	Generation <sup>2</sup>	
		UG***	DWRBC <sup>3</sup>
Energy Charge - \$/kWh			
Summer Season - On-Peak	0.28829 (R)	0.28543 (I)	0.00000
Mid-Peak	0.28829 (R)	0.17707 (I)	0.00000
Off-Peak	0.24482 (R)	0.11382 (I)	0.00000
Winter Season - Mid-Peak	0.28829 (R)	0.21752 (I)	0.00000
Off-Peak	0.24482 (R)	0.13851 (I)	0.00000
Super-Off-Peak	0.22919 (R)	0.11890 (I)	0.00000
Baseline Credit**** - \$/kWh	(0.09759) (I)	0.00000	
Fixed Recovery Charge - \$/kWh	0.00090 (R)		
Basic Charge - \$/day			
Single-Family Residence	0.031		
Multi-Family Residence	0.024		
Minimum Charge** - \$/day			
Single Family Residence	0.346		
Multi-Family Residence	0.346		
Minimum Charge (Medical Baseline)** - \$/day			
Single Family Residence	0.173		
Multi-Family Residence	0.173		
California Climate Credit <sup>10</sup>	(71.00) (I)		
California Alternate Rates for Energy Discount - %	100.00*		
Family Electric Rate Assistance Discount	100.00		
<b>Option 4-9 PM-CPP</b>			
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	(0.67183) (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 (\$0.00003) 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.

(I)

\*\*\*\*\*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 DWRBC = 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.

(Continued)

(To be inserted by utility)

Advice 4929-E

Decision 2H13

Issued by

Michael Backstrom

Vice President

(To be inserted by Cal. PUC)

Date Submitted Dec 28, 2022

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Resolution E-5217



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

Revised  
Cancelling  
Revised  
Cal. PUC Sheet No. 86132-E  
Cal. PUC Sheet No. 85624-E

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

Sheet 6

RATES (Continued)

<u>Option PRIME / Option PRIME-CPP</u>	Delivery Service Total <sup>1</sup>	Generation <sup>2</sup>	
		UG**	DWREC <sup>3</sup>
Energy Charge - \$/kWh/Meter/Day			
Summer Season			
On-Peak	0.22789 (I)	0.42769 (I)	0.00000
Mid-Peak	0.22789 (I)	0.15221 (I)	0.00000
Off-Peak	0.15191 (I)	0.10162 (I)	0.00000
Winter Season			
Mid-Peak	0.23353 (I)	0.36028 (I)	0.00000
Off-Peak	0.14530 (I)	0.08630 (I)	0.00000
Super-Off-Peak	0.14530 (I)	0.08630 (I)	0.00000
Fixed Recovery Charge - \$/kWh	0.00280 (I)		
Basic Charge - \$/Meter/Day	0.427 (I)		
EV Meter Credit (Separately Metered E	(0.323) (N)		
EV Submeter Credit - \$/Meter/Day	(0.111) (R)		
California Climate Credit <sup>10</sup>	(71.00)		
California Alternate Rates for Energy Discount - %	100.00*		
Family Electric Rate Assistance Discou	100.00		
Medical Line Item Discount - %	100.000		
<u>Option PRIME-CPP</u>			
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		(0.71812) (R)	

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

\*\* The ongoing Competition Transition Charge (CTC) of (\$0.00003) 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.

(Continued)

(To be inserted by utility)  
Advice 5041-E  
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Michael Backstrom  
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6H9



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

Revised Cal. PUC Sheet No. 85618-E  
Cancelling Revised Cal. PUC Sheet No. 85109-E

Schedule D-CARE  
CALIFORNIA ALTERNATE RATES FOR ENERGY  
DOMESTIC SERVICE

Sheet 1

APPLICABILITY

Applicable to domestic service to 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 29.8 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 \$0.00888 per kWh and the Wildfire Fund Non-Bypassable Charge of \$0.00530 per kWh. (R) The 29.8 percent discount, in addition to these exemptions result in an average effective CARE Discount of 32.5 percent.

(Continued)

(To be inserted by utility)

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1H12 22-12-031

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Resolution

### 6.2.3 Southern California Gas

Following are the SoCalGas natural gas tariffs applied in this study. Table 23 describes the baseline territories that were assumed for each climate zone.

