CITY OF PALM SPRINGS OFFICE OF SUSTAINABILITY Healthy Planet, Healthy You.	**COMMITTEE REPORT**
PRESENTED FOR COMMISSION MEETING DATE: 06/15/21	**SUBMITTED BY: David Freedman**
COMMITTEE NAME: Standing Committee on Solar and Green Building	**SUBMITTED DATE: 06/09/21**
COMMITTEE MEETING DATE: 06/01/21	**NEXT COMMITTEE MEETING DATE: TBD**

Committee Meeting Agenda:

A. Presentation and Discussion of New SCE Commercial Energy Efficiency Incentives
B. Outdoor Lighting Requirements Under Zoning and Energy Codes
C. Committee Expansion
D. GHG Inventory Update
E. Reach Code Proposal
F. EV Charger Expansion
G. Sustainability Scholarship and Home Energy Assessment Rebates
H. Legislative and Regulatory Update
I. DCE Issues/Updates
J. Agenda Items for June Commission Meeting
K. Adjournment – Discuss Date of Next Committee Meeting

Summary:

Manager Tallarico and Program Coordinator Sheldon represented the Office of Sustainability. Chair Clark and Vice Chair McCann attended for the first three agenda items. Francine Pitassi and Taylor McKerlich of Willdan and Rick Stephens of Inland Mechanical Services made the presentation on behalf of Southern California Edison (SCE) noted below. In the absence of Commissioner Flanagan to establish a quorum for a formal Committee meeting, the focus was on the reporting items on the posted agenda.

A. Presentation and Discussion of New SCE Commercial Energy Efficiency Incentives

Ms. Pitassi noted that SCE has contracted with Willdan as third-party administrator of a five-year program offering $900 million in incentives for energy efficiency incentives for commercial and multifamily buildings, including residential care facilities, consuming more than 20 kilowatts per month. Approval from the California Public utilities commission (CPUC) is pending, but SCE has authorized Willdan to begin outreach on the incentive program. The program is financed by public purpose charges paid by SCE customers, and customers of Desert Community Energy (DCE) are also eligible since they pay SCE delivery charges.

The purpose of the program is to reduce energy and natural gas consumption from the grid. Eligible projects include HVAC and indoor lighting upgrades. Willdan or its trade allies such as Inland Mechanical Services will conduct a no-cost audit on energy savings measures and put together the project cost. The objective is to influence the customer to do the energy saving project and obtain a quicker return on investment, in three to five years. Willdan can also offer

financing to cover project costs beyond the incentives.

Considering the outdoor lighting discussion next on the agenda, Ms. Pitassi said that outdoor lighting upgrades are not yet part of the program, but she hoped that the CPUC would authorize them. She will send manager Tallarico details on the CPUC proceeding and whether a letter from the City to the CPUC supporting inclusion of outdoor lighting in the program would be helpful. Once the program is launched, Manager Tallarico will include information about it under Energy Efficiency on the Office of Sustainability landing page on the City website. He will check with Ms. Pitassi on whether the program will also cover cannabis grow facilities and new construction.

B. Outdoor Lighting Requirements Under Zoning and Energy Codes

Vice Chair McCann provided an update on his outdoor lighting memo to the Commission for its June 15 meeting. The memo will contain a recommendation to staff to resolve possible conflicts between the outdoor lighting standards in Section 93.21.00 of the Zoning Code and those in the 2019 California Energy Code, adopted in Section 8.04.065 of the Municipal Code.

C. Committee Expansion

Chair Clark noted that he would like to expand the charter of the Solar and Green Building Committee to cover all elements of the City's Climate Action Roadmap, especially on-road transportation, which accounts for about 50% of the City's GHG inventory. He would like to participate in the expanded Committee and will develop a preliminary approach for evaluating the GHG impact of on-road transportation before recommending any Committee changes.

D. GHG Inventory Update

The City issued a news release publicizing that it achieved its 2020 GHG emissions reduction target by reducing emissions more than 15 percent below 2010 levels, as a direct result of the launch of DCE and the commitment by most customers to stay with the Carbon Free program. Councilmember Kors shared the results in his report at the May 27 Council meeting. The GHG memos produced by the contractor, PlaceWorks, have been uploaded to the Office of Sustainability page of the City website, under Plans and Publications.

Manager Tallarico Council said he expects to present the GHG inventory reports to Council before the summer break, together with a discussion of actions the City has taken and can take to reduce its GHG emissions.

