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SUBJECT: ENERGY EFFICIENT RENOVATIONS POLICY FOR MAJOR RESIDENTIAL ADDITIONS AND ALTERATIONS

RECOMMENDATION

Introduce a Draft Ordinance, entitled, "An Ordinance of the City Council of the City of San Luis Obispo, California, adopting Local Amendments to Part 6 of the Building Construction and Fire Prevention Code, 2023" approving the Energy Efficient Renovations Policy for major residential additions and alterations.

POLICY CONTEXT

A suite of adopted City Council policies support the staff recommendation to adopt the Energy Efficient Renovations Policy for existing single-family residential buildings. A select summary of this policy context is below:

- Land Use Element of the General Plan:
  - Policy 9.4 (Climate Action Plan) - The City shall maintain and implement its Climate Action Plan to reduce community and municipal greenhouse gas ("GHG") emissions consistent with State laws and objectives.
  - Policy 9.7 (Sustainable Design) - The City shall promote and, where appropriate, require sustainable building practices that consume less energy, water and other resources, facilitate natural ventilation, use daylight effectively, and are healthy, safe, comfortable, and durable.
- Conservation and Open Space Element of the General Plan:
  - Policy 2.2.1 (Atmospheric Change) - City actions shall seek to minimize undesirable climate changes and deterioration of the atmosphere's protective functions that result from the release of carbon dioxide and other substances.
  - Goal 4.2 (Sustainable energy use) - Increase use of sustainable energy sources such as solar, wind and thermal energy, and reduce reliance on non-sustainable energy sources to the extent possible with available technology and resources.

- Climate Adaptation and Safety Element of the General Plan:
    - Policy HE-4.3 (Green and Healthy Buildings) - The City shall support fuel switching retrofits (from fossil fuel to high-efficiency electric appliances), energy efficiency retrofits, and distributed energy resources as low-carbon solutions to create safe, cool, and healthy buildings and consider programs and projects that support these retrofits as critical to maintaining community safety and to supporting disaster preparedness.
- Resolution 11159 (2020 Series) adopted the Climate Action Plan for Community Recovery with the goal of community carbon neutrality by 2035 and a sub-goal of 50 percent reduction in emissions from existing buildings by 2030.
- Resolution No. 11381 (2022 Series) reaffirmed these goals and created a work program for fiscal years 2023-27, including Green Buildings Action 2.1.E, which directs staff to, "Develop an equitable framework for requiring electrification retrofits and develop cost effective building electrification policies for additions and alterations."
- 2023-25 Financial Plan Climate Action Major City Goal action 4.1.i directs staff to conduct a study session, and pending Council direction, develop an equitable framework for cost-effective building electrification retrofit policies, with an initial focus on additions and alterations, as called for by CAP Green Buildings Task 2.1.E. Staff conducted the study session on December 4, 2023 and received strategic direction to return with an additions and alterations policy in 2024.

REPORT-IN-BRIEF

On August 19, 2020, Council approved the City's Climate Action Plan for Community Recovery ("CAP"), and adopted Resolution 11159 (2020 Series), which includes the goal of carbon neutrality by 2035 and building sector goals of 1) zero emissions from new buildings, and 2) a 50 percent reduction in emissions from existing buildings by 2030. On December 6, 2022, the Climate Action Plan was updated, and the building sector goals were reaffirmed.

On December 5, 2023, staff conducted a Study Session with City Council to discuss the various policy options available to increase the rate of existing buildings emissions reductions. Council directed staff to return in 2024 with draft energy efficiency requirements for major additions and alterations. This report and the attached proposed ordinance provide these draft requirements, referred to as the Energy Efficient Renovations Policy, for Council's consideration.

Focusing on the biggest energy users in residential buildings, water heating and space heating, as well as whole building efficiency, the Energy Efficient Renovations Policy would require that major additions and alterations (as further defined herein) will need to include certain energy efficiency measures as part of their project. The Policy would be implemented via local amendments to the California Energy Code and would not apply to cooking equipment (e.g., stoves), laundry dryers, or other unregulated energy uses.

To be consistent with federal and state law, the City must make findings that the proposed building code amendments related to building energy performance are cost effective and use less energy than the standard State Code. The California Energy Commission (CEC) must agree with the City's analysis before the local amendments to the California Energy Code can go into effect. This report provides findings that the proposed amendments that affect building energy use are cost effective (as further defined herein). The study that illustrates cost effectiveness is provided as Attachment B.

Should Council move forward with staff's recommendation, the second reading of the Ordinance would occur on June 4, 2024. Pending California Energy Commission approval of the local amendments to the California Energy Code, staff would develop project intake forms and work with 3C-REN to develop an Energy Code Coach support service ahead of the reach code going into effect on January 1, 2025.

DISCUSSION

Background

On August 19, 2020, Council approved the City's Climate Action Plan for Community Recovery ("CAP"), and adopted Resolution 11159 (2020 Series), which includes the goal of carbon neutrality by 2035 and building sector goals of 1) zero emissions from new buildings, and 2) a 50 percent reduction in emissions from existing buildings by 2030.

On December 6, 2022, the Climate Action Plan was updated, and the building sector goals were reaffirmed. In addition to a suite of solutions to support voluntary retrofits, the updated Climate Action Plan includes work task "Green Buildings 4.1.A", which directs staff to "Develop an equitable framework for requiring electrification retrofits and develop cost-effective building electrification policies for additions and alterations." This action is included in the 2023-25 Financial Plan as Climate Action Major City Goal Task 4.1.i.

As the City's electricity provided by Central Coast Community Energy (3CE) is on track to be 100% renewable by 2030, efforts to reduce climate emissions from buildings in SLO focus on reducing natural gas consumption and increasing overall building energy efficiency. Between 80 and 90 percent of gas used in residential buildings is consumed by a building's water heater and furnace. Due to current regulatory limitations, the City is excluding stoves and laundry dryers from existing building policy discussion. For these reasons, the existing building policy discussion, including the Energy Efficient Renovations Policy discussed in this report, will focus on water heating, space conditioning, and whole home energy efficiency.

On December 5, 2023, staff conducted a Study Session with City Council to discuss the various policy options available to increase the rate of building decarbonization. Council provided strategic direction to staff to return in 2024 with draft energy efficiency requirements for major additions and alterations. This report provides these draft requirements, now referred to as the Energy Efficient Renovations Policy, for Council's consideration.

Proposed Approach
As discussed in the September 19, 2023 Council Agenda Report regarding local energy code amendments for *new* buildings, the *California Restaurant Association v. City of Berkeley* ruling prevents the City from requiring all-electric buildings. Staff identified increased building energy performance requirements via local amendments to the California Energy Code (also known as a "reach code") as an allowable and viable alternative way to achieve lower emissions in new buildings. Just as with new buildings, Section 10-106 of the California Energy Code also allows for local amendments for efficiency standards for existing buildings in projects that include additions and alterations.[1] Similar to new buildings, Section 10-106 also notes that local amendments must be cost effective and result in buildings that consume less energy than permitted by the state Energy Code.

The California Energy Code establishes whole-building efficiency requirements, which account for a building's water heater, HVAC (heating, ventilation, and air conditioning) system, solar generating system, and insulation, among other things. However, it does not account for cooking equipment, laundry dryers, or other unregulated energy uses.

Proposed Energy Efficiency Renovations Policy
Staff proposes that single-family residential *major* additions and alterations be required to include certain energy efficiency measures, and in some cases include zero emission readiness provisions (i.e., pre-wiring for future electric appliances). This section provides proposed definitions for a "major addition" and "major alteration", the energy efficiency measures required for compliance, and proposed exemptions.

Proposed Policy Applicability
Staff reviewed construction and compliance measure cost estimates, previously submitted building permits, and examples from the nearly 20 statewide existing building energy reach codes to identify the appropriate applicability for buildings in San Luis Obispo. Based on cost of construction and compliance and in seeking to adopt a policy that effectively fits into major construction projects, staff propose that the policy apply to single-family homes under the following definitions and thresholds for applicability:

- Major Addition - Any change to an existing building that increases conditioned floor area by 500 or more square feet.
- Major Alteration - Any construction or renovation to an existing structure other than a repair whose work area covers 500 or more square feet of the total floor area of the existing building.
- Major Addition and Alteration – Any project whose combined addition and alteration has a work area equal to or greater than 500 square feet.
- Compliance Period - Per the draft ordinance, work that is completed within a one-year period would count toward the thresholds noted above.

[1] Building Energy Efficiency Standards: https://www.energy.ca.gov/sites/default/files/2022-12/CEC-400-2022-010_CMF.pdf

Proposed Policy Compliance Requirements
As proposed, projects that are identified as a Major Addition, Major Alteration, or Major Addition and Alteration, would have to complete the first two requirements listed below, and in some cases would also be required to complete the third requirement.

- Requirement 1 - Upgrade all internal and external lighting to LED lighting and upgrade external fixtures to include photocells or timers so that they are not operated during the daytime.
- Requirement 2 - Select from one of the following:
    a. A combination of energy efficient measures from Table 1 (below) totaling 8 or more points, or
    b. A heat pump hot water heater, or
    c. A heat pump HVAC system, or
    d. A rooftop solar energy system.
- Requirement 3 - Projects that are subject to the policy *and* that are electively upgrading their electrical service to 200 amps and their electrical panel must install breakers in the panel, run conduit and wiring to the location of a future heat pump hot water heater and heat pump HVAC system, and install outlets for those future systems.

Table 1. Energy Efficiency Measures[2]

Measure	Measure Points
Water Heating Package	1
Air Sealing	1
R-49 Attic Insulation	2
Duct Sealing	2
New Ducts and Duct Sealing	4
Windows	3
R-19 Floor Insulation	8
R-30 Floor Insulation	10

Proposed Exemptions
To accommodate the wide variability in existing buildings, staff proposes the following exemptions(the list below provides a brief overview of exemptions which are described in greater detail in Attachment A):

1. Repairs. Repairs are expressly exempt from the Policy.
2. Hardship. Projects with compliance costs that are more than 10% of total project cost, or that have building specific conditions that make compliance technically infeasible, may request a hardship exemption. Hardship exemptions will also cover

[2] Attachment A provides additional information about each energy efficiency measure.

unexpected circumstances. Approval of an infeasibility claim will be at the discretion of the Chief Building Official. As with all building code determinations and interpretations, decisions are appealable to the Construction Board of Appeals.

3. Pre-Compliance. Projects that can demonstrate that they have previously installed compliance measures will be given credit for those measures.
4. Historic Buildings. Historic buildings that could not comply without affecting their listing or registry status would be exempt.
5. Hazard Mitigation. Alterations completed solely for seismic safety upgrades would be exempt.
6. Roof and Windows: Alterations that consist solely of roof and/or window projects would be exempt.
7. New Units: When an addition or alteration results in the creation of a new residential unit, the square footage of that unit shall not be counted towards the 500 square threshold.

Examples of Applicable Projects and Compliance
The types of projects that would be applicable to the Energy Efficient Renovation Policy under the definitions proposed above would be elective major construction projects that are closer to new construction than a typical smaller addition or alteration might be. These types of projects require a building permit and are required to comply with state and local codes and requirements. As such, depending on the project scope, applicants of these types of projects typically already have an architect, engineer, and energy code compliance expert on their design team. In many cases, the construction teams of such projects include a general contractor and both plumbing and electrical sub-contractors.

Staff reviewed recent permits and standard construction cost estimates to develop an example major addition and major alteration, described in Figure 1, below. Since it is unlikely that most people in the community have considered adding 500 square feet to their home or altering 500 square feet of their home, it is helpful to provide examples of both types of projects. Note that costs are estimates and may be higher or lower depending on specific situations.

Figure 1. Additions and Alterations

•MAJOR ADDITION EXAMPLE

•- 1,000 sq ft single family home adds 550 square feet in a second story with two new bedrooms and a full bathroom

•- Electively upgrades electrical service and installs new panel

•MAJOR ALTERATION EXAMPLE

•- 1,500 sq ft single family home alters 800 square feet, including converting 2 bedrooms, a hallway, and open space into 3 bedrooms and adding a new bathroom

The major addition example can be used to illustrate how compliance works. In this project, it is likely that the project would include replacing a hot water heater, so the builder/owner would likely choose to comply with the heat pump hot water heater measure. Since they are electively upgrading their electric service and panel, they would also add a breaker, conduit and wire, and an outlet for a future HVAC system. Taken together, the LED lighting upgrades, zero emission building readiness requirements, and heat pump hot water heater installation is estimated to cost $5,000-$15,000. Compliance would result in an approximately 2-6% increase in project costs. However, much of these costs could be offsets by available rebates and incentives as described below.

Cost Effectiveness

The California Energy Commission (CEC) requires any local energy standards that exceed the California Energy Code to be cost effective and to use less energy than the state requirements. The CEC requires the local agency to adopt a determination, at a public meeting, that the energy standards are cost effective. Staff has provided recommended findings that meet these standards below and in the draft Ordinance provided as Attachment A. The determination must subsequently be filed with the CEC, which would be completed by staff upon adoption of the draft Ordinance.

The CEC provides two different cost effectiveness metrics. "On-bill" cost effectiveness refers to the direct cost experienced by the homeowner. For something to be cost effective "on-bill", the energy bill savings of a measure must at least pay for the cost of that measure over a 20-year period. The other approach is "Long-Term Systemwide Cost" (LSC). LSC considers the cost to install energy efficiency measures, the on-bill savings from those measures, and larger system costs that everyone pays for like energy infrastructure costs and the impacts of climate change. For CEC approval, a local

amendment to the California Energy Code must show a compliance pathway that is *either* "on-bill" or "LSC" cost effective. As described below, staff's proposed policy has "on-bill" *and* "LSC" cost effective compliance pathways.