**Table 23. 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 was applied on a monthly basis according to the rates shown in Table 24. These rates are based on applying a normalization curve to the November 2023 tariff based on ten years of historical gas data. Long-term historical natural gas rate data was only available for SoCalGas' procurement charges.<sup>27</sup> 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 2023 rates. CARE rates reflect the 20 percent discount per the GR tariff.

**Table 24. SoCalGas Monthly Gas Rate (\$/therm)**

Month	Procurement Charge	Transportation Charge		Total Charge	
		Baseline	Excess	Baseline	Excess
January	\$0.72	\$0.86	\$1.31	\$1.92	\$2.36
February	\$0.50	\$0.86	\$1.31	\$1.57	\$2.02
March	\$0.44	\$0.86	\$1.31	\$1.48	\$1.93
April	\$0.39	\$0.86	\$1.31	\$1.39	\$1.84
May	\$0.41	\$0.86	\$1.31	\$1.43	\$1.87
June	\$0.46	\$0.86	\$1.31	\$1.49	\$1.93
July	\$0.47	\$0.86	\$1.31	\$1.51	\$1.96
August	\$0.51	\$0.86	\$1.31	\$1.58	\$2.03
September	\$0.46	\$0.86	\$1.31	\$1.52	\$1.96
October	\$0.45	\$0.86	\$1.31	\$1.48	\$1.92
November	\$0.48	\$0.86	\$1.31	\$1.54	\$1.99
December	\$0.57	\$0.86	\$1.31	\$1.63	\$2.08

#### Southern California Gas Company

#### Residential Rates

Nov-23

Customer Type	Commodity	Rate	Procurement	Transportation	New Rate	New Rate	Absolute	%
			Charge	Charge	Effective	Effective	Rate Change	% Change
Residential Individually Metered								
	Schedule No. GR	GR	Baseline	67.806	86.490	154.296	125.096	29.200
	Res. Service	GR	Non Baseline	67.806	131.037	198.843	169.726	29.117
		GT-R	Baseline	00.000	86.490	86.490	87.038	-0.548
		GT-R	Non Baseline	00.000	131.037	131.037	131.668	-0.631

<sup>27</sup> 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 \(live.com\)](RES2023.xlsx)

## 6.2.4 San Diego Gas & Electric

Following are the SDG&E electricity and natural gas tariffs applied in this study. Table 25 describes the baseline territories that were assumed for each climate zone. A net surplus compensation rate of \$0.04542/ kWh was applied to any net annual electricity generation based on a one-year average of the rates between December 2022 and November 2023.

**Table 25. 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 26. These rates are based on applying a normalization curve to the November 2023 tariff based on ten years of historical gas data. CARE rates reflect the 20 percent discount per the G-CARE tariff.

**Table 26. SDG&E Monthly Gas Rate (\$/therm)**

Month	Total Charge	
	Baseline	Excess
January	\$2.34	\$2.63
February	\$2.28	\$2.57
March	\$2.21	\$2.51
April	\$2.14	\$2.45
May	\$2.18	\$2.48
June	\$2.23	\$2.55
July	\$2.26	\$2.57
August	\$2.32	\$2.62
September	\$2.26	\$2.59
October	\$2.21	\$2.55
November	\$2.24	\$2.57
December	\$2.38	\$2.70

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. 37022-E  
Canceling Revised Cal. P.U.C. Sheet No. 36337-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 + DWR Credit	Total Rate	
<b>Summer:</b>					
On-Peak	0.25752	R 0.00530	I 0.57043	I 0.83325	I
Off-Peak	0.25752	R 0.00530	I 0.25697	I 0.51979	I
Super Off-Peak	0.25752	R 0.00530	I 0.09233	I 0.35515	I
<b>Winter:</b>					
On-Peak	0.43809	I 0.00530	I 0.19307	I 0.63646	I
Off-Peak	0.43809	I 0.00530	I 0.10855	I 0.55194	I
Super Off-Peak	0.43809	I 0.00530	I 0.08402	I 0.52741	I
Summer Baseline Adjustment Credit up to 130% of Baseline	(0.11724)	R		(0.11724)	R
Winter Baseline Adjustment Credit up to 130% of Baseline	(0.11724)	R		(0.11724)	R
Minimum Bill (\$/day)	0.380	I		0.380	I