E. Reach Code Proposal

Commissioner Freedman presented his proposal for a Palm Springs Reach Code that would require certain residential remodels to carry out energy efficiency upgrades when such measures are not already triggered by California Energy Code provisions. These measures are cost-effective over their life cycle and would reduce energy consumption and GHG emissions, as further described in the memo included in the Commission meeting packet. Commissioner Freedman is working on a model with the state Reach Codes team. The California Energy Commission (CEC) has already approved similar ordinances.

F. EV Charger Expansion

Manager Tallarico reported that he is continuing to work with contractor for permitting. SCE has raised right-of-way issues for the City Hall parking lot, which may delay issuance of that permit. The contractor is working on the surety bond, and the agreements will be signed once the bond is approved.

G. Sustainability Scholarship and Home Energy Assessment Rebates

Manager Tallarico reported that applications have been submitted for a water recycling system at a cannabis facility and replacing plastics at a beauty facility. For the 2021-22 fiscal year, the Sustainability Scholarship will focus on supporting businesses in their compliance with the City's recently enacted food ware ordinance. The home energy assessment rebates will have a $5,000 separate budget allocation. None of the current fiscal year's budget of $10,000 has been spent.

H. Legislative and Regulatory Update

Commissioner Freedman provided an update on energy-related state legislative and regulatory proceedings that will impact the City and DCE.

- The CEC held three days of public hearings on the draft 2022 Energy Code, which it is scheduled to adopt along with the related Environmental Impact Report at its August Business Meeting. Council will adopt the 2022 Energy Code and the other state Building Standards Codes in late 2022, effective January 1, 2023. Commissioner Freedman has sent the CEC staff slide presentations from the hearings to Manager Tallarico for forwarding to the Building Division.
- The CEC held two days of workshops on building decarbonization, as part of the effort under AB 3232 to reduce GHG emissions from the state's building stock by at least 40 percent below 1990 levels by January 1, 2030. One of the workshop presentations is attached.
- The state Senate approved and sent to the Assembly SB 612, which would help ensure that Community Choice Aggregators such as DCE receive access to legacy resource benefits held by an investor-owned utility such as SCE. SB 617, which would require local governments to adopt an automated solar permitting application by September 30, 2023, is being held in the Senate Appropriations Committee suspense file. City Council has issued support letters in favor of both bills.
- The state Assembly rejected AB 1139, which would have limited the Net Energy Metering (NEM) bill credits solar customers receive for their electricity generation. The bill was moved to the inactive file at the request of its sponsor and could be reintroduced next year. The CPUC is also considering changes to the NEM compensation rules.

I. DCE Issues/Updates

The next DCE Board meeting will be on June 21. The DCE Board will approve its FY 2021-22 budget at the meeting.

J. Agenda Items for June Commission Meeting

Manager Tallarico and Commissioner Freedman divided the topics they will each present at the June 15 Commission meeting, reflecting the matters discussed above.

K. Adjournment – Discuss Date of Next Committee Meeting

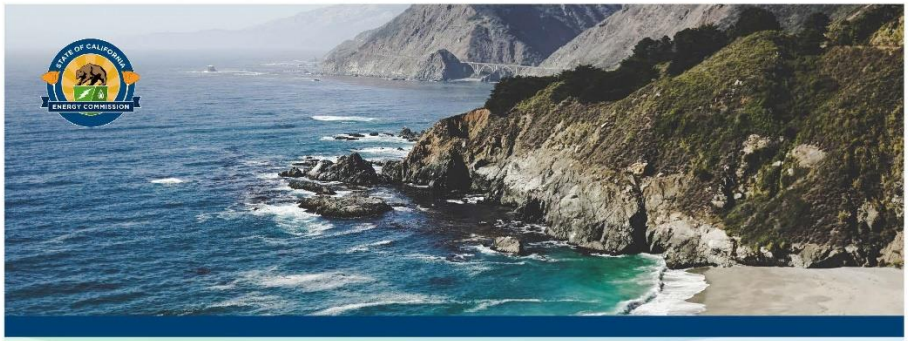
The next Committee meeting will be scheduled once the Committee's new charter and roster have been set.

Recommendation/Request:

Continuing working on energy-related GHG reduction measures to further City and State goals.

ACTION ITEMS REQUEST TO COMMISSION	• Approve Reach Code proposal. • Approve other GHG inventory action items when they are presented.
ACTION ITEMS REQUEST TO OFFICE OF SUSTAINABILITY	• Work with City Manager to schedule Council discussion of GHG inventory, including Reach Code proposal. • Implement EV charger deployment. • Process Sustainability Scholarship and home energy assessment pilot program applications.
POTENTIAL FISCAL IMPACT/REQUEST IF ANY	• The City has received more than $150,000 in grant funding for EV chargers, which will be used in connection with the installations, unless the grants expire before they can be used. The City will not incur any costs for the Level Ill stations but will incur a cost of $4,500 for each Level II charging station. The City will receive leasing revenues totaling about $18,900 per year. Both the costs and the revenues will be in the Sustainability budget. • For FY 21-22, the Sustainability Scholarship will focus on supporting businesses in their compliance with the City's recently enacted food ware ordinance. • The home energy assessment rebate program will have a $5,000 budget allocation in FY 21-22.