In support of reach code development, the California Energy Codes and Standards Statewide Utility Program, which includes the State's Investor-Owned Utilities (Pacific Gas, and Electric (PG&E), San Diego Gas and Electric (SDG&E), and Southern California Edison (SCE), under the auspices of the California Public Utilities Commission) developed and published the 2024 Single Family Cost Effectiveness Report, provided as Attachment B.[3]

This study and the associated cost-effectiveness data are highly detailed and are included in the record to support Council's findings and policy decisions. The study and the associated cost-effectiveness data include a calculated benefit-to-cost ratio for a wide variety of measures and climate zones. A benefit-cost value of "1" or greater illustrates that the measures save more than they cost and are therefore "cost effective."[4] The study and the associated cost-effectiveness data are the basis for staff's recommended cost effectiveness findings and are sufficient to illustrate compliance with the requirements set forth under California Administrative Code Chapter 10-106.

Based on the study, staff recommends finding that the proposed local additions and alterations amendments to the 2022 California Energy Code to be cost-effective and consume less energy than otherwise permitted by Title 24, Part 6. The following additional detail is included for transparency and to facilitate the California Energy Commission's review of the City's cost effectiveness findings:

- *The City's requirement that major additions or alterations install energy efficiency measures includes at least five cost effective measure packages:*
    - Package 1, installing the efficiency measure of R-30 Floor Insulation would save energy relative to the base code and would achieve a benefit to cost ratio of 1.4 on an on-bill basis.
    - Package 2, installing the efficiency measure of R-19 Floor Insulation would save energy relative to the base code and would achieve a benefit to cost ratio of 1.4 on an on-bill basis.
    - Package 3 to installing a Heat Pump Water Heater (HPWH), would save energy relative to the base code and would achieve a benefit to cost ratio of 1.6 on an LSC basis.
    - Package 4, Heat Pump Space Heater, would also save energy relative to the base code and would achieve a benefit to cost ratio of 4.2 on an LSC basis.

[3] The California Energy Codes and Standards Statewide Utility Program publishes cost effectiveness reports and accompanying study data at: https://localenergycodes.com/content/resources

[4] For more detail, see section 2.1.3 of https://localenergycodes.com/download/1266/file_path/fieldList/2022%20Nonres%20New%20Construction%20Cost-eff%20Report.pdf

- Package 5 to install PV + Electric Ready Pre-Wiring would also save energy relative to the base code and would achieve a benefit to cost ratio of 1.4 on an on-bill basis.

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:

- Central Coast Community Energy provides the Electrify Your Home program, which provides rebates and incentives to contractors completing heat pump hot water heater ($4,600 to $6,385), heat pump HVAC ($1,500 to $5,000), and associated electrical work (lesser of $2,000 or 50% of total project cost).
- 3C-REN provides single family incentives for energy savings associated with energy efficiency projects. Incentives are available for heat pump hot water heaters ($1,500 to $6,000) and heat pump HVAC ($2,000 to $9,000).
- The Inflation Reduction Act added new provisions to the federal tax code that allows for tax credits for certain energy efficiency measures (30% off of total project cost, up to $1,200), heat pump hot water heaters (30% up to $2,000), heat pump HVAC systems (30% off of total project cost up to $2,000) and rooftop solar generation systems (30% off of total project cost with no maximum). [5]
- The *Energy Code Coach* program offered by 3C-REN provides no-cost personalized support to help building professionals and local government staff navigate the Energy Code, including local amendments adopted by the City. The City will work with 3C-REN staff to develop a help desk support service to answer applicant questions about compliance with the Energy Efficient Renovations Policy. This service will be hosted by 3C-REN at no-cost to the City.

Previous Council or Advisory Body Action

- August 2020 – Council adopted Resolution 11159 (2020 Series) which approved the Climate Action Plan for Community Recovery with the goal of community carbon neutrality by 2035 and a sub-goal of 50 percent reduction in emissions from existing buildings by 2030.
- December 2022 – Council adopted Resolution No. 11381 (2022 Series) reaffirming these goals and created a work program for fiscal years 2023-27, including Green Buildings Action 2.1.E, which directs staff to, "Develop an equitable framework for requiring electrification retrofits and develop cost effective building electrification policies for additions and alterations."
- June 2023 – Council adopted the 2023-25 Financial Plan Climate Action Major City Goal 4.1.i, which directs staff to conduct a study session, and pending Council direction, develop an equitable framework for cost effective building electrification retrofit policies, with an initial focus on additions and alterations, as called for by CAP Green Buildings Task 2.1.E.

[5] *The 3CE, 3CREN, and tax credit incentives may be "stacked" and used together to cover 100% of project costs.*

- December 2023 – Council receives a report and presentation from staff regarding existing building energy retrofit policy options and provides direction to staff to return in Spring of 2024 with a draft policy related to energy efficiency requirements in major residential additions and alterations.

Public Engagement

Ahead of the December study session on existing buildings, staff conducted numerous public engagement activities. Since receiving Council strategic direction to develop an additions and alterations retrofit policy at that study session, staff have conducted the additional following outreach:

- Community Workshops and Survey. At the December 2023 study session, staff received direction to reach out directly to neighborhood groups. Following this direction, staff held two workshops in March of 2024 – one at Laguna Middle School and one at the downtown library. Staff reached out directly to community members associated with neighborhood groups including Residents for Quality Neighborhoods, Alta Vista, and Save Our Downtown. Staff requested that these community members forward meeting invites directly to their membership and worked with them to facilitate ease of access. Approximately 15 community members attended across the two meetings and provided substantial feedback that led to direct changes in the policy, including the addition of solar as a compliance measure, the replacement of a percentage metric for the definition of major alteration with a square foot metric, removing accessory dwelling units as triggers for existing building retrofits, and introducing flexibility for an applicant to identify where a future water heater or HVAC system might be placed as they work to comply with the proposed electric readiness requirements.

  To support broader access to the workshop, staff also developed an Open City Hall exercise that included a narrated version of the workshop presentation; 284 community members visited, leaving 112 comments.[6] Critical feedback included concerns about administrative complexity and potential impacts on other Building Department related activities, the potential for negatively impacting housing costs and affordability, disagreements about the importance of local climate action, and concerns about unintended consequences. Other feedback included general support for the policy with recommendations to make compliance as streamlined as possible, facilitate access to rebates and incentives, and ensure that the exemptions are as clear as possible.

- Chamber of Commerce. Staff presented to the Legislative Action Committee on April 11 to provide detail about the proposed energy efficient renovations policy described in this Council Agenda Report.

[6] Comments from the exercise are archived and available for viewing at: https://communityfeedback.opengov.com/portals/sanluisobispoca/Issue_13269

- Climate Coalition. City Staff presented to the Climate Coalition Executive Director on April 22 and multiple representatives from the Climate Coalition attended the community workshops as described above.
- Central Coast Community Energy. City staff met with 3CE staff to discuss the ongoing availability of relevant rebates and incentives. As part of this outreach, Building Department staff also met with 3CE Program Staff to identify ways to streamline rebate applications and as a result, are currently working on integrating 3CE's rebate process into relevant online permit applications.
- One-on-One Discussions with Contractors. Staff met with several contractors, ranging from large corporate-owned to small family-owned companies. Staff found that the regional workforce generally has the capacity and capability to install the compliance measures included in staff's proposed policy.
- Construction Board of Appeals: Staff presented the proposed policy with a special focus on exemptions at an informational presentation to the Construction Board of Appeals on April 25. Board member questions focused on issues related to electrical panel capacity for proposed improvements, future statewide electric appliance regulations, and the applicability of Accessory Dwelling Units.
- Developer's Roundtable: Staff presented the proposed policy and received feedback from the Developer's Roundtable on May 2. Participants primarily asked clarifying questions and one participant asked for the City to share more information about available rebates and incentives.

Policy Implementation Considerations

The policy would be implemented via an additional intake form required at time of building permit submittal. Building staff would review the application for consistency with the policy and field verification would happen as part of the typical inspection process. To limit the impact on Building Department staff, the Office of Sustainability proposes teaming with 3C-REN's "Energy Code Coach" Program to spend June through December of 2024 developing project intake forms, developing staff guidance curriculum and training, convening Code Coach staff and Building Department staff for internal training, and developing applicant communications and public facing guidance documents. In addition, 3C-REN's Energy Code Coach will provide a technical assistance hotline starting on January 1, 2025, to answer basic applicant questions about the policy, provide applicants information about common compliance pathways, connect applicants to rebates and incentives, and answer City staff questions about compliance during field verification. City staff have worked with 3C-REN staff to confirm the availability of and support for this scope of work.

Staff recommends that the City Council consider the following during discussion of the draft ordinance:

1. Based on direction provided by Council at the study session, the ordinance addresses single family additions and remodels over a certain size. According to past permit records there are approximately 15 projects of this size and scope per year – most of which already complied with the provisions of the policy. It is

therefore expected that approximately 5-10 projects would be required to add energy efficiency measures due to this ordinance per year, but the total would increase over time and contribute to the City's goal of carbon neutrality by 2035. Staff estimate that compliance would reduce covered buildings greenhouse gas emissions by up to 40%. Due to the fact that this ordinance addresses additions and alterations to single-family homes it is not likely that it will impact developers. Building and Safety staff have reported that the types of projects generally completed in the City that would be subject to this ordinance are homeowners and those that purchase houses to flip (although this has become a less common practice lately).

2. As this policy change is occurring outside the regular building code update cycle, it will require re-adoption during the building code update ahead of January 2026 as is also the case with energy reach code provisions for new buildings and other local amendments made in other parts of the building code.
3. As with any change to regulations or codes, this policy will require some additional training for staff and assistance/education for the public as they learn the new requirements. This may marginally increase the amount of time required to review projects that are subject to the regulations, especially early in the implementation of the new ordinance when staff and the public are adjusting to the new requirements.
4. Energy efficiency retrofits for multi-family projects and for the main properties of attached Accessory Dwelling Units (ADUs) were initially considered as part of the policy development process. Multi-family projects were removed from staff's recommendation due to an extended delay in the statewide cost effectiveness study for this property type. Accessory Dwelling Units were removed due to extensive community concern about potential impacts to housing production. In both cases, staff believes there are cost effective ways to include electric readiness and energy efficiency measures in these projects and recommends reevaluating the feasibility of including these types of projects as part of the 2026 Energy Code update.

SCHEDULE AND NEXT STEPS

Should Council approve staff's recommendations, work would proceed on the timeline provided in Table 2 below.

Table 2. Schedule and Next Steps

Task	Timeframe
Second reading of the draft Ordinance (Attachment A) and submittal to the California Energy Commission.	June 2024
Receive approval from the California Energy Commission	September-October 2024
Develop implementation forms, training, and help desk services.	July – December 2024
Policy goes into effect	January 1, 2025

CONCURRENCE

The Community Development Department and City Attorney's Office concurs with this report.

ENVIRONMENTAL REVIEW

Staff's recommendations are found to be 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 for causing a significant effect on the environment. Further, this ordinance is also exempt from CEQA under the categorical exemptions in Section 15308 of the CEQA Guidelines in that the proposed ordinance would institute regulatory requirements intended to protect the environment and natural resources.

FISCAL IMPACT

Budgeted: Yes
Budget Year: 2023-24
Funding Identified: Yes

Fiscal Analysis:

Funding Sources	Total Budget Available	Current Funding Request	Remaining Balance	Annual Ongoing Cost
General Fund	$	$	$	$
State				
Federal				
Fees				
Other:				
Total	**$**	**$**	**$**	**$**

The reach code requirements will be implemented through the building permit review process as described in the Policy Implementation section above. There may be costs associated with training staff and providing additional support to the community during the implementation of this program. If implementation of this program impacts time required to review permit plans, then fees for review of building permit plans may increase to absorb the cost, but any impacts are expected to be marginal. Some of this additional work can be directly supported by the 3C-REN Energy Code Coach Program, which provides technical support for code interpretation. Funded under the auspices of the California Public Utilities Commission, Energy Code Coach is free to the user and can be accessed at no cost by project applicants and City staff.

ALTERNATIVES

1. ***Council could decide not to adopt the ordinance.*** Staff does not recommend this alternative as the Policy is supportive of achieving the goal of reducing emissions from existing buildings in half by 2030.
2. ***Council could provide direction to staff to continue to work on the ordinance to explore the inclusion of new ADUs and multifamily units.*** Upon receiving this direction, staff would continue to work on the policy and return at a later date with options to address multi-family units and ADUs.
3. ***Council could provide direction on program specifics including definitions, compliance measures, exemptions, and effective date.*** Staff requests that Council provide specific direction on proposed changes.
4. ***Council could provide direction to delay reach code adoption to coincide with the 2025 California Building Code update.*** The 2025 code would be adopted in late 2025 and would go into effect in 2026, which would delay implementation by one year.

ATTACHMENTS

A - Draft Ordinance Adopting the Energy Efficient Renovations Policy
B - 2024 Single Family Cost-Effectiveness Study

ORDINANCE NO. _____ (2024 SERIES)

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF SAN LUIS OBISPO, CALIFORNIA, ADOPTING LOCAL AMENDMENTS TO PART 6 OF THE BUILDING CONSTRUCTION AND FIRE PREVENTION CODE, 2023

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, City of San Luis Obispo residents and businesses have repeatedly identified climate action as a top community priority; and

WHEREAS, Resolution 11159 (2020 Series) adopts the City of San Luis Obispo Climate Action Plan for Community Recovery, which includes a communitywide goal of carbon neutrality by 2035 and sector specific goal of reducing emissions from existing buildings by half by 2030; and

WHEREAS, Resolution 11381 (2022 Series) reaffirmed these communitywide and sector specific goals; and

WHEREAS, the inventoried greenhouse gas emissions in the City of San Luis Obispo come from a variety of sources, primarily transportation and energy use in buildings and facilities; and

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

WHEREAS, Public Resources Code Section 25402.1 (h)(2) allows local agencies to adopt local amendments that are cost-effective and that result in buildings that use less energy than would otherwise be required by the 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 Code Cycle: Custom Cost Effectiveness Analysis - City of San Luis Obispo" existing building cost-effectiveness study, and finds it 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 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, the requirements specified in this Ordinance were reviewed via public comment and through a publicly noticed public hearing process.