Description - TOU DR1-CARE	UDC Total Rate	DWR BC + WF-NBC	EECC Rate + DWR Credit	Total Rate	Total Effective Care Rate
<b>Summer - CARE Rates:</b>					
On-Peak	0.25682	R 0.00000	I 0.57043	I 0.82725	I 0.55366
Off-Peak	0.25682	R 0.00000	I 0.25697	I 0.51379	I 0.33965
Super Off-Peak	0.25682	R 0.00000	I 0.09233	I 0.34915	I 0.22725
<b>Winter - CARE Rates:</b>					
On-Peak	0.43739	I 0.00000	I 0.19307	I 0.63046	I 0.41930
Off-Peak	0.43739	I 0.00000	I 0.10855	I 0.54594	I 0.36160
Super Off-Peak	0.43739	I 0.00000	I 0.08402	I 0.52141	I 0.34485
Summer Baseline Adjustment Credit up to 130% of Baseline	(0.11724)	R		(0.11724)	R
Winter Baseline Adjustment Credit up to 130% of Baseline	(0.11724)	R		(0.11724)	R
Minimum Bill (\$/day)	0.190	I		0.190	I

#### 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, with the EECC rates reflecting a DWR Credit. 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 0.00530 + DWR-BC Bond Charge is 0.00000.

R, I

(Continued)

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Advice Ltr. No. 4129-E	Dan Skopec	Effective	Jan 1, 2023
Decision No.	Senior Vice President Regulatory Affairs	Resolution No.	E-5217

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

15. Baseline Usage: The following quantities of electricity are used to calculate the baseline adjustment credit.

	Baseline Allowance For Climatic Zones*			
	Coastal	Inland	Mountain	Desert
<b>Basic Allowance</b>				
Summer (June 1 to October 31)	9.0	10.4	13.6	15.9
Winter (November 1 to May 31)	9.2	9.6	12.9	10.9
<b>All Electric**</b>				
Summer (June 1 to October 31)	6.0	8.7	15.2	17.0
Winter (November 1 to May 31)	8.8	12.2	22.1	17.1

\* Climatic Zones are shown on the Territory Served, Map No. 1.

\*\* All Electric allowances are available upon application to those customers who have permanently installed space heating or who have electric water heating and receive no energy from another source.



San Diego Gas & Electric Company  
San Diego, California

Revised Cal. P.U.C. Sheet No. 37217-E  
Canceling Revised Cal. P.U.C. Sheet No. 37016-E

## SCHEDULE EV-TOU-5

Sheet 1

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

#### APPLICABILITY

Service under this schedule is specifically limited to customers who require service for charging of a currently registered Motor Vehicle, as defined by the California Motor Vehicle Code, which is: 1) a battery electric vehicle (BEV) or plug-in hybrid electric vehicle (PHEV) recharged via a recharging outlet at the customer's premises; or 2) a natural gas vehicle (NGV) refueled via a home refueling appliance (HRA) at the customer's premises. This schedule is not available to customers with a conventional charge sustaining (battery recharged solely from the vehicle's on-board generator) hybrid electric vehicle (HEV).

Residential customers taking service on Schedule NBT, who are required to utilize EV-TOU-5 as their otherwise applicable schedule (OAS) for electric service, do not require a qualifying motor vehicle, as described above to participate on Schedule EV-TOU-5.

Customers on this schedule may also qualify for a semi-annual California Climate Credit \$(60.70) per Schedule GHG-ARR.

N  
N  
N

#### TERRITORY

Within the entire territory served by the utility.

#### RATES

##### Total Rates:

Description – EV-TOU-5 Rates	UDC Total Rate	DWR BC + WF-NBC	EECC Rate + DWR Credit	Total Rate
Basic Service Fee	16.00			16.00
<b>Summer</b>				
On-Peak	0.28032	I 0.00530	I 0.53067	I 0.81629
Off-Peak	0.28032	I 0.00530	I 0.19567	I 0.48129
Super Off-Peak	0.05588	I 0.00530	I 0.09233	I 0.15351
<b>Winter</b>				
On-Peak	0.28032	I 0.00530	I 0.22587	I 0.51149
Off-Peak	0.28032	I 0.00530	I 0.16213	I 0.44775
Super Off-Peak	0.05588	I 0.00530	I 0.08402	I 0.14520

(Continued)

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Revised Cal. P.U.C. Sheet No. 37019-E