DOCKETED	
Docket Number:	21-IEPR-06
Project Title:	Building Decarbonization and Energy Efficiency
TN #:	237984
Document Title:	Presentation - California's Greenhouse Gas Emissions
Description:	S2.1A Michael Sokol, Efficiency Division, CEC
Filer:	Raquel Kravitz
Organization:	California Energy Commission
Submitter Role:	Commission Staff
Submission Date:	5/25/2021 12:15:53 PM
Docketed Date:	5/25/2021



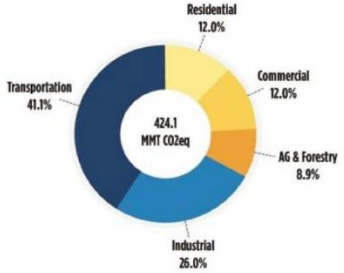
Building Decarbonization

Workshop for the 2021 Integrated Energy Policy Report (IEPR)

Michael Sokol, Efficiency Division Deputy Director
California Energy Commission

May 25, 2021

California's Greenhouse Gas Emissions



Source: CEC using data from CARB 2019 GHG Inventory and the adopted 2019 IEPR Electricity Forecast. Emissions estimate extracted from *2018 IEPR Update*, Chapter 1, Figure 1, p. 27.

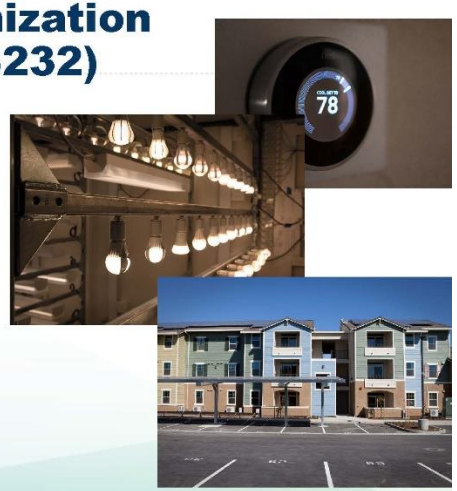
Legislative and Regulatory Context

- **SB 32** (2016, Pavley) – Reduce statewide GHG emissions 40% below 1990 levels by 2030
- **AB 3232** (2018, Friedman) – Assessment of potential to reduce building GHG 40% by 2030
- **SB 100** (2018, De León) - 100% zero carbon resources by 2045
- **SB 1477** (2018, Stern) – Low-emissions building technology deployment incentives
- **CEC, CPUC, CARB, and other agencies** taking action to assess and implement strategies to reduce building GHG

Building Decarbonization Assessment (AB 3232)

Assembly Bill 3232 Requirements:

- CO_2e cost per metric ton
- Space and water heating cost-effectiveness
- GHG emission reduction from low-income and multifamily housing, high-rise buildings
- Load management strategies
- Ratepayer, construction costs, and grid reliability considerations



More Info: https://www.energy.ca.gov/data-reports/reports/building-decarbonization-assessment

Variables Impacting Decarbonization

Building/Technology Impacts

- Building age
- New construction practices and costs
- Availability of heat pumps and low-GWP refrigerants
- Electric panel upgrades
- Internet access

Variables Impacting Decarbonization

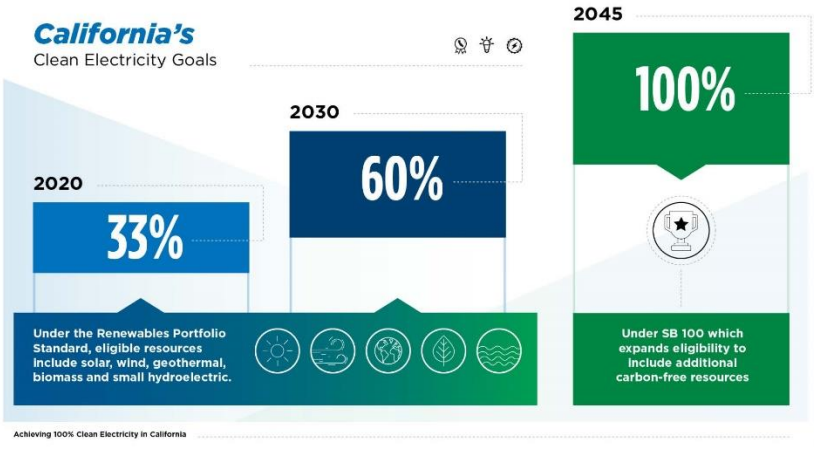
Customer/Consumer Impacts

- Project financing
- Program design
- Scheduling retrofits
- Retrofit costs
- Cooking practices
- Utility bill changes
- Existing programmatic and regulatory restrictions
- Workforce training
- Split incentives