NOW, THEREFORE, BE IT ORDAINED by the Council of the City of San Luis Obispo as follows:

SECTION 1. Purpose. It is the purpose and intent of this Ordinance to establish standards for single-family residential retrofits including major additions and alterations that exceed minimum 2022 Title 24 Part 6 requirements.

SECTION 2. Adoption**.** The local amendments to Part 6 of the City of San Luis Obispo Building Construction and Fire Prevention Code, 2023 (SLOMC Section 15.02.060) as specified in Exhibit A, are hereby adopted by the City of San Luis Obispo to be codified under Chapter 15.02.060 and Chapter 15.04.065. The Council hereby adopts the recitals herein as separate and additional findings of fact in support of adoption of the ordinance.

SECTION 3. Severability. If any word, phrase sentence part, section, subsection or other portion of this amendment or any application thereof to any person or circumstance is declared void, unconstitutional, or invalid for any reason, then such word, phrase, sentence, part, section, subsection, or other portion, or the prescribed application thereof, shall be severable, and the remaining provisions of this amendment, and all applications thereof, not having been declared void, unconstitutional or invalid, shall remain in full force and effect.

SECTION 5. Findings. 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 of San Luis Obispo, and the City Council adopts the following findings in support of local necessity for the changes or modifications:

1. San Luis Obispo is situated along a wildland-urban interface and has been identified as a Community at Risk from wildfire and is extremely vulnerable to wildfires and firestorms, and human activities releasing greenhouse gases into the atmosphere cause increases in worldwide average temperature, drought conditions, vegetative fuel, and length of fire seasons- contributing to the likelihood and consequences of fire.

2. The City of San Luis Obispo is situated at the base of a watershed of the Santa Lucia Mountains and flooding of San Luis, Chorro, Stenner, Old Garden, and Brizzolara Creeks results in conditions rendering fire department vehicular traffic unduly burdensome or impossible, as witnessed in major floods that occurred in 1952, 1961, 1969, 1973, 1978, 1982, 1995, and 2023. Furthermore, flood conditions described above create the potential for overcoming the ability of the fire department to aid or assist in fire control, evacuations, rescues and other emergency task demands inherent in such situations. The resulting overburdening of fire department personnel may cause a substantial or total lack of protection against fire for the buildings and structures located in the City of San Luis Obispo. The afore-described conditions support the imposition of fire protection requirements greater than those set forth in the California State Building Standards Code and support the imposition of more restrictive requirements than set forth in the California Energy Code for the purpose of reducing the City's contributions to Greenhouse Gas Emissions resulting in a warming climate and related severe weather events.

3. The aforementioned flood and rain events result in conditions wherein stormwater can inundate the wastewater treatment system as witnessed in major floods that occurred in 1952, 1961, 1969, 1973, 1978, 1982, and 1995. Furthermore, rain events and flood conditions described above create a condition referred to as Inflow and Infiltration (I/I) that allow rain and flood waters to flow and/or seep into the wastewater system and overcome the ability of the wastewater collection system and Water Reclamation Facility (WRF) to convey and treat sewage. The resulting overburdening of the wastewater system can result in threats to public health, public and private property and water quality and violations and fines from the State of California, the Environmental Protection Agency (EPA) or others. To the extent that climate change has the potential to make these conditions worse, more restrictive Energy Code requirements to achieve reduced greenhouse gas emissions are necessary.

4. Seasonal climatic conditions during the late summer and fall create numerous serious difficulties in the control and protection against fire situations in the City of San Luis Obispo. The hot, dry weather in combination with Santa Lucia (offshore) winds frequently results in wildland fires in the brush-covered slopes on the Santa Lucia Mountains, San Luis Mountain, and the Irish Hills areas of the City of San Luis Obispo. The aforementioned areas surround the City. When a fire occurs in said areas, such as occurred in 1985 when the Los Pilitas fire burned six days and entered the City and damaged many structures, the entirety of local fire department personnel is 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 climatic 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. Therefore, the above-described findings support the imposition of measures to increase the efficiency of existing buildings in the City to reduce greenhouse gas emissions.

5. Failure to address and substantially reduce greenhouse gas emissions creates an increased risk to the health, safety, and welfare of City residents.

6. 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 "2022 Code Cycle: Custom Cost Effectiveness Analysis - City of San Luis Obispo" cost effectiveness study prepared by the California Energy Codes and Standards Statewide Utility Program. Specifically, the City finds that there are at least five cost effective measure packages:

    - Package 1, installing the efficiency measure of R-30 Floor Insulation would save energy relative to the base code and would achieve a benefit to cost ratio of 1.4 on an on-bill basis.
    - Package 2, installing the efficiency measure of R-19 Floor Insulation would save energy relative to the base code and would achieve a benefit to cost ratio of 1.4 on an on-bill basis.
    - Package 3 to installing a Heat Pump Water Heater (HPWH), would save energy relative to the base code and would achieve a benefit to cost ratio of 1.6 on a "Long-term System Cost" (LSC basis).
    - Package 4, Heat Pump Space Heater, would save energy relative to the base code and would achieve a benefit to cost ratio of 4.2 on an LSC basis.
    - Package 5 to install PV + Electric Ready Pre-Wiring would save energy relative to the base code and would achieve a benefit to cost ratio of 1.4 on an on-bill basis.

SECTION 6. CEQA. 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 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 of San Luis Obispo 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.

SECTION 7. Violations**.** Violation of the requirements of this Ordinance shall be considered, at the City's election, an infraction of the City of San Luis Obispo Municipal Code punishable by all sanctions prescribed in Chapter 1.12, or an administrative violation punishable as provided under Chapter 1.24.

SECTION 8. Effective Date. Pending approval by the California Energy Commission, this Ordinance shall be effective on January 1, 2025.

SECTION 9. Ordinance Summary. A summary of this ordinance, together with the names of Council members voting for and against, shall be published at least five (5) days prior to its final passage, in The New Times, a newspaper published and circulated in this City. This ordinance shall go into effect at the expiration of thirty (30) days after its final passage.

INTRODUCED on the ____ day of _____ 2024, **AND FINALLY ADOPTED** by the Council of the City of San Luis Obispo on the ____ day of ____, 2024, on the following vote:

AYES:
NOES:
ABSENT:

_____
Mayor Erica A. Stewart

ATTEST:

_____
Teresa Purrington
City Clerk

APPROVED AS TO FORM:

_____
J. Christine Dietrick
City Attorney

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the official seal of the City of San Luis Obispo, California, on _____.

_____
Teresa Purrington, City Clerk

O _____

Exhibit A

Section 15.02.060

Amend Section 15.020.060 to read as follows:

The City of San Luis Obispo hereby adopts the 2022 California Energy Code as Part 6 of the San Luis Obispo Building Construction and Fire Prevention Code, 2023. Except as otherwise provided herein, or as later amended in Section 15.04.060 and 15.04.065, or affected by San Luis Obispo Health and Safety Code Chapter 8.11, Part 6 of the San Luis Obispo Building Construction and Fire Prevention Code, 2023, 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 15.04.065
AMENDMENTS – ENERGY STANDARDS – ADDITIONS AND ALTERATIONS

A. Adoption of Codes and Applicability

The effective date of this ordinance shall be January 1, 2025 and is applicable to existing single family residential buildings. The amendments contained in 15.04.065 do not apply to repairs to buildings.

B. 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 500 or more square feet in a one-year period.

MAJOR ALTERATION is any construction or renovation to an existing structure other than a repair or alteration whose work area covers 500 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.

WORK AREA That portion or portions of a building consisting of all reconfigured spaces as indicated on the construction documents. Work area excludes other portions of the building where incidental work entailed by the intended work must be performed and portions of the building where work not initially intended by the owner is specifically required by this code.

C. 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).

D. 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 4 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. 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.

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. 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 major addition and alteration.** Any project that includes an addition and alteration that has a work area equal to or greater than 500 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. 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.

4. **Electric Readiness.** Any major addition, major alteration, or combination major addition and alteration that includes a new electrical panel and electrical service upgrade to 200A or more shall include electric readiness components per 150.0(n)1(A)-(B) and 150.0(t)

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 10% 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 (i.e., compliance exceeds 10% of total project cost);
ii. That it is technically infeasible to achieve compliance through any available set of measures.
iii. 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 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 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.

(3) Denial of exemption. If the chief building official 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 the determination of the chief building official 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.

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 building official, then these measures shall not be required to be newly installed.

Exception 4 to Section 150.0(w): The applicant may request an exemption to any requirements of this chapter which would impair the historic integrity of any building listed on a local, state, or federal register of historic structures, as determined by the chief building official and as regulated by the California Historic Building Code (Title 24, Part 8). In making a determination of exemption, the chief building official 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 safety improvements.

Exception 6 to Section 150.0(w): An alteration that consists solely of roof and/or window projects.

Exception 7 to Section 150.0(w): When an addition or alteration results in the creation of a new residential unit, the square footage of that unit shall not be counted towards the 500 square foot "Major" addition, alteration, or addition and alteration threshold.

D. Add new Table 150.0-I to read as follows:

Table 150.0-I: Measure Menu

Measures	**Target Score 8**
E1 - LED lamps and Exterior Photocells	Mandatory
E2 - Water Heating Package	1
E3 - Air Sealing	1
E4 - R-49 Attic Insulation	2
E5 - Duct Sealing	2
E6 - New Ducts + Duct Sealing	4
E7 - Windows	3
E8 - R-19 Floor Insulation	8
E9 - R-30 Floor Insulation	10
E10 - Heat Pump Water Heater (HPWH)	12
E11 - Heat Pump Space Heater	11
ER1 - Solar PV + Electric Ready Pre-Wire	13
Note: the measures in the Measure Menu table shall conform to the specifications in Table 150.0-J	

E. Add new Table 150.0-J to read as follows:

Table 150.0-J: Measure Specifications

ID	Measure Specification
Energy Efficiency Measures	
E1	Lighting Measures – Replace all interior and exterior screw-in incandescent, halogen, and compact fluorescent lamps with LED lamps. Install photocell controls on all exterior lighting luminaires consistent with current Title 24 requirements for new single family residential buildings. Alternative means of exterior lighting timing controls, including smart home devices, may be approved.
E2	Water Heating Package: 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 ¾ 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. Water heaters 20 gallons or less, or water heaters that are not able to add exterior insulation may not take credit for this measure.
E3	Air Sealing: 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. Compliance shall be demonstrated with blower door testing conducted by a certified HERS Rater no more than three years prior to the permit application date 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. 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 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.
E4	R-49 Attic Insulation: 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. 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.
E5	Duct Sealing: 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.
E6	New Ducts and Duct Sealing: 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.
E7	Windows: Replace at least 50% of existing windows with high performance windows with an area-weighted average U-factor no greater than 0.30.

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E8	R-19 Floor Insulation: 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.
E9	R-30 Floor Insulation: 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.
E10	Heat Pump Water Heater (HPWH): Replace existing electric resistance or natural gas storage water heater with a heat pump water heater.
E11	Heat Pump Space Heater: Replace all existing gas and electric resistance space heating systems with an electric-only heat pump system.
Solar PV and Electric-Readiness Measures	
ER1	PV and Electric Ready Pre-Wire: 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, Include electric readiness components per 150.0(n)1(A)-(B) and 150.0(t) and one of: A. Energy Storage Systems (ESS) Ready, as specified in Section 150.0(s), or 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.

F. 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.

G. 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

2. 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.

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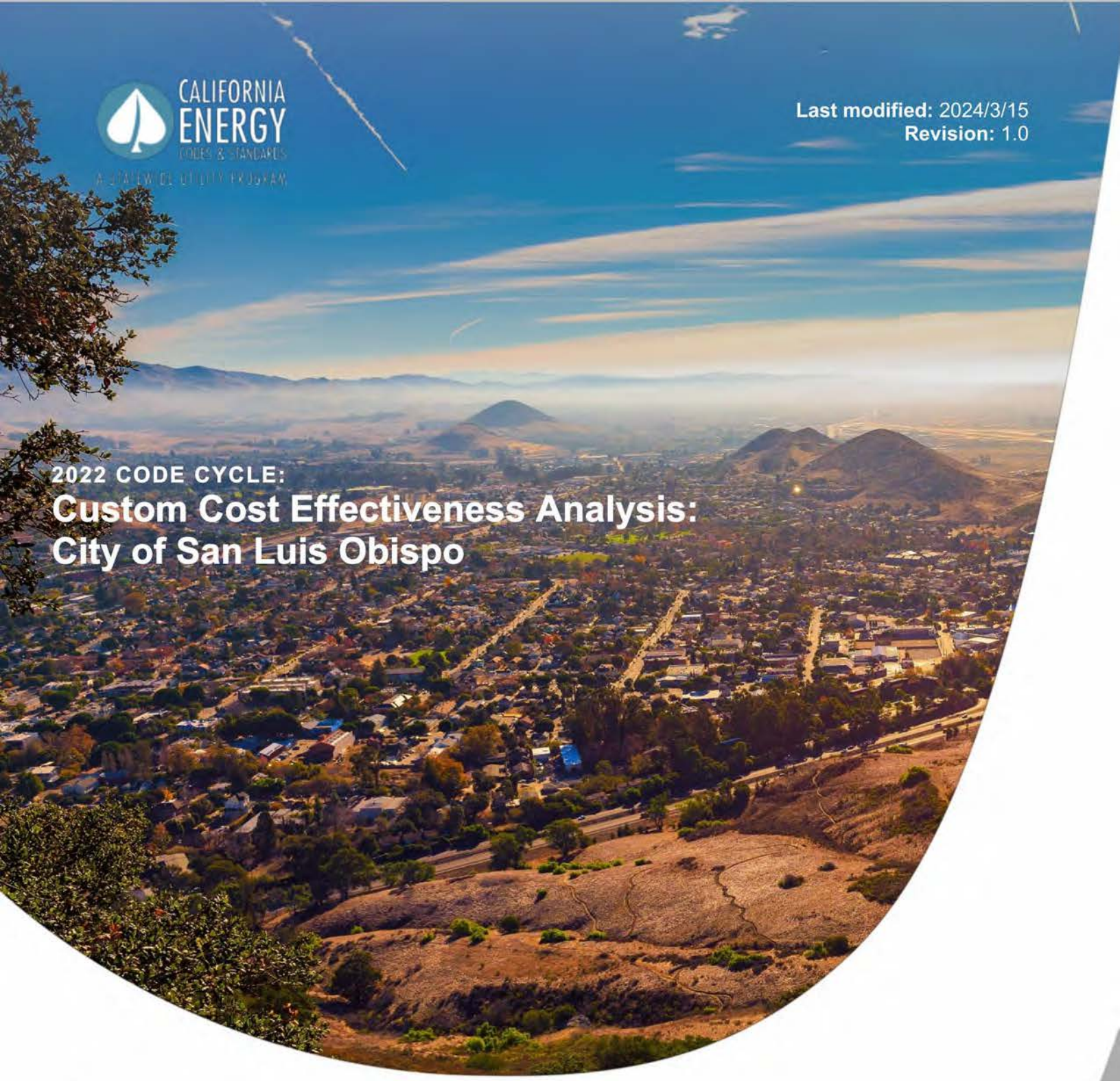