Canceling Revised Cal. P.U.C. Sheet No. 35912-E

**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 \$0.00242 per kWh and the Transmission Access Charge Balancing Account Adjustment (TACBAA) of \$0.01631 per kWh. PPP Energy charges includes Low Income PPP rate (LI-PPP) \$0.01669/kWh, Non-low Income PPP rate (Non-LI-PPP) \$0.00333/kWh (pursuant to PUC Code Section 399.8, the Non-LI-PPP rate may not exceed January 1, 2000 levels), Procurement Energy Efficiency Surcharge Rate of \$0.00422 /kWh, California Solar Initiative rate (CSI) of \$0.00000/kWh and Self-Generation Incentive Program rate (SGIP) \$0.00122/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

(Continued)

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Canceling Cal. P.U.C. Sheet No. \_\_\_\_\_

### SCHEDULE TOU-ELEC

Sheet 1

#### DOMESTIC TIME-OF-USE FOR HOUSEHOLDS WITH ELECTRIC VEHICLES, ENERGY STORAGE, OR ELECTRIC HEAT PUMPS

##### APPLICABILITY

Service under this schedule is available on a voluntary basis for all residential customers who meet one or more of the following criteria: 1) require service for charging of a currently registered Motor Vehicle, as defined by the California Motor Vehicle Code, which is: a) a battery electric vehicle (BEV) or plug-in hybrid electric vehicle (PHEV) recharged via a recharging outlet at the customer's premises; or b) a natural gas vehicle (NGV) refueled via a home refueling appliance (HRA) at the customer's premises; 2) have a behind-the-meter energy storage device that is interconnected through Electric Rule 21; or 3) have an electric heat pump for water heating or climate control. This schedule is not available to customers with a conventional charge sustaining (battery recharged solely from the vehicle's on-board generator) hybrid electric vehicle (HEV).

This schedule is also available to customers who meet the above criteria as well as qualify for the California Alternate Rates for Energy (CARE) Program as outlined in Schedule E-CARE, and/or Medical Baseline as outlined in Special Condition (SC) 5. The rates for CARE customers and/or Medical Baseline are identified in the rate tables below as TOU-ELEC-CARE and TOU-ELEC-MB rates, respectively.

There is a cap of 10,000 customers who may take service on this rate, as defined in SC 10.

Pursuant to D.22-11-022, customers that opt-in to schedule TOU-ELEC within its first year of being offered have the option to return to their previous rate schedule prior to the 12-month requirement. See SC4 Terms of Service for all requirements.

Customers on this schedule may also qualify for a semi-annual California Climate Credit (\$60.70) per Schedule GHG-ARR.

##### TERRITORY

Within the entire territory served by the utility.

##### RATES

###### Total Rates:

Description - TOU-ELEC Rates	UDC Total Rate	DWR BC + WF-NBC	EECC Rate	Total Rate
Monthly Service Fee	16.00			16.00
<b>Summer</b>				
On-Peak	0.22228	0.00530	0.51568	0.74326
Off-Peak	0.22228	0.00530	0.14644	0.37402
Super Off-Peak	0.22228	0.00530	0.09785	0.32543
<b>Winter</b>				
On-Peak	0.22228	0.00530	0.27460	0.50218
Off-Peak	0.22228	0.00530	0.13323	0.36081
Super Off-Peak	0.22228	0.00530	0.08905	0.31663

(Continued)

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San Diego Gas & Electric Company  
San Diego, California

Original \_\_\_\_\_ Cal. P.U.C. Sheet No. 37196-E  
Canceling \_\_\_\_\_ Cal. P.U.C. Sheet No. \_\_\_\_\_

### SCHEDULE TOU-ELEC

Sheet 2

DOMESTIC TIME-OF-USE FOR HOUSEHOLDS WITH ELECTRIC VEHICLES, ENERGY STORAGE,  
OR ELECTRIC HEAT PUMPS

RATES (Continued)

Description – TOU-ELEC CARE Rates	UDC Total Rate	DWR BC + WF-NBC	EECC Rate	Total Rate	Total Effective CARE Rate
Monthly Service Fee	16.00			16.00	16.00
<b>Summer – CARE Rates:</b>					
On-Peak	0.22158	0.00000	0.51568	0.73726	0.49222
Off-Peak	0.22158	0.00000	0.14644	0.36802	0.24013
Super Off-Peak	0.22158	0.00000	0.09785	0.31943	0.20696
<b>Winter – CARE Rates:</b>					
On-Peak	0.22158	0.00000	0.27460	0.49618	0.32763
Off-Peak	0.22158	0.00000	0.13323	0.35481	0.23111
Super Off-Peak	0.22158	0.00000	0.08905	0.31063	0.20095