Last modified: 2024/3/15
Revision: 1.0

2022 CODE CYCLE:

Custom Cost Effectiveness Analysis: City of San Luis Obispo

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

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

Legal Notice

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Acronym List

3CE – Central Coast Community Energy

B/C – Benefit-to-Cost Ratio

CBECC - California Building Energy Code Compliance

CBSC - California Building Standards Commission

CEC - California Energy Commission

CZ – Climate Zone

GHG - Greenhouse Gas

IOU – Investor-Owned Utility

POU – Publicly Owned Utility

PG&E – Pacific Gas & Electric (utility)

SCE – Southern California Edison (utility)

SCG – Southern California Gas (utility)

SDG&E – San Diego Gas & Electric (utility)

SLO – San Luis Obispo

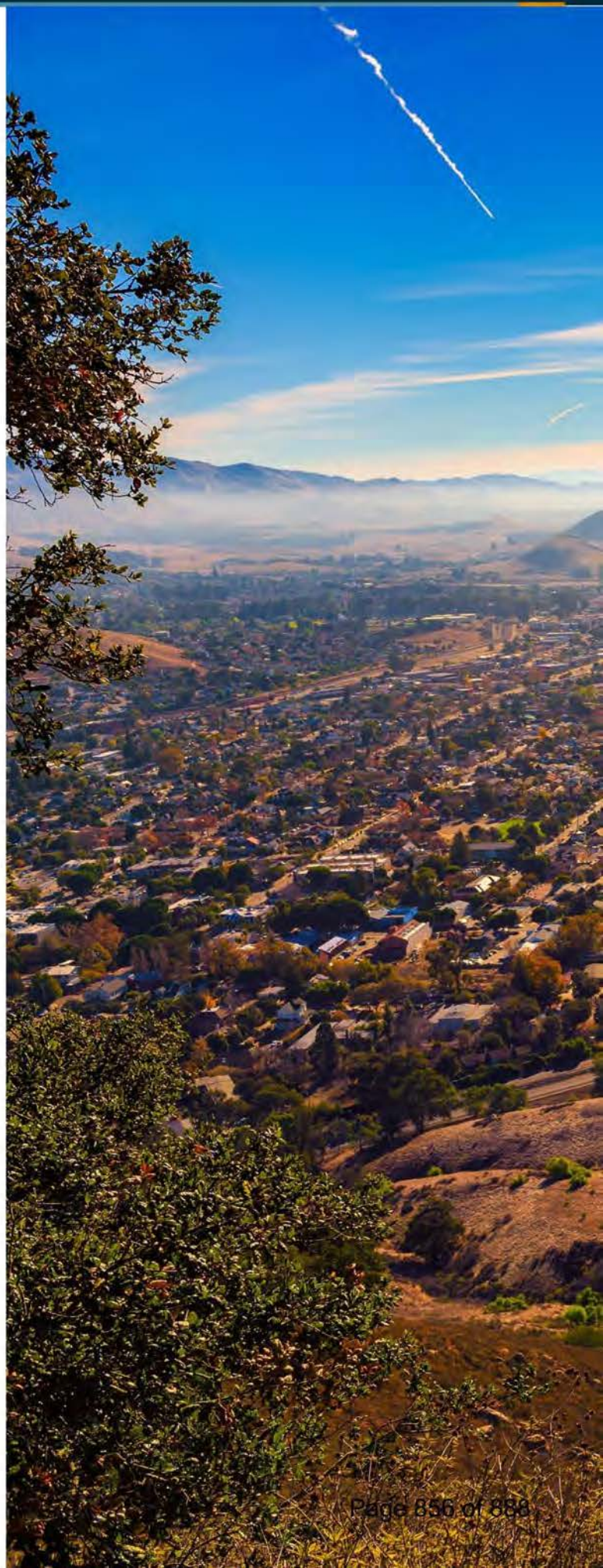
kWh – Kilowatt Hour

NPV – Net Present Value

PV - Solar Photovoltaic

TDV - Time Dependent Valuation

Title 24 – California Code of Regulations Title 24, Part 6



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1 Introduction

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.

This report is an addendum to the *2022 Single Family Retrofit Cost-effectiveness Study* (Statewide Reach Codes Team, 2024) modified to accurately represent local conditions for San Luis Obispo (SLO) in California Climate Zone 5 and Central Coast Community Energy's (3CE's) service territory. The study analyzes 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 methodology, prototype characteristics, and measure packages are retained from the main study referenced above except for the energy costs are calculated using local 3CE utility rates. Measure packages include 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). A 1,665 square foot single family home prototype with an attached garage was evaluated in this study.

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

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

2 Methodology and Assumptions

2.1 Reach Codes

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

2.1.1 Benefits

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

- On-Bill: Customer-based lifecycle cost approach that values energy based upon estimated site energy usage and customer on-bill savings using electricity and natural gas utility rate schedules over a 30-year duration, accounting for a three percent discount rate and energy cost inflation per Appendix 7.2.3.
- 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 CO2 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.

The Reach Codes Team performed energy simulations using the 2025 research version of the Residential California Building Energy Code Compliance software (CBECC).

2.1.2 Costs

The Reach Codes Team assessed the incremental costs and savings of the energy packages over the lifecycle of 30 years. 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. The Reach Codes Team obtained measure costs from a contractor survey conducted in the summer of 2023.

2.1.3 Metrics

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

- NPV: The Reach Codes Team uses net savings (NPV benefits minus NPV costs) as the cost-effectiveness metric. If the net savings of a measure or package is positive, it is considered cost effective. Negative net savings represent net costs to the consumer. A measure that has negative energy cost benefits (energy cost increase) can still be cost effective if the costs to implement the measure are even more negative (i.e., construction and maintenance cost savings).
- B/C Ratio: Ratio of the present value of all benefits to the present value of all costs over 30 years (NPV benefits divided by NPV costs). The criteria for cost-effectiveness is a B/C greater than 1.0. A value of one indicates the savings over the life of the measure are equivalent to the incremental cost of that measure. A value greater than one represents a positive return on investment.

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

construction cost savings and lifetime energy cost savings), B/C ratio cost-effectiveness is represented by ">1". Because of these situations, NPV savings are also reported, which, in these cases, are positive values.

2.1.4 Utility Rates

Table 1 summarizes the utility tariffs applied in this analysis. The standard tariff was applied in most cases. Homes with a heat pump service space or water heating in IOU territory are eligible for either the electrification or the standard tariff. In these cases, results are provided using both tariff options. The Net Billing Tariff (NBT) tariff was applied to homes with onsite generation (PV systems).

For a more detailed breakdown of the rates selected refer to Appendix 7.2 Utility Rate Schedules.

Table 1. Utility Tariffs for San Luis Obispo

Electric / Gas Utility	Standard Electric Tariff	Electrification Tariffs	Tariffs Required Under NBT	Natural Gas Tariff
3CE / SoCalGas	E-TOU Option C	E-ELEC	E-ELEC	GR

The Reach Code Team applied the recently approved net billing tariff (NBT) rules for PV systems. NBT, also known as NEM-3, is the successor tariff to NEM 2.0. The rate paid for electricity exported to the grid is much lower under NBT than under NEM 2.0. The hourly export rates applied in this study were obtained from analysis conducted by Energy and Environmental Economics (E3) for the California Public Utilities Commission as part of the NEM revisit.[1] These hourly export rates vary for each major IOU and by year, the 2024 export rate projections were used for this analysis.

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. 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 4.4 Sensitivities, was based on those used within the 2025 LSC factors (LSC replaces TDV in the 2025 code cycle) which assumed steep increases in gas rates in the latter half of the analysis period. Appendix 7.2.3 and the main 2022 Single Family Retrofit Cost-effectiveness Study (Statewide Reach Codes Team, 2024) for details.

2.2 Greenhouse Gas Emissions

The analysis uses the greenhouse gas (GHG) emissions estimates built-in to CBECC-Res. There are 8760 hourly multipliers accounting for time dependent energy use and carbon emissions based on source emissions, including renewable portfolio standard projections. Natural gas fugitive emissions, which are shown to be substantial, are not included. There are two strings of multipliers—one for Northern California climate zones, and another for Southern California climate zones.[2]

[1] https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/demand-side-management/customer-generation/nem-revisit/net-billing-tariff

[2] CBECC-Res multipliers are the same for CZs 1-5 and 11-13 (presumed to be Northern California), while there is another set of multipliers for CZs 6-10 and 14-16 (assumed to be Southern California).

3 Prototype Designs and Measure Packages

3.1 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, 3 and the Energy Commission single family new construction prototypes are larger than many existing single family homes across California. For this analysis, a 1,665 square foot prototype was evaluated. Table 2 describes the basic characteristics of the single family prototype. Additions are not evaluated in this analysis as they are already addressed in Section 150.2 of Title 24, Part 6. The CEC has proposed significant 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).

Table 2: Residential Prototype Characteristics

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

Three building vintages were evaluated to determine sensitivity of existing building performance on cost-effectiveness of upgrades. For example, it is widely recognized that adding attic insulation in an older home with no insulation is cost-effective, however, newer homes will likely have existing attic insulation reducing the cost-effectiveness of an incremental addition of insulation. The building characteristics for each vintage were determined based on either prescriptive requirements from 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 3 summarizes the assumptions for each of the three vintages. Additionally, the analysis assumed the following features when modeling the prototype buildings. Efficiencies were defined by year of the most recent equipment replacement based on standard equipment lifetimes.

- Individual space conditioning and water heating systems, one per single family building.
- Split-system air conditioner with natural gas furnace.
    - 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 3 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.

[3] https://www.census.gov/const/C25Ann/sftotalmedavgsqft.pdf

Table 3. Efficiency Characteristics for Three Vintage Cases

Building Component Efficiency Feature	Vintage Case		
	Pre-1978	1978-1991	1992-2010
Envelope			
Exterior Walls	2x4, 16-inch on center wood frame, R-0[a]	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[b]	Metal, single pane: 1.16/0.76	Metal, dual pane: 0.79/0.70	Vinyl, dual pane Low-E: 0.55/0.40
House Infiltration at 50 Pascals	15 ACH50	10 ACH50	7 ACH50
HVAC Equipment			
Heating Efficiency	78 AFUE (assumes 2 replacements)	78 AFUE (assumes 1 replacement)	78 AFUE
Cooling Efficiency	10 SEER (assumes 2 replacements)	10 SEER (assumes 1 replacement)	13 SEER, 11 EER
Duct Location & Details	Attic, R-2.1, 30% leakage at 25 Pa	Attic, R-2.1, 25% leakage at 25 Pa	Attic, R-4.2, 15% leakage at 25 Pa
Whole Building Mechanical Ventilation	None	None	None
Water Heating Equipment			
Water Heater Efficiency	0.575 Energy Factor (assumes 2 replacements)	0.575 Energy Factor (assumes 1 replacement)	0.575 Energy Factor
Water Heater Type	40-gallon gas storage	40-gallon gas storage	40-gallon gas storage
Pipe Insulation	None	None	None
Hot Water Fixtures	Standard, non-low flow	Standard, non-low flow	Standard, non-low flow

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

[b] 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.

4 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/.

The following describes which results are presented in the tables in this section. See the main 2022 Single Family Retrofit Cost-Effectiveness Study (Statewide Reach Codes Team, 2024) for details of the measures.

- Table 4 through Table 6 show the cost-effective results for the pre-1978 vintage for heat pump space heaters (HPSHs) including dual fuel heat pumps (DFHPs), heat pump water heaters (HPWHs) and envelope and duct measures, respectively, for E-TOU-C rate.
- Table 7 through Table 9 show the cost-effective results for the pre-1978 vintage for PV, HPSH, and HPWH, upgrade measures, respectively, for E-Elec rate.
- Table 10 through Table 12 show the cost-effective results for the 1978-1991 vintage for heat pump space heaters, heat pump water heaters and envelope and duct measures, respectively, for E-TOU-C rate.
- Table 13 through Table 15 show the cost-effective results for the 1978-1991 vintage for PV, HPSH, and HPWH upgrade measures, respectively, for E-Elec rate.
- Table 16 through Table 18 show the cost-effective results for the 1992-2010 vintage for heat pump space heaters, heat pump water heaters and envelope and duct measures, respectively, for E-TOU-C rate.
- Table 19 through Table 21 show the cost-effective results for the 1992-2010 vintage for PV, HPSH, and HPWH upgrade measures, respectively, for E-Elec rate.