Description – TOU-ELEC MB Rates	UDC Total Rate	DWR BC + WF-NBC	EECC Rate	Total Rate	Total Effective MB Rate
Monthly Service Fee	16.00			16.00	16.00
<b>Summer – MB Rates:</b>					
On-Peak	0.22228	0.00000	0.51568	0.73796	0.59037
Off-Peak	0.22228	0.00000	0.14644	0.36872	0.29498
Super Off-Peak	0.22228	0.00000	0.09785	0.32013	0.25610
<b>Winter – MB Rates:</b>					
On-Peak	0.22228	0.00000	0.27460	0.49688	0.39750
Off-Peak	0.22228	0.00000	0.13323	0.35551	0.28441
Super Off-Peak	0.22228	0.00000	0.08905	0.31133	0.24906

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 9 for PCIA (Power Charge Indifference Adjustment) recovery.
- (2) Total Rates presented are for customers that receive commodity supply and delivery service from Utility. Differences in total rates paid by Direct Access (DA) and Community Choice Aggregation (CCA) customers are identified in Schedule DA-CRS and CCA-CRS, respectively.
- (3) DWR-BC and WF-NBC charges do not apply to CARE or Medical Baseline customers.
- (4) WF-NBC rate is 0.00530 + DWR-BC Bond Charge is 0.00000

2H5  
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San Diego Gas & Electric Company  
San Diego, California

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### SCHEDULE TOU-ELEC

Sheet 3

DOMESTIC TIME-OF-USE FOR HOUSEHOLDS WITH ELECTRIC VEHICLES, ENERGY STORAGE,  
OR ELECTRIC HEAT PUMPS

N

N

N

#### RATES (CONTINUED)

##### UDC Rates

Description - TOU-ELEC	Transm	Distr	PPP	ND	CTC	LGC	RS	TRAC	UDC Total
Monthly Service Fee (\$/Mo)		16.00							16.00
<b>Summer:</b>									
On-Peak	0.07340	0.10796	0.02546	0.00007	0.00153	0.01383	0.00003	0.00000	0.22228
Off-Peak	0.07340	0.10796	0.02546	0.00007	0.00153	0.01383	0.00003	0.00000	0.22228
Super Off-Peak	0.07340	0.10796	0.02546	0.00007	0.00153	0.01383	0.00003	0.00000	0.22228
<b>Winter:</b>									
On-Peak	0.07340	0.10796	0.02546	0.00007	0.00153	0.01383	0.00003	0.00000	0.22228
Off-Peak	0.07340	0.10796	0.02546	0.00007	0.00153	0.01383	0.00003	0.00000	0.22228
Super Off-Peak	0.07340	0.10796	0.02546	0.00007	0.00153	0.01383	0.00003	0.00000	0.22228

Description - TOU-ELEC - CARE Rates	Transm	Distr	PPP	ND	CTC	LGC	RS	TRAC	UDC Total
Monthly Service Fee (\$/Mo)		16.00							16.00
<b>Summer CARE Rates:</b>									
On-Peak	0.07340	0.10726	0.02546	0.00007	0.00153	0.01383	0.00003	0.00000	0.22158
Off-Peak	0.07340	0.10726	0.02546	0.00007	0.00153	0.01383	0.00003	0.00000	0.22158
Super Off-Peak	0.07340	0.10726	0.02546	0.00007	0.00153	0.01383	0.00003	0.00000	0.22158
<b>Winter CARE Rates:</b>									
On-Peak	0.07340	0.10726	0.02546	0.00007	0.00153	0.01383	0.00003	0.00000	0.22158
Off-Peak	0.07340	0.10726	0.02546	0.00007	0.00153	0.01383	0.00003	0.00000	0.22158
Super Off-Peak	0.07340	0.10726	0.02546	0.00007	0.00153	0.01383	0.00003	0.00000	0.22158