4.1 Pre-1978 Vintage

Table 4: E-TOU-C Rate HPSH Single Family Cost-Effectiveness Summary Pre-1978

Case	Annual Elec Savings (kWh)	Annual Gas Savings (therms)	Average Annual GHG Reductions (metric tons)	Annual Site Energy (kBtu)	Annual Source Energy (kBtu/ft2)	Utility Cost Savings		Incremental Cost		On-Bill		2025 LSC	
						First Year	Lifecycle (2022$)	First Year	Lifecycle (2022$)	B/C Ratio	NPV	B/C Ratio	NPV
DFHP Existing Furnace	(1,774)	209	0.93	14,840	8.07	($255)	($2,963)	$2,349	$1,008	0.00	($3,971)	8.25	$7,306
DFHP New Furnace	(1,783)	204	0.90	14,281	7.78	($270)	($3,392)	$7,200	$8,708	0.00	($12,101)	1.11	$993
HPSH (Std Efficiency)	(2,265)	233	0.98	15,584	8.38	($430)	($6,680)	$1,020	$1,618	0.00	($8,298)	5.88	$7,900
HPSH (High Efficiency)	(1,855)	233	1.05	16,982	9.13	($252)	($2,619)	$3,951	$6,430	0.00	($9,049)	1.98	$6,319
Ducted MSHP	(1,847)	233	1.05	17,011	9.15	($249)	($2,536)	$1,442	$2,951	0.00	($5,487)	4.35	$9,880
Ductless MSHP (Std Efficiency)	(1,667)	208	0.94	15,070	8.18	($227)	($2,436)	$8,826	$14,274	0.00	($16,709)	0.89	($1,536)
Ductless MSHP (High Efficiency)	(589)	208	1.12	18,747	10.19	$233	$8,061	$12,410	$20,158	0.40	($12,097)	1.06	$1,171

Table 5: E-TOU-C Rate HPWH Single Family Cost-Effectiveness Summary Pre-1978

Case	Annual Elec Savings (kWh)	Annual Gas Savings (therms)	Average Annual GHG Reductions (metric tons)	Annual Site Energy (kBtu)	Annual Source Energy (kBtu/ft2)	Utility Cost Savings		Incremental Cost		On-Bill		2025 LSC	
						First Year	Lifecycle (2022$)	First Year	Lifecycle (2022$)	B/C Ratio	NPV	B/C Ratio	NPV
240V Fed. Min. HPWH	(1,391)	171	0.87	12,314	7.80	($330)	($5,167)	$4,332	$6,554	0.00	($11,721)	1.65	$4,252
240V Market Std. NEEA HPWH	(1,076)	171	0.90	13,414	8.21	($179)	($1,725)	$5,193	$7,967	0.00	($9,692)	1.64	$5,136
240V Market Std. NEEA HPWH + DR	(967)	171	0.92	13,789	8.43	($124)	($461)	$5,193	$7,967	0.00	($8,428)	1.80	$6,335
120V Market Std. NEEA HPWH	(935)	172	0.93	13,960	8.47	($107)	($75)	$2,893	$4,273	0.00	($4,348)	3.41	$10,296
240V Fed. Min. HPWH (Exterior Closet)	(1,424)	169	0.85	12,036	7.66	($349)	($5,628)	$4,751	$6,973	0.00	($12,601)	1.49	$3,384
240V Fed. Min. HPWH (Interior Closet)	(1,158)	128	0.65	8,836	5.87	($307)	($5,248)	$4,413	$6,634	0.00	($11,883)	1.12	$792
240V Fed. Min. HPWH (Interior Closet, ducted)	(1,354)	180	0.93	13,396	8.39	($296)	($4,254)	$5,492	$7,714	0.00	($11,967)	1.60	$4,591

Table 6: E-TOU-C Rate Envelope and Duct Measures Single Family Cost-Effectiveness Summary Pre-1978

Case	Annual Elec Savings (kWh)	Annual Gas Savings (therms)	Average Annual GHG Reductions (metric tons)	Annual Site Energy (kBtu)	Annual Source Energy (kBtu/ft2)	Utility Cost Savings		Incremental Cost		On-Bill		2025 LSC	
						First Year	Lifecycle (2022$)	First Year	Lifecycle (2022$)	B/C Ratio	NPV	B/C Ratio	NPV
30% Air Sealing	15	15	0.09	1,575	0.86	$53	$1,533	$4,684	$4,684	0.33	($3,151)	0.43	($2,686)
New Ducts: R-6	133	49	0.30	5,328	2.86	$162	$4,430	$4,808	$4,808	0.92	($379)	1.48	$2,301
New Ducts: R-8	137	51	0.32	5,601	3.02	$169	$4,634	$6,311	$6,311	0.73	($1,677)	1.18	$1,148
Duct Sealing: 10%	50	32	0.19	3,355	1.83	$89	$2,515	$2,590	$2,590	0.97	($75)	1.69	$1,789
Wall Insulation: R-13	56	49	0.29	5,054	2.74	$126	$3,603	$2,950	$2,950	1.22	$653	2.19	$3,510
Attic Insulation: R-38	67	36	0.22	3,802	2.05	$106	$2,969	$6,762	$6,762	0.44	($3,793)	0.74	($1,784)
Attic Insulation: R-49	75	39	0.24	4,154	2.23	$116	$3,252	$7,446	$7,446	0.44	($4,194)	0.73	($2,001)
R-19 Raised Floor Insulation	4	87	0.52	8,759	4.83	$178	$5,370	$3,633	$3,633	1.48	$1,737	3.02	$7,356
R-30 Raised Floor Insulation	(3)	100	0.59	9,945	5.49	$198	$6,011	$4,113	$4,113	1.46	$1,898	3.03	$8,342
Cool Roof (0.20 Ref) (at roof replacement)	11	(13)	(0.07)	(1,242)	(0.67)	($20)	($657)	$893	$1,203	0.00	($1,860)	0.00	($2,685)
Cool Roof (0.25 Ref) (at roof replacement)	14	(19)	(0.11)	(1,898)	(1.03)	($32)	($1,031)	$1,786	$2,407	0.00	($3,438)	0.00	($4,688)
Window Upgrade: 0.28 vs 0.30 U-factor	89	28	0.17	3,068	1.64	$101	$2,718	$11,871	$11,871	0.23	($9,154)	0.35	($7,742)

Table 7: E-Elec Rate Solar PV Single Family Cost-Effectiveness Summary Pre-1978

Case	Annual Elec Savings (kWh)	Annual Gas Savings (therms)	Average Annual GHG Reductions (metric tons)	Annual Site Energy (kBtu)	Annual Source Energy (kBtu/ft2)	Utility Cost Savings		Incremental Cost		On-Bill		2025 LSC	
						First Year	Lifecycle (2022$)	First Year	Lifecycle (2022$)	B/C Ratio	NPV	B/C Ratio	NPV
3kW PV	3,854	0	0.11	13,150	1.22	$510	$11,627	$9,608	$11,574	1.00	$52	0.72	($3,283)

Table 8: E-Elec Rate HPSH Single Family Cost-Effectiveness Summary Pre-1978

Case	Annual Elec Savings (kWh)	Annual Gas Savings (therms)	Average Annual GHG Reductions (metric tons)	Annual Site Energy (kBtu)	Annual Source Energy (kBtu/ft2)	Utility Cost Savings		Incremental Cost		On-Bill		2025 LSC	
						First Year	Lifecycle (2022$)	First Year	Lifecycle (2022$)	B/C Ratio	NPV	B/C Ratio	NPV
DFHP Existing Furnace	(1,774)	209	0.93	14,840	8.07	($393)	($6,112)	$2,349	$1,008	0.00	($7,120)	8.25	$7,306
DFHP New Furnace	(1,783)	204	0.90	14,281	7.78	($408)	($6,528)	$7,200	$8,708	0.00	($15,236)	1.11	$993
HPSH (Std Efficiency)	(2,265)	233	0.98	15,584	8.38	($531)	($8,970)	$1,020	$1,618	0.00	($10,588)	5.88	$7,900
HPSH (High Efficiency)	(1,855)	233	1.05	16,982	9.13	($382)	($5,584)	$3,951	$6,430	0.00	($12,014)	1.98	$6,319
Ducted MSHP	(1,847)	233	1.05	17,011	9.15	($380)	($5,518)	$1,442	$2,951	0.00	($8,470)	4.35	$9,880
Ductless MSHP (Std Efficiency)	(1,667)	208	0.94	15,070	8.18	($388)	($6,096)	$8,826	$14,274	0.00	($20,369)	0.89	($1,536)
Ductless MSHP (High Efficiency)	(589)	208	1.12	18,747	10.19	$3	$2,804	$12,410	$20,158	0.14	($17,354)	1.06	$1,171
HPSH + 3kW PV	2,688	233	1.12	32,485	9.94	$207	$7,845	$10,628	$13,192	0.59	($5,347)	1.43	$5,633

Table 9: E-Elec Rate HPWH Single Family Cost-Effectiveness Summary Pre-1978

Case	Annual Elec Savings (kWh)	Annual Gas Savings (therms)	Average Annual GHG Reductions (metric tons)	Annual Site Energy (kBtu)	Annual Source Energy (kBtu/ft2)	Utility Cost Savings		Incremental Cost		On-Bill		2025 LSC	
						First Year	Lifecycle (2022$)	First Year	Lifecycle (2022$)	B/C Ratio	NPV	B/C Ratio	NPV
240V Fed. Min. HPWH	(1,391)	171	0.87	12,314	7.80	($349)	($5,604)	$4,332	$6,554	0.00	($12,158)	1.65	$4,252
240V Market Std. NEEA HPWH	(1,076)	171	0.90	13,414	8.21	($224)	($2,739)	$5,193	$7,967	0.00	($10,706)	1.64	$5,136
240V Market Std. NEEA HPWH + DR	(967)	171	0.92	13,789	8.43	($173)	($1,591)	$5,193	$7,967	0.00	($9,558)	1.80	$6,335
120V Market Std. NEEA HPWH	(935)	172	0.93	13,960	8.47	($160)	($1,290)	$2,893	$4,273	0.00	($5,562)	3.41	$10,296
240V Fed. Min. HPWH (Exterior Closet)	(1,424)	169	0.85	12,036	7.66	($366)	($6,007)	$4,751	$6,973	0.00	($12,980)	1.49	$3,384
240V Fed. Min. HPWH (Interior Closet)	(1,158)	128	0.65	8,836	5.87	($345)	($6,111)	$4,413	$6,634	0.00	($12,745)	1.12	$792
240V Fed. Min. HPWH (Interior Closet, ducted)	(1,354)	180	0.93	13,396	8.39	($318)	($4,763)	$5,492	$7,714	0.00	($12,477)	1.60	$4,591
240V Fed. Min. HPWH + 3kW PV	3,562	171	1.00	29,215	9.36	$518	$14,166	$13,940	$18,128	0.78	($3,962)	1.22	$3,933

4.2 1978-1991 Vintage

Table 10: E-TOU-C Rate HPSH Single Family Cost-Effectiveness Summary 1978-1991

Case	Annual Elec Savings (kWh)	Annual Gas Savings (therms)	Average Annual GHG Reductions (metric tons)	Annual Site Energy (kBtu)	Annual Source Energy (kBtu/ft2)	Utility Cost Savings		Incremental Cost		On-Bill		2025 LSC	
						First Year	Lifecycle (2022$)	First Year	Lifecycle (2022$)	B/C Ratio	NPV	B/C Ratio	NPV
DFHP Existing Furnace	(1,277)	150	0.67	10,672	5.76	($165)	($1,818)	$2,349	$1,008	0.00	($2,826)	5.88	$4,914
DFHP New Furnace	(1,283)	147	0.64	10,271	5.54	($175)	($2,099)	$7,200	$8,708	0.00	($10,807)	0.80	($1,776)
HPSH (Std Efficiency)	(1,644)	169	0.71	11,279	6.01	($294)	($4,530)	$1,020	$1,618	0.00	($6,148)	4.21	$5,192
HPSH (High Efficiency)	(1,348)	169	0.76	12,291	6.57	($167)	($1,626)	$3,951	$6,430	0.00	($8,056)	1.43	$2,761
Ducted MSHP	(1,341)	169	0.76	12,314	6.58	($164)	($1,561)	$1,442	$2,951	0.00	($4,512)	3.13	$6,289
Ductless MSHP (Std Efficiency)	(1,152)	143	0.65	10,417	5.61	($133)	($1,208)	$8,826	$14,274	0.00	($15,481)	0.61	($5,499)
Ductless MSHP (High Efficiency)	(407)	143	0.77	12,957	7.06	$179	$5,910	$12,410	$20,158	0.29	($14,248)	0.73	($5,390)

Table 11: E-TOU-C Rate HPWH Single Family Cost-Effectiveness Summary 1978-1991

Case	Annual Elec Savings (kWh)	Annual Gas Savings (therms)	Average Annual GHG Reductions (metric tons)	Annual Site Energy (kBtu)	Annual Source Energy (kBtu/ft2)	Utility Cost Savings		Incremental Cost		On-Bill		2025 LSC	
						First Year	Lifecycle (2022$)	First Year	Lifecycle (2022$)	B/C Ratio	NPV	B/C Ratio	NPV
240V Fed. Min. HPWH	(1,391)	170	0.86	12,273	7.77	($352)	($5,840)	$4,332	$6,554	0.00	($12,394)	1.64	$4,202
240V Market Std. NEEA HPWH	(1,077)	170	0.90	13,361	8.17	($202)	($2,421)	$5,193	$7,967	0.00	($10,388)	1.64	$5,087
240V Market Std. NEEA HPWH + DR	(967)	170	0.92	13,738	8.39	($147)	($1,149)	$5,193	$7,967	0.00	($9,116)	1.79	$6,285
120V Market Std. NEEA HPWH	(935)	171	0.92	13,893	8.43	($130)	($774)	$2,893	$4,273	0.00	($5,047)	3.39	$10,213
240V Fed. Min. HPWH (Exterior Closet)	(1,424)	169	0.85	12,036	7.66	($371)	($6,272)	$4,751	$6,973	0.00	($13,245)	1.49	$3,384
240V Fed. Min. HPWH (Interior Closet)	(1,162)	130	0.67	9,069	6.00	($316)	($5,511)	$4,413	$6,634	0.00	($12,145)	1.16	$1,058
240V Fed. Min. HPWH (Interior Closet, ducted)	(1,355)	180	0.93	13,367	8.37	($320)	($4,987)	$5,492	$7,714	0.00	($12,701)	1.59	$4,541