Description - TOU-ELEC - MB Rates	Transm	Distr	PPP	ND	CTC	LGC	RS	TRAC	UDC Total
Monthly Service Fee (\$/Mo))		16.00							16.00
<b>Summer - MB Rates</b>									
On-Peak	0.07340	0.10796	0.02546	0.00007	0.00153	0.01383	0.00003	0.00000	0.22228
Off-Peak	0.07340	0.10796	0.02546	0.00007	0.00153	0.01383	0.00003	0.00000	0.22228
Super Off-Peak	0.07340	0.10796	0.02546	0.00007	0.00153	0.01383	0.00003	0.00000	0.22228
<b>Winter - MB Rates</b>									
On-Peak	0.07340	0.10796	0.02546	0.00007	0.00153	0.01383	0.00003	0.00000	0.22228
Off-Peak	0.07340	0.10796	0.02546	0.00007	0.00153	0.01383	0.00003	0.00000	0.22228
Super Off-Peak	0.07340	0.10796	0.02546	0.00007	0.00153	0.01383	0.00003	0.00000	0.22228

(Continued)

3H11

Issued by

Submitted

Jan 31, 2023

Advice Ltr. No.

4152-E

Effective

Jan 31, 2023

Decision No.

D.22-11-022

Resolution No.

N



San Diego Gas & Electric Company  
San Diego, California

Original \_\_\_\_\_ Cal. P.U.C. Sheet No. 37198-E  
Canceling \_\_\_\_\_ Cal. P.U.C. Sheet No. \_\_\_\_\_

### SCHEDULE TOU-ELEC

Sheet 4

#### DOMESTIC TIME-OF-USE FOR HOUSEHOLDS WITH ELECTRIC VEHICLES, ENERGY STORAGE, OR ELECTRIC HEAT PUMPS

N

N

N

**Notes:** Transmission Energy charges include the Transmission Revenue Balancing Account Adjustment (TRBAA) of \$0.00242 per kWh and the Transmission Access Charge Balancing Account Adjustment (TACBAA) of \$0.01631 per kWh. PPP Energy charges includes Low Income PPP rate (LI-PPP) \$0.01669/kWh, Non-low Income PPP rate (Non-LI-PPP) \$0.00333/kWh (pursuant to PU Code Section 399.8, the Non-LI-PPP rate may not exceed January 1, 2000 levels), Procurement Energy Efficiency Surcharge Rate of \$0.00422 /kWh, California Solar Initiative rate (CSI) of \$0.00000/kWh and Self-Generation Incentive Program rate (SGIP) \$0.00122/kWh.

#### 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. 10:00 a.m. – 2:00 p.m. in March and April	Midnight – 6:00 a.m.

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

N

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4H7	Issued by	Submitted	Jan 31, 2023
Advice Ltr. No. 4152-E		Effective	Jan 31, 2023
Decision No. D.22-11-022		Resolution No.	_____



San Diego Gas & Electric Company  
San Diego, California

Revised \_\_\_\_\_ Cal. P.U.C. Sheet No. 35718-E  
Canceling \_\_\_\_\_ Revised \_\_\_\_\_ Cal. P.U.C. Sheet No. 32576-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:** Qualified residential CARE customers will receive a total effective discount according to the following:

	2015	2016	2017	2018	2019	2020 and beyond
<b>Effective Discount</b>	40%	39%	38%	38%	36% R	35%

Pursuant to Commission Decision (D.) 15-07-001, the average effective CARE discount for residential customers will decrease 1% each year until an average effective discount of 35% is reached in 2020.

The average effective CARE discount consists of: (a) exemptions from paying the CARE Surcharge, Department of Water Resources Bond Charge (DWR-BC), Vehicle-Grid Integration (VGI) costs, and California Solar Initiative (CSI); (b) a 50% minimum bill relative to Non-CARE; (c) the California Wildfire Fund Charge (WF-NBC) and (d) a separate line-item bill discount for all qualified residential CARE customers with the exclusion of CARE Medical Baseline customers taking service on tiered rates schedules. D.15-07-001 retained the rate subsidies in Non-CARE Medical Baseline tiered rates and thereby a separate line-item discount is provided for these CARE Medical Baseline customers

T

(Continued)

1C5

Advice Ltr. No. 3928-E

Issued by  
**Dan Skopec**  
Vice President

Submitted \_\_\_\_\_ Dec 30, 2021  
Effective \_\_\_\_\_ Jan 1, 2022

## 6.2.5 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 27. These rates are based on applying a normalization curve to the October 2023 tariff based on seven years of historical gas data. The monthly service charge applied was \$14.01 per month per the November 2023 G-1 tariff.