Table 12: E-TOU-C Rate Envelope and Duct Measures Single Family Cost-Effectiveness Summary 1978-1991

Case	Annual Elec Savings (kWh)	Annual Gas Savings (therms)	Average Annual GHG Reductions (metric tons)	Annual Site Energy (kBtu)	Annual Source Energy (kBtu/ft2)	Utility Cost Savings		Incremental Cost		On-Bill		2025 LSC	
						First Year	Lifecycle (2022$)	First Year	Lifecycle (2022$)	B/C Ratio	NPV	B/C Ratio	NPV
30% Air Sealing	7	9	0.06	950	0.51	$34	$997	$4,684	$4,684	0.21	($3,687)	0.26	($3,452)
New Ducts: R-6	90	33	0.20	3,565	1.93	$104	$2,827	$4,808	$4,808	0.59	($1,982)	1.00	($13)
New Ducts: R-8	93	35	0.22	3,807	2.05	$109	$2,993	$6,311	$6,311	0.47	($3,318)	0.81	($1,200)
Duct Sealing: 10%	65	16	0.10	1,810	0.98	$60	$1,607	$2,590	$2,590	0.62	($982)	0.97	($75)
Attic Insulation: R-38	26	13	0.08	1,425	0.77	$39	$1,084	$2,555	$2,555	0.42	($1,472)	0.73	($691)
Attic Insulation: R-49	33	17	0.10	1,770	0.95	$49	$1,346	$3,612	$3,612	0.37	($2,265)	0.65	($1,264)
R-19 Raised Floor Insulation	(75)	47	0.27	4,479	2.55	$50	$1,804	$3,633	$3,633	0.50	($1,829)	1.51	$1,862
R-30 Raised Floor Insulation	(79)	59	0.34	5,623	3.18	$69	$2,391	$4,113	$4,113	0.58	($1,721)	1.68	$2,797
Cool Roof (0.20 Ref) (at roof replacement)	7	(9)	(0.05)	(874)	(0.47)	($14)	($465)	$893	$1,203	0.00	($1,668)	0.00	($2,236)
Cool Roof (0.25 Ref) (at roof replacement)	9	(14)	(0.08)	(1,335)	(0.73)	($23)	($726)	$1,786	$2,407	0.00	($3,132)	0.00	($4,005)
Window Upgrade: 0.28 vs 0.30 U-factor	56	26	0.16	2,796	1.51	$78	$2,144	$11,871	$11,871	0.18	($9,727)	0.31	($8,175)

Table 13: E-Elec Rate Solar PV Single Family Cost-Effectiveness Summary 1978-1991

Case	Annual Elec Savings (kWh)	Annual Gas Savings (therms)	Average Annual GHG Reductions (metric tons)	Annual Site Energy (kBtu)	Annual Source Energy (kBtu/ft2)	Utility Cost Savings		Incremental Cost		On-Bill		2025 LSC	
						First Year	Lifecycle (2022$)	First Year	Lifecycle (2022$)	B/C Ratio	NPV	B/C Ratio	NPV
3kW PV	3,733	0	0.10	12,736	1.18	$564	$12,855	$9,608	$11,574	1.11	$1,281	0.70	($3,432)

Table 14: E-Elec Rate HPSH Single Family Cost-Effectiveness Summary 1978-1991

Case	Annual Elec Savings (kWh)	Annual Gas Savings (therms)	Average Annual GHG Reductions (metric tons)	Annual Site Energy (kBtu)	Annual Source Energy (kBtu/ft2)	Utility Cost Savings		Incremental Cost		On-Bill		2025 LSC	
						First Year	Lifecycle (2022$)	First Year	Lifecycle (2022$)	B/C Ratio	NPV	B/C Ratio	NPV
DFHP Existing Furnace	(1,277)	150	0.67	10,672	5.76	($265)	($4,090)	$2,349	$1,008	0.00	($5,098)	5.88	$4,914
DFHP New Furnace	(1,283)	147	0.64	10,271	5.54	($275)	($4,364)	$7,200	$8,708	0.00	($13,072)	0.80	($1,776)
HPSH (Std Efficiency)	(1,644)	169	0.71	11,279	6.01	($367)	($6,181)	$1,020	$1,618	0.00	($7,799)	4.21	$5,192
HPSH (High Efficiency)	(1,348)	169	0.76	12,291	6.57	($259)	($3,733)	$3,951	$6,430	0.00	($10,162)	1.43	$2,761
Ducted MSHP	(1,341)	169	0.76	12,314	6.58	($257)	($3,679)	$1,442	$2,951	0.00	($6,631)	3.13	$6,289
Ductless MSHP (Std Efficiency)	(1,152)	143	0.65	10,417	5.61	($251)	($3,900)	$8,826	$14,274	0.00	($18,174)	0.61	($5,499)
Ductless MSHP (High Efficiency)	(407)	143	0.77	12,957	7.06	$18	$2,227	$12,410	$20,158	0.11	($17,931)	0.73	($5,390)
HPSH + 3kW PV	3,309	169	0.85	28,180	7.57	$361	$10,401	$10,628	$13,192	0.79	($2,791)	1.21	$2,758

Table 15: E-Elec Rate HPWH Single Family Cost-Effectiveness Summary 1978-1991

Case	Annual Elec Savings (kWh)	Annual Gas Savings (therms)	Average Annual GHG Reductions (metric tons)	Annual Site Energy (kBtu)	Annual Source Energy (kBtu/ft2)	Utility Cost Savings		Incremental Cost		On-Bill		2025 LSC	
						First Year	Lifecycle (2022$)	First Year	Lifecycle (2022$)	B/C Ratio	NPV	B/C Ratio	NPV
240V Fed. Min. HPWH	(1,391)	170	0.86	12,273	7.77	($381)	($6,493)	$4,332	$6,554	0.00	($13,047)	1.64	$4,202
240V Market Std. NEEA HPWH	(1,077)	170	0.90	13,361	8.17	($179)	($1,898)	$5,193	$7,967	0.00	($9,865)	1.64	$5,087
240V Market Std. NEEA HPWH + DR	(967)	170	0.92	13,738	8.39	($129)	($743)	$5,193	$7,967	0.00	($8,710)	1.79	$6,285
120V Market Std. NEEA HPWH	(935)	171	0.92	13,893	8.43	($116)	($452)	$2,893	$4,273	0.00	($4,725)	3.39	$10,213
240V Fed. Min. HPWH (Exterior Closet)	(1,424)	169	0.85	12,036	7.66	($320)	($5,117)	$4,751	$6,973	0.00	($12,090)	1.49	$3,384
240V Fed. Min. HPWH (Interior Closet)	(1,162)	130	0.67	9,069	6.00	($286)	($4,830)	$4,413	$6,634	0.00	($11,464)	1.16	$1,058
240V Fed. Min. HPWH (Interior Closet, ducted)	(1,355)	180	0.93	13,367	8.37	($275)	($3,961)	$5,492	$7,714	0.00	($11,675)	1.59	$4,541
240V Fed. Min. HPWH + 3kW PV	3,562	170	1.00	29,174	9.33	$558	$14,917	$13,940	$18,128	0.82	($3,211)	1.21	$3,800

4.3 1992-2010 Vintage

Table 16: E-TOU-C Rate HPSH Single Family Cost-Effectiveness Summary 1992-2010

Case	Annual Elec Savings (kWh)	Annual Gas Savings (therms)	Average Annual GHG Reductions (metric tons)	Annual Site Energy (kBtu)	Annual Source Energy (kBtu/ft2)	Utility Cost Savings		Incremental Cost		On-Bill		2025 LSC	
						First Year	Lifecycle (2022$)	First Year	Lifecycle (2022$)	B/C Ratio	NPV	B/C Ratio	NPV
DFHP Existing Furnace	(1,130)	136	0.61	9,784	5.34	($130)	($1,209)	$2,349	$1,008	0.00	($2,217)	5.65	$4,692
DFHP New Furnace	(1,134)	133	0.59	9,426	5.14	($138)	($1,437)	$7,200	$8,708	0.00	($10,145)	0.76	($2,098)
HPSH (Std Efficiency)	(1,439)	151	0.65	10,216	5.51	($239)	($3,515)	$1,020	$1,618	0.00	($5,133)	4.00	$4,859
HPSH (High Efficiency)	(1,181)	151	0.69	11,096	5.98	($129)	($1,004)	$3,951	$6,430	0.00	($7,434)	1.32	$2,078
Ducted MSHP	(1,173)	151	0.69	11,126	6.00	($125)	($919)	$1,442	$2,951	0.00	($3,870)	2.91	$5,623
Ductless MSHP (Std Efficiency)	(1,025)	133	0.61	9,762	5.31	($98)	($540)	$8,826	$14,274	0.00	($14,814)	0.59	($5,782)
Ductless MSHP (High Efficiency)	(388)	133	0.71	11,935	6.50	$166	$5,465	$12,410	$20,158	0.27	($14,693)	0.67	($6,588)

Table 17: E-TOU-C Rate HPWH Single Family Cost-Effectiveness Summary 1992-2010

Case	Annual Elec Savings (kWh)	Annual Gas Savings (therms)	Average Annual GHG Reductions (metric tons)	Annual Site Energy (kBtu)	Annual Source Energy (kBtu/ft2)	Utility Cost Savings		Incremental Cost		On-Bill		2025 LSC	
						First Year	Lifecycle (2022$)	First Year	Lifecycle (2022$)	B/C Ratio	NPV	B/C Ratio	NPV
240V Fed. Min. HPWH	(1,392)	170	0.86	12,259	7.77	($358)	($6,017)	$4,332	$6,554	0.00	($12,570)	1.64	$4,186
240V Market Std. NEEA HPWH	(1,077)	170	0.90	13,347	8.17	($208)	($2,590)	$5,193	$7,967	0.00	($10,557)	1.63	$5,053
240V Market Std. NEEA HPWH + DR	(968)	170	0.92	13,724	8.39	($152)	($1,319)	$5,193	$7,967	0.00	($9,286)	1.79	$6,269
120V Market Std. NEEA HPWH	(935)	171	0.92	13,876	8.42	($136)	($941)	$2,893	$4,273	0.00	($5,213)	3.39	$10,196
240V Fed. Min. HPWH (Exterior Closet)	(1,424)	169	0.85	12,036	7.66	($376)	($6,432)	$4,751	$6,973	0.00	($13,405)	1.49	$3,384
240V Fed. Min. HPWH (Interior Closet)	(1,181)	130	0.66	8,979	5.96	($331)	($5,899)	$4,413	$6,634	0.00	($12,534)	1.14	$941
240V Fed. Min. HPWH (Interior Closet, ducted)	(1,357)	180	0.93	13,354	8.37	($327)	($5,187)	$5,492	$7,714	0.00	($12,900)	1.59	$4,524

Table 18: E-TOU-C Rate Envelope and Duct Measures Single Family Cost-Effectiveness Summary 1992-2010

Case	Annual Elec Savings (kWh)	Annual Gas Savings (therms)	Average Annual GHG Reductions (metric tons)	Annual Site Energy (kBtu)	Annual Source Energy (kBtu/ft2)	Utility Cost Savings		Incremental Cost		On-Bill		2025 LSC	
						First Year	Lifecycle (2022$)	First Year	Lifecycle (2022$)	B/C Ratio	NPV	B/C Ratio	NPV
30% Air Sealing	4	6	0.04	613	0.33	$25	$729	$4,684	$4,684	0.16	($3,955)	0.17	($3,901)
New Ducts: R-6	49	11	0.07	1,267	0.68	$42	$1,109	$4,808	$4,808	0.23	($3,700)	0.37	($3,043)
New Ducts: R-8	53	14	0.09	1,530	0.82	$48	$1,282	$6,311	$6,311	0.20	($5,029)	0.33	($4,213)
Duct Sealing: 10%	6	5	0.03	523	0.28	$12	$346	$1,400	$1,400	0.25	($1,054)	0.49	($718)
Attic Insulation: R-38	4	3	0.02	335	0.18	$8	$227	$1,781	$1,781	0.13	($1,554)	0.25	($1,332)
Attic Insulation: R-49	9	6	0.04	628	0.34	$15	$433	$1,827	$1,827	0.24	($1,395)	0.46	($978)
Cool Roof (0.20 Ref) (at roof replacement)	0	(7)	(0.04)	(718)	(0.39)	($14)	($413)	$893	$1,203	0.00	($1,616)	0.00	($2,069)
Cool Roof (0.25 Ref) (at roof replacement)	(1)	(11)	(0.06)	(1,096)	(0.60)	($21)	($636)	$1,786	$2,407	0.00	($3,043)	0.00	($3,722)
Window Upgrade: 0.28 vs 0.30 U-factor	32	39	0.23	3,968	2.15	$84	$2,423	$11,871	$11,871	0.20	($9,449)	0.42	($6,826)

Table 19: E-Elec Rate Solar PV Single Family Cost-Effectiveness Summary 1992-2010

Case	Annual Elec Savings (kWh)	Annual Gas Savings (therms)	Average Annual GHG Reductions (metric tons)	Annual Site Energy (kBtu)	Annual Source Energy (kBtu/ft2)	Utility Cost Savings		Incremental Cost		On-Bill		2025 LSC	
						First Year	Lifecycle (2022$)	First Year	Lifecycle (2022$)	B/C Ratio	NPV	B/C Ratio	NPV
3kW PV	3,654	0	0.10	12,468	1.15	$475	$10,820	$9,608	$11,574	0.93	($754)	0.70	($3,499)