**Table 27. CPAU Monthly Gas Rate (\$/therm)**

Month	G1 Volumetric Total Baseline	G1 Volumetric Total Excess
January	\$1.83532	\$3.35639
February	\$1.38055	\$2.59947
March	\$1.32506	\$2.47695
April	\$1.29680	\$2.44038
May	\$1.29511	\$2.43804
June	\$1.32034	\$2.45406
July	\$1.35688	\$2.61519
August	\$1.40696	\$2.67944
September	\$1.42130	\$2.70301
October	\$1.42310	\$2.48300
November	\$1.46286	\$2.45547
December	\$1.62415	\$2.62128

**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				
	\$ 0.09999	\$ 0.06954	\$ 0.00568	\$ 0.17521
Tier 2 usage Any usage over Tier 1				0.24666
<u>Minimum Bill (\$/day)</u>				0.4181

**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 11 kWh per day, prorated by Meter reading days of Service. As an example, for a 30-day bill, the Tier 1 level would be 330 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 7-1-2022

Sheet No E-1-1  
Effective 7-1-2023

## 6.2.6 Sacramento Municipal Utilities District (Electric Only)

Following are the SMUD electricity tariffs applied in this study. The rates effective January 2023 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
<b>Time-of-Day (5-8 p.m.) Rate (RT02)</b>					
<b>Non-Summer Season (October - May)</b>					
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
<b>Summer Season (June - September)</b>					
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

1. 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.).
2. The CPP Rate provides a discount per kWh on the Mid-Peak and Off-Peak prices during summer months.
3. 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](http://www.smud.org).
4. 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](http://www.smud.org).
5. The CPP Rate Event Price and discount will be updated annually at SMUD's discretion and posted on [www.smud.org](http://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

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

**A. Time-of-Day (5-8 p.m.) Rate (rate category RT02)**

1. The TOD (5-8 p.m.) Rate is the standard rate for SMUD's residential customers. Eligible customers can elect the Fixed Rate under Rate Schedule R as an alternative rate.
2. The TOD (5-8 p.m.) Rate is an optional rate for customers who have an eligible renewable electrical generation facility under Rate Schedule NEM1 that was approved for installation by SMUD prior to January 1, 2018.
3. This rate has five kilowatt-hour (kWh) prices, depending on the time-of-day and season as shown below. Holidays are detailed in Section V. Conditions of Service.

<b>Summer (Jun 1 - Sept 30)</b>	<b>Peak</b>	Weekdays between 5:00 p.m. and 8:00 p.m.
	<b>Mid-Peak</b>	Weekdays between noon and midnight except during the Peak hours.
	<b>Off-Peak</b>	All other hours, including weekends and holidays <sup>1</sup> .
<b>Non-Summer (Oct 1 - May 31)</b>	<b>Peak</b>	Weekdays between 5:00 p.m. and 8:00 p.m.
	<b>Off-Peak</b>	All other hours, including weekends and holidays <sup>1</sup> .

<sup>1</sup> See Section V. Conditions of Service

## 6.2.7 Fuel Escalation Assumptions

The average annual escalation rates in Table 28 were used in this study. These 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 29 presents the average annual escalation rates used in the utility rate escalation sensitivity analysis shown in Section 3.2.4. Rates were applied for the same 30-year period and are based on the escalation rate assumptions within the 2025 LSC factors from 2027 through 2053.<sup>28</sup> 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 years 2024, 2025, and 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.

**Table 28: 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
2024	4.6%	1.8%	1.6%	2.8%
2025	4.6%	1.8%	1.6%	2.8%
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%

<sup>28</sup><https://www.energy.ca.gov/files/2025-energy-code-hourly-factors>. Actual escalation factors were provided by consultants E3.

**Table 29: 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)
2024	4.6%	2.1%
2025	4.6%	2.1%
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%

## 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.



Visit [LocalEnergyCodes.com](http://LocalEnergyCodes.com) to access our resources and sign up for newsletters.