Table 20: E-Elec Rate HPSH Single Family Cost-Effectiveness Summary 1992-2010

Case	Annual Elec Savings (kWh)	Annual Gas Savings (therms)	Average Annual GHG Reductions (metric tons)	Annual Site Energy (kBtu)	Annual Source Energy (kBtu/ft2)	Utility Cost Savings		Incremental Cost		On-Bill		2025 LSC	
						First Year	Lifecycle (2022$)	First Year	Lifecycle (2022$)	B/C Ratio	NPV	B/C Ratio	NPV
DFHP Existing Furnace	(1,130)	136	0.61	9,784	5.34	($321)	($5,572)	$2,349	$1,008	0.00	($6,580)	5.65	$4,692
DFHP New Furnace	(1,134)	133	0.59	9,426	5.14	($329)	($5,794)	$7,200	$8,708	0.00	($14,503)	0.76	($2,098)
HPSH (Std Efficiency)	(1,439)	151	0.65	10,216	5.51	($407)	($7,359)	$1,020	$1,618	0.00	($8,977)	4.00	$4,859
HPSH (High Efficiency)	(1,181)	151	0.69	11,096	5.98	($314)	($5,234)	$3,951	$6,430	0.00	($11,663)	1.32	$2,078
Ducted MSHP	(1,173)	151	0.69	11,126	6.00	($311)	($5,162)	$1,442	$2,951	0.00	($8,113)	2.91	$5,623
Ductless MSHP (Std Efficiency)	(1,025)	133	0.61	9,762	5.31	($141)	($1,533)	$8,826	$14,274	0.00	($15,807)	0.59	($5,782)
Ductless MSHP (High Efficiency)	(388)	133	0.71	11,935	6.50	$89	$3,706	$12,410	$20,158	0.18	($16,452)	0.67	($6,588)
HPSH + 3kW PV	3,514	151	0.78	27,117	7.07	$323	$9,292	$10,628	$13,192	0.70	($3,900)	1.19	$2,475

Table 21: E-Elec Rate HPWH Single Family Cost-Effectiveness Summary 1992-2010

Case	Annual Elec Savings (kWh)	Annual Gas Savings (therms)	Average Annual GHG Reductions (metric tons)	Annual Site Energy (kBtu)	Annual Source Energy (kBtu/ft2)	Utility Cost Savings		Incremental Cost		On-Bill		2025 LSC	
						First Year	Lifecycle (2022$)	First Year	Lifecycle (2022$)	B/C Ratio	NPV	B/C Ratio	NPV
240V Fed. Min. HPWH	(1,392)	170	0.86	12,259	7.77	($393)	($6,807)	$4,332	$6,554	0.00	($13,361)	1.64	$4,186
240V Market Std. NEEA HPWH	(1,077)	170	0.90	13,347	8.17	($268)	($3,956)	$5,193	$7,967	0.00	($11,923)	1.63	$5,053
240V Market Std. NEEA HPWH + DR	(968)	170	0.92	13,724	8.39	($217)	($2,801)	$5,193	$7,967	0.00	($10,769)	1.79	$6,269
120V Market Std. NEEA HPWH	(935)	171	0.92	13,876	8.42	($205)	($2,508)	$2,893	$4,273	0.00	($6,781)	3.39	$10,196
240V Fed. Min. HPWH (Exterior Closet)	(1,424)	169	0.85	12,036	7.66	($408)	($7,166)	$4,751	$6,973	0.00	($14,139)	1.49	$3,384
240V Fed. Min. HPWH (Interior Closet)	(1,181)	130	0.66	8,979	5.96	($383)	($7,073)	$4,413	$6,634	0.00	($13,708)	1.14	$941
240V Fed. Min. HPWH (Interior Closet, ducted)	(1,357)	180	0.93	13,354	8.37	($365)	($6,044)	$5,492	$7,714	0.00	($13,757)	1.59	$4,524
240V Fed. Min. HPWH + 3kW PV	3,562	170	1.00	29,160	9.33	$468	$12,827	$13,940	$18,128	0.71	($5,301)	1.21	$3,767

4.4 Sensitivities

Table 22 shows the On-Bill NPV results of Climate Zone 5 with 3CE utility rates and the impacts of escalation rates for select cases. The "Standard Results" in Table 22 assumes the escalation rates used in the analysis presented elsewhere in this report. Table 23 shows the impact of electrical panel upgrades. The "Standard Results" in Table 23 does not assume a panel upgrade is required. Both cases in Table 23 are based on the escalation rates used in the analysis presented elsewhere in this report.

Table 22. Sensitivity Analysis Results for On-Bill NPV

Measure	Vintage	Standard Results	2025 LSC Escalation
DFHP Existing Furnace	1992-2010	($2,217)	$1,935
DFHP New Furnace	1992-2010	($10,145)	($6,117)
HPSH (Std Efficiency)	1992-2010	($5,133)	($669)
HPSH (High Efficiency)	1992-2010	($7,434)	($2,838)
Ducted MSHP	1992-2010	($3,870)	$730
HPSH + 3kW PV	1992-2010	($3,900)	$1,238
240V Fed. Min. HPWH	1992-2010	($12,570)	($8,539)
240V Market Std. NEEA HPWH	1992-2010	($10,557)	($6,946)
240V Market Std. NEEA HPWH + DR	1992-2010	($9,286)	($5,730)
120V Market Std. NEEA HPWH	1992-2010	($5,213)	($1,715)
240V Fed. Min. HPWH (Exterior Closet)	1992-2010	($13,405)	($9,369)
240V Fed. Min. HPWH (Interior Closet)	1992-2010	($12,534)	($10,102)
240V Fed. Min. HPWH (Interior Closet, ducted)	1992-2010	($12,900)	($8,604)
240V Fed. Min. HPWH + 3kW PV	1992-2010	($5,301)	$554
30% Air Sealing	Pre-1978	($3,151)	($2,262)
R-6 Ducts	Pre-1978	($379)	$1,649
R-8 Ducts	Pre-1978	($1,677)	$457
10% Duct Sealing	Pre-1978	($75)	$1,230
R-13 Wall Insulation	Pre-1978	$653	$2,616
R-38 Attic Insulation	Pre-1978	($3,793)	($2,317)
R-49 Attic Insulation	Pre-1978	($4,194)	($2,582)
R-30 Raised Floor Insulation	Pre-1978	$1,898	$5,830
Cool Roof (0.20 Ref) (at roof replacement)	Pre-1978	($1,860)	($2,356)

Table 23. Electric Panel Upgrade Sensitivity [Pre-1978]

Measure	Standard Results		Electric Panel Upgrade	
	On-Bill NPV	LSC NPV	On-Bill NPV	LSC NPV
HPSH (Std Efficiency)	($8,298)	$7,900	($13,368)	$5,120
240V Fed. Min. HPWH	($11,721)	$4,252	($14,600)	$1,472

5 Summary

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. Heat pump space heating: HPSHs were found to be LSC cost-effective in most cases, but not On-Bill cost-effective in any case. Cost-effectiveness for the ductless MSHP cases was poorer and was found to be LSC cost-effective for only the pre-1978 vintage for high efficiency equipment.
    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.
    b. Ductless MSHPs, evaluated for homes with existing ductless systems, have a high incremental cost because they are 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.
2. Heat pump water heating: All the HPWH measures were LSC cost-effective but were not On-Bill cost-effective for all three vintages. 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.
    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).
3. Envelope measures: Improving envelope performance can be very cost-effective in older homes. However, none of the envelope measures were found to be cost-effective in homes built 1978 and later. 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 for the pre-1978 vintage.
    a. Adding new ducts with R-6, R-8 or duct sealing to 10% showed to be cost effective based on LSC only.
    b. Adding attic insulation was not cost effective based on either metric.
    c. Wall insulation showed to be cost effective On-Bill and on LSC.
    d. Adding R-19 or R-30 floor insulation was cost-effective On-Bill and on LSC.
    e. Upgrading to a cool roof at roof replacement with 0.2 or 0.25 solar reflectance was shown to not be cost effective. This is expected in Climate Zone 5 where heating loads dominate since cool roofs increase heating energy use by reducing solar heat gain through the roof and attic.

   f. 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 showed to be substantial, even though it is not cost-effective.
4. 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.
5. Table 22 shows how escalation rate assumptions will impact cost-effectiveness.
   a. 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 as well as envelope and duct 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.[4] The CPUC will decide 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.
6. 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 for vintages pre-1978 and 1978-1991.
   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 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.

[4] https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/electric-costs/demand-response-dr/demand-flexibility-rulemaking

6 References

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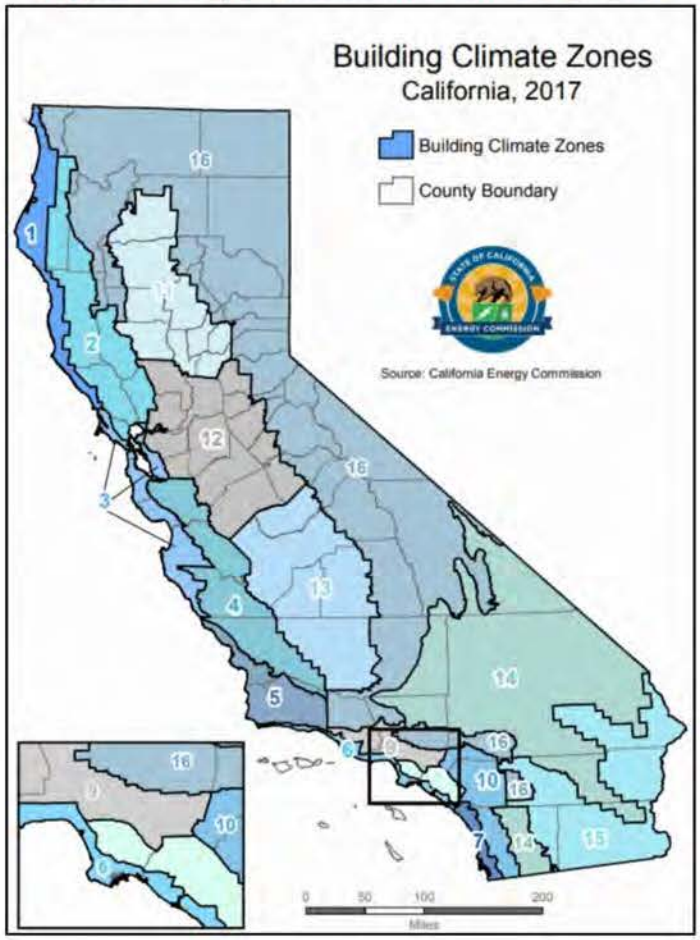
7 Appendices

7.1 Map of California Climate Zones

Climate zone geographical boundaries are depicted in Figure 1. The map in Figure 1 along with a zip-code search directory is available at: https://ww2.energy.ca.gov/maps/renewable/building_climate_zones.html

Figure 1. Map of California climate zones.



7.2 Utility Rate Schedules

The Reach Codes Team used 3CE electricity and SoCalGas gas tariffs detailed below to determine the On-Bill savings for each package.

7.2.1 Central Coast Community Energy – Electricity

Following are the 3CE tariffs applied in this study. The E-TOU-C and E-Elec rate was applied to PG&E territory T, climate zone 5.[5] Table 24 and Table 25 provide a comparison of the generation rates and total effective rates comparing 3CE and PG&E's standard E-TOU-C rate and electric E-Elec rate.

The 2019 PCIA charge was used based on feedback from SLO staff.

Table 24: Comparison of 3CE and PG&E's E-TOU-C Rates

PG&E/3CE Comparison	Summer Peak	Summer Part-Peak	Summer Off-Peak	Winter Peak	Winter Part-Peak	Winter Off-Peak
PG&E Bundled Generation Rate ($/kWh) (No PCIA Charge)	$0.22387	0	$0.16043	$0.17528	0	$0.15025
3CE Bundled Generation Rate ($/kWh) (No PCIA Charge)	$0.22422	0	$0.09322	$0.18422	0	$0.10022
Bundled Generation Rate % Difference	(0.2%)	0	42%	(5%)	0	33%
PG&E Total Rate ($/kWh)	$0.61806	0	$0.53462	$0.51536	0	$0.48701
3CE Total Rate ($/kWh)	$0.61794	0	$0.46694	$0.52383	0	$0.43651
Total Rate % Difference	.02%	0	13%	(2%)	0	10%

Table 25: Comparison of 3CE and PG&E's E-Elec Rates

PG&E/3CE Comparison	Summer Peak	Summer Part-Peak	Summer Off-Peak	Winter Peak	Winter Part-Peak	Winter Off-Peak
PG&E Bundled Generation Rate ($/kWh) (No PCIA Charge)	$0.30550	$0.20639	$0.16129	$0.14337	$0.12340	$0.11005
3CE Bundled Generation Rate ($/kWh) (No PCIA Charge)	$0.22422	$0.11122	$0.09022	$0.18422	$0.11222	$0.09922
Bundled Generation Rate % Difference	27%	46%	44%	(28%)	9%	10%
PG&E Total Rate ($/kWh)	$0.63580	$0.47392	$0.41724	$0.40429	$0.38220	$0.36834
3CE Total Rate ($/kWh)	$0.55405	$0.37828	$0.34570	$0.44467	$0.37055	$0.35704
Total Rate % Difference	13%	20%	17%	(10%)	3%	3%

[5] ELEC_SCHEDS_E-TOU-C.pdf (pge.com)
ELEC_SCHEDS_E-ELEC.pdf (pge.com)

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Revised Cal. P.U.C. Sheet No. 57019-E
Cancelling Revised Cal. P.U.C. Sheet No. 56550-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	
Summer				
Total Usage	$0.61806	(I)	$0.53462	(I)
Baseline Credit (Applied to Baseline Usage Only)	($0.10556)	(R)	($0.10556)	(R)
Winter				
Total Usage	$0.51536	(I)	$0.48701	(I)
Baseline Credit (Applied to Baseline Usage Only)	($0.10556)	(R)	($0.10556)	(R)
Delivery Minimum Bill Amount ($ per meter per day)	$0.37612			
California Climate Credit (per household, per semi-annual payment occurring in the April and October bill cycles)	($55.17)	(R)		(T)

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.

(D)

(Continued)

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Pacific Gas and Electric Company
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Cancelling Revised Cal. P.U.C. Sheet No. 56551-E

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

RATES: (Cont'd.)