Contact [info@localenergycodes.com](mailto:info@localenergycodes.com) for no-charge assistance from expert Reach Code advisors



Follow us on LinkedIn

## Single Family FlexPath

### Referenced Studies

Title: [Single Family Residential Retrofits \(FlexPath and Specific Measures\)](#)

Backup Data: [SF Retrofits Study Data](#)

Prepared for: Kelly Cunningham, Codes and Standards Program, Pacific Gas and Electric Company

Prepared by: Frontier Energy Inc., Misti Bruceri & Associates, LLC

Last Modified: 2024/04/25

Last Modified: 2021/08/27

Title: [Application of 2022 Studies to 2025 Energy Code: Existing Single Family Building Upgrades](#)

Prepared for: Kelly Cunningham, Codes and Standards Program, Pacific Gas and Electric Company

Prepared by: Frontier Energy Inc., Misti Bruceri & Associates, LLC

Last Modified: 2025/08/15

### Proposed Requirements

The ordinance requires that major alterations or additions above a certain size select a subset of energy measures from a list to incorporate into their scope.

### Cost-Effectiveness Results

Please see attached output from the Cost-Effectiveness Explorer. The memo describes the application of the results of the previous two cost-effectiveness studies to the current ordinance.



State of California - Department of Fish and Wildlife  
2025 ENVIRONMENTAL DOCUMENT FILING FEE  
CASH RECEIPT  
DFW 753.5a (REV. 01/01/25) Previously DFG 753.5a

[Print](#)

[StartOver](#)

[Save](#)

RECEIPT NUMBER:

56 —

STATE CLEARINGHOUSE NUMBER (If applicable)

SEE INSTRUCTIONS ON REVERSE. TYPE OR PRINT CLEARLY.

LEAD AGENCY <b>City of Ojai</b>	LEAD AGENCY EMAIL <b>Lucas.seibert@ojai.ca.gov</b>	DATE
COUNTY/STATE AGENCY OF FILING <b>Ventura</b>		DOCUMENT NUMBER
PROJECT TITLE		

**Ordinance Adopting amendments to City of Ojai's Muni Code, Title Nine, Ch. One**

PROJECT APPLICANT NAME <b>Lucas Seibert</b>	PROJECT APPLICANT EMAIL <b>Lucas.Seibert@ojai.ca.gov</b>	PHONE NUMBER <b>(805)646-5581</b>
PROJECT APPLICANT ADDRESS <b>401 S. Ventura St</b>	CITY <b>Ojai</b>	STATE <b>CA</b>
ZIP CODE <b>93023</b>		

PROJECT APPLICANT (Check appropriate box)

Local Public Agency  School District  Other Special District  State Agency  Private Entity

CHECK APPLICABLE FEES:

<input type="checkbox"/> Environmental Impact Report (EIR)	\$4,123.50	\$ 0.00
<input type="checkbox"/> Mitigated/Negative Declaration (MND)(ND)	\$2,968.75	\$ 0.00
<input type="checkbox"/> Certified Regulatory Program (CRP) document - payment due directly to CDFW	\$1,401.75	\$ 0.00

Exempt from fee  
 Notice of Exemption (attach)  
 CDFW No Effect Determination (attach)  
 Fee previously paid (attach previously issued cash receipt copy)

<input type="checkbox"/> Water Right Application or Petition Fee (State Water Resources Control Board only)	\$850.00	\$ 0.00
<input checked="" type="checkbox"/> County documentary handling fee	\$	\$ 50.00
<input type="checkbox"/> Other	\$	\$

PAYMENT METHOD:

Cash  Credit  Check  Other TOTAL RECEIVED \$ 50.00

SIGNATURE

AGENCY OF FILING PRINTED NAME AND TITLE

*Lucas Seibert, Community Development*  
*Director*

POSTED  
SEP 15 2025

Filed in County Clerk's Office  
Michelle Ascencion  
Ventura County Clerk-Recorder

**2025100010717**

09/15/2025  
02:22 PM  
VEN  
DocType: FISH  
ESPINOZE  
Pages: 2  
Fees: \$50.00

FILED  
SEP 15 2025  
DATE:  
**MICHELLE ASCENCION**  
Ventura County Clerk-Recorder  
By: *an m. g.*, Deputy

MICHELLE ASCENCION  
Ventura County Clerk and Recorder  
By: \_\_\_\_\_, Deputy



ORIGINAL - PROJECT APPLICANT

COPY - CDFW/ASB

COPY - LEAD AGENCY

Attachment 5

1 of 2