UNBUNDLING OF E-TOU-C TOTAL RATES

Energy Rates by Component ($ per kWh)	PEAK		OFF-PEAK	
Generation:				
Summer (all usage)	$0.22387	(I)	$0.16043	(I)
Winter (all usage)	$0.17528	(I)	$0.15025	(I)
Distribution:**				
Summer (all usage)	$0.23044	(I)	$0.21044	(I)
Winter (all usage)	$0.17633	(I)	$0.17301	(I)

Conservation Incentive Adjustment (Baseline Usage)	($0.03852)	(R)
Conservation Incentive Adjustment (Over Baseline Usage)	$0.06704	(I)
Transmission* (all usage)	$0.04785	(R)
Transmission Rate Adjustments* (all usage)	($0.00016)	(R)
Reliability Services* (all usage)	$0.00012	(R)
Public Purpose Programs (all usage)	$0.02727	(I)
Nuclear Decommissioning (all usage)	($0.00259)	(R)
Competition Transition Charges (all usage)	$0.00101	(I)
Energy Cost Recovery Amount (all usage)	($0.00003)	(I)
Wildfire Fund Charge (all usage)	$0.00561	(I)
New System Generation Charge (all usage)**	$0.00757	(I)
Wildfire Hardening Charge (all usage)	$0.00254	
Recovery Bond Charge (all usage)	$0.00528	
Recovery Bond Credit (all usage)	($0.00528)	
Bundled Power Charge Indifference Adjustment (all usage)***	$0.00752	(R)

* Transmission, Transmission Rate Adjustments and Reliability Service charges are combined for presentation on customer bills.
** Distribution and New System Generation Charges are combined for presentation on customer bills.
*** Direct Access, Community Choice Aggregation and Transitional Bundled Service Customers pay the applicable Vintaged Power Charge Indifference Adjustment. Generation and Bundled PCIA are combined for presentation on bundled customer bills.

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

RATES:(Cont'd.)

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

TOTAL BUNDLED RATES

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

Total Energy Rates ($ per kWh)	PEAK	PART-PEAK	OFF-PEAK
Summer Usage	$0.63702	$0.47514	$0.41846
Winter Usage	$0.40551	$0.38342	$0.36956

California Climate Credit (per household, per semi-annual payment occurring in the April and October bill cycles)	($55.17)

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

UNBUNDLING OF TOTAL RATES

Energy Rates by Component ($ per kWh)	PEAK	PART-PEAK	OFF-PEAK
Generation:			
Summer Usage	$0.30554	$0.20643	$0.16133
Winter Usage	$0.14341	$0.12344	$0.11009
Distribution:**			
Summer Usage	$0.23690	$0.17413	$0.16255
Winter Usage	$0.16752	$0.16540	$0.16489
Transmission* (all usage)	$0.04715	$0.04715	$0.04715
Transmission Rate Adjustments* (all usage)	($0.00160)	($0.00160)	($0.00160)
Reliability Services* (all usage)	$0.00012	$0.00012	$0.00012
Public Purpose Programs (all usage)	$0.02727	$0.02727	$0.02727
Nuclear Decommissioning (all usage)	($0.00259)	($0.00259)	($0.00259)
Competition Transition Charges (all usage)	$0.00101	$0.00101	$0.00101
Energy Cost Recovery Amount (all usage)	($0.00003)	($0.00003)	($0.00003)
Wildfire Fund Charge (all usage)	$0.00561	$0.00561	$0.00561
New System Generation Charge (all usage)**	$0.00759	$0.00759	$0.00759
Wildfire Hardening Charge (all usage)	$0.00207	$0.00207	$0.00207
Recovery Bond Charge (all usage)	$0.00597	$0.00597	$0.00597
Recovery Bond Credit (all usage)	($0.00597)	($0.00597)	($0.00597)
Bundled Power Charge Indifference Adjustment (all usage)***	$0.00798	$0.00798	$0.00798

* 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.

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Central Coast Community Energy

CCCE Rates in PG&E Territory

Effective: January 1, 2024

RESIDENTIAL CUSTOMERS						
CCCE RATE SCHEDULE	PERIOD	3Cchoice (Default COS)	3Cprime (Default COS)	3Cchoice (Seasonal Flat**)	3Cprime (Seasonal Flat**)	TIME PERIOD DEFINITIONS
E-1						
ENERGY CHARGE ($/KWH)	YEAR-ROUND	0.12400	0.13200	N/A	N/A	All electric usage
EV (EV-A and EV-B)						**Summer - May through October; Winter - November through April**
ENERGY CHARGE ($/KWH)	SUMMER PEAK	0.20500	0.21300	0.12900	0.13700	2pm to 9pm, Monday - Friday 3pm to 7pm, Saturday Sunday & holidays*
	SUMMER PART-PEAK	0.10100	0.10900	0.12900	0.13700	7am to 2pm & 9pm to 11pm, Monday - Friday
	SUMMER OFF-PEAK	0.09600	0.10400	0.12900	0.13700	All other hours
	WINTER PEAK	0.18300	0.19100	0.12200	0.13000	2pm to 9pm, Monday - Friday 3pm to 7pm, Saturday Sunday & holidays*
	WINTER PART-PEAK	0.12900	0.13700	0.12200	0.13000	7am to 2pm & 9pm to 11pm, Monday - Friday
	WINTER OFF-PEAK	0.08200	0.09000	0.12200	0.13000	All other hours
EV-2A						**Summer - June through September; Winter - October through May**
ENERGY CHARGE ($/KWH)	SUMMER PEAK	0.22300	0.23100	0.12900	0.13700	4pm to 9pm, every day
	SUMMER PART-PEAK	0.11000	0.11800	0.12900	0.13700	3pm to 4pm & 9pm to 12am, every day
	SUMMER OFF-PEAK	0.08900	0.09700	0.12900	0.13700	All other hours
	WINTER PEAK	0.18300	0.19100	0.12200	0.13000	4pm to 9pm, every day
	WINTER PART-PEAK	0.11100	0.11900	0.12200	0.13000	3pm to 4pm & 9pm to 12am, every day
	WINTER OFF-PEAK	0.09800	0.10600	0.12200	0.13000	All other hours
E-ELEC						**Summer - June through September; Winter - October through May**
ENERGY CHARGE ($/KWH)	SUMMER PEAK	0.22300	0.23100	0.12900	0.13700	4pm to 9pm, every day
	SUMMER PART-PEAK	0.11000	0.11800	0.12900	0.13700	3pm to 4pm & 9pm to 12am, every day
	SUMMER OFF-PEAK	0.08900	0.09700	0.12900	0.13700	All other hours
	WINTER PEAK	0.18300	0.19100	0.12200	0.13000	4pm to 9pm, every day
	WINTER PART-PEAK	0.11100	0.11900	0.12200	0.13000	3pm to 4pm & 9pm to 12am, every day
	WINTER OFF-PEAK	0.09800	0.10600	0.12200	0.13000	All other hours
E-TOU-B						**Summer - June through September; Winter - October through May**
ENERGY CHARGE ($/KWH)	SUMMER PEAK	0.22300	0.23100	0.12900	0.13700	4pm to 9pm, Monday - Friday
	SUMMER OFF-PEAK	0.09200	0.10000	0.12900	0.13700	All other times including holidays*
	WINTER PEAK	0.18300	0.19100	0.12200	0.13000	4pm to 9pm, Monday - Friday
	WINTER OFF-PEAK	0.09900	0.10700	0.12200	0.13000	All other times including holidays*
E-TOU-C^						**Summer - June through September; Winter - October through May**
ENERGY CHARGE ($/KWH)	SUMMER PEAK	0.22300	0.23100	0.12900	0.13700	4pm to 9pm, every day
	SUMMER OFF-PEAK	0.09200	0.10000	0.12900	0.13700	All other hours
	WINTER PEAK	0.18300	0.19100	0.12200	0.13000	4pm to 9pm, every day
	WINTER OFF-PEAK	0.09900	0.10700	0.12200	0.13000	All other hours
E-TOU-D						**Summer - June through September; Winter - October through May**
ENERGY CHARGE ($/KWH)	SUMMER PEAK	0.22300	0.23100	0.12900	0.13700	5pm to 8pm, Monday - Friday
	SUMMER OFF-PEAK	0.09200	0.10000	0.12900	0.13700	All other times including holidays
	WINTER PEAK	0.18300	0.19100	0.12200	0.13000	5pm to 8pm, Monday - Friday
	WINTER OFF-PEAK	0.09900	0.10700	0.12200	0.13000	All other times including holidays*

^Effective October 1, 2023 EM-TOU customers will be regrouped from E-6 to E-TOU-C in alignment with the time period change scheduled by PG&E.

*Holidays are New Year's Day, President's Day, Memorial Day, Independene Day, Labor Day, Veteran's Day, Thanksgiving Day and Christmas Day.

**Seasonal Flat Rate enrollment closed on October 31, 2021. Offered as part of 3CE's shift to a Cost-of-Service rate design model, Seasonal Flat Rate enrollment was available to eligible customers with the qualification that these Seasonal Flat Rates would end on January 1, 2025.

Central Coast Community Energy

CCCE Rates in PG&E Territory

Effective: January 1, 2024

POWER CHARGE INDIFFERENCE ADJUSTMENT (PCIA) & Franchise Fee (FF)

The Power Charge Indifference Adjustment (PCIA) is a fee collected by PG&E and assessed to customers who receive their electric ENERGY services from another provider. The PCIA is considered an "exit fee" assessed by PG&E to cover costs for departing customers; resources acquired prior to a customer's change in service providers, and to ensure their current customers are "indifferent" to costs associated with the departed customers. PG&E assigns customers a "PCIA Vintage" based on the date a customer's respective community enrolled in alternative service; this date is reset upon reenrollment if a customer opts-out and later re-enrolls in CCCE service. PCIA rates are generally updated by PG&E each January. The PCIA is charged on a per kWh basis based on net monthly usage, and is unaffected by time-of-use.

The Franchise Fee is collected by PG&E to pay for the right to use public streets for running gas and electric service through. This fee is imposed by cities and counties for all customers (including PG&E-only customers) but is collected separately from CCA customers. The Franchise Fee is charged on a per kWh basis, based on net monthly usage and is unaffected by time-of-use, nor will any city or county receive less from the Franchise Fee if they join a Community Choice Energy agency.

Vintage Year	PCIA	FF
2009	0.00705	0.00123
2010	0.01085	0.00120
2011	0.01166	0.00119
2012	0.01119	0.00120
2013	0.01137	0.00120
2014	0.01110	0.00120
2015	0.01106	0.00120
2016	0.01083	0.00120
2017	0.01057	0.00120
2018	0.00912	0.00121
2019	0.00705	0.00123
2020	0.00671	0.00123
2021	-0.00562	0.00132
2022	0.00039	0.00128
2023	0.00752	0.00122
2024	0.00752	0.00122

7.2.2 SoCalGas – Gas

The SoCalGas monthly gas rate in $/therm applied in this analysis is shown in Table 26. The gas rates were developed based on the latest available gas rate for February 2024 and a curve to reflect how natural gas prices fluctuate with seasonal supply and demand. The seasonal curve was estimated from SoCalGas's monthly residential tariffs between 2014 and 2023. 12-month curves were created from monthly gas rates for each of the ten years. The ten annual curves were then averaged to arrive at an average normalized annual curve. Long-term historical natural gas rate data was only available for SoCalGas' procurement charges.[6] 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 February 2024 rates. The costs presented in Table 26 were then derived by establishing the February baseline and excess rates from the latest 2024 tariff as a reference point, and then using the normalized curve to estimate the cost for the remaining months relative to the February rates.

Table 26: SoCalGas Monthly Gas Rate ($/therm)

Month	Total Charge	
	Baseline	Excess
Jan	$1.73685	$2.16346
Feb	$1.46941	$1.89602
Mar	$1.40304	$1.82965
Apr	$1.33281	$1.75942
May	$1.35857	$1.78518
June	$1.40441	$1.83102
July	$1.42375	$1.85036
Aug	$1.48077	$1.90738
Sept	$1.42813	$1.85474
Oct	$1.39955	$1.82616
Nov	$1.44858	$1.87519
Dec	$1.53152	$1.95813

[6] 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)

7.2.3 Fuel Escalation Rates

The average annual escalation rates in Table 27 were used in this study. The electricity and natural gas rates are based on assumptions from the CPUC 2021 En Banc hearings on utility costs through 2030 (California Public Utilities Commission, 2021a). Escalation rates through the remainder of the 30-year evaluation period are based on the escalation rate assumptions within the 2022 TDV factors. No data was available to estimate electricity escalation rates for 3CE, therefore electricity escalation rates for PG&E and statewide natural gas escalation rates were applied.

Table 28 presents the average annual escalation rates used in the utility rate escalation sensitivity analysis shown in Section 4.4. 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.[7] 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 27: Real Utility Rate Escalation Rate Assumptions, CPUC En Banc and 2022 TDV Basis

Year	Statewide Natural Gas Average Rate (%/year, real)	PG&E Electric Average Rate (%/year, real)
2024	4.6%	1.8%
2025	4.6%	1.8%
2026	4.6%	1.8%
2027	4.6%	1.8%
2028	4.6%	1.8%
2029	4.6%	1.8%
2030	4.6%	1.8%
2031	2.0%	0.6%
2032	2.4%	0.6%
2033	2.1%	0.6%
2034	1.9%	0.6%
2035	1.9%	0.6%
2036	1.8%	0.6%
2037	1.7%	0.6%
2038	1.6%	0.6%
2039	2.1%	0.6%
2040	1.6%	0.6%
2041	2.2%	0.6%
2042	2.2%	0.6%
2043	2.3%	0.6%
2044	2.4%	0.6%
2045	2.5%	0.6%
2046	1.5%	0.6%
2047	1.3%	0.6%
2048	1.6%	0.6%
2049	1.3%	0.6%
2050	1.5%	0.6%
2051	1.8%	0.6%
2052	1.8%	0.6%
2053	1.8%	0.6%

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

Table 28: 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.

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