Seven Broad Strategies of Building Decarbonization

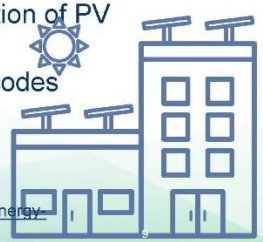
1. Building end-use electrification
2. Decarbonizing electricity generation system
3. Energy efficiency
4. Refrigerant conversion and leakage reduction
5. Distributed energy resources
6. Decarbonizing gas system
7. Demand flexibility

Senate Bill 100



Proposed 2022 Energy Code Goals

- Increase building energy efficiency cost-effectively
- Contribute to the state's GHG reduction goals
- Enable pathways for all-electric buildings
- Reduce residential building impacts on the electricity grid
- Promote demand flexibility and self-utilization of PV generation
- Provide tools for local government reach codes



More Info: https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/2022-building-energy-efficiency

2022 Energy Code Update

1. Electric Heat Pumps
2. Electric Ready
3. Solar + Batteries
4. Indoor Air Quality

Local Ordinances Exceeding 2019 Energy Code

48 Local energy ordinances adopted by 40 jurisdictions

23 Require all-electric construction (Some do not apply to all building types)

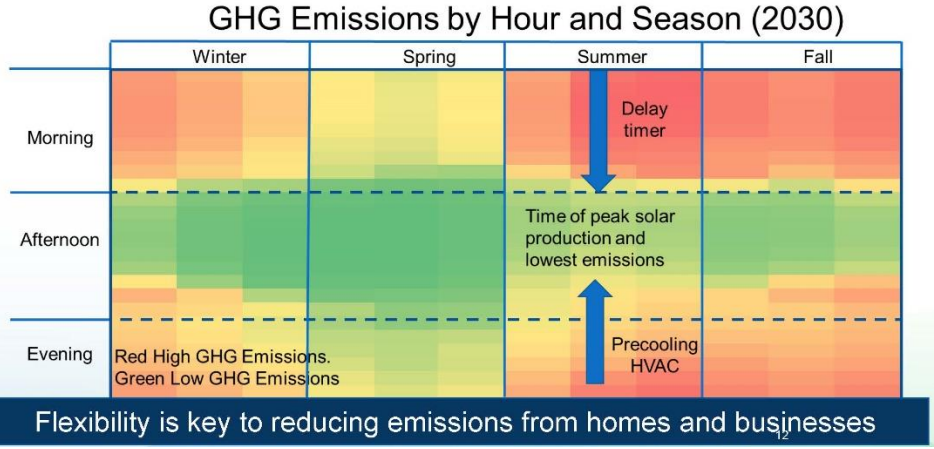
20 Require electric preferred construction

27 Require additional solar photovoltaics

25 Require additional EV infrastructure or charging

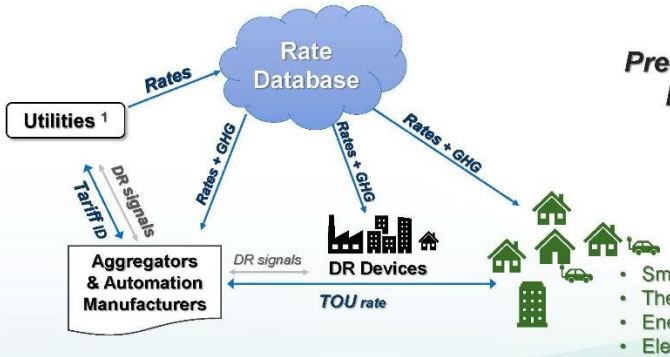
1 IN 3 CALIFORNIANS lives in a community with an energy code exceeding state standards

Load Flexibility - Schedule, Shift, and Curtail



Flexibility is key to reducing emissions from homes and businesses

Load Management Standards



Pre-Rulemaking – In Progress

- Smart plugs
- Thermostats
- Energy management systems
- Electric vehicle charging
- Batteries
- Water heater controls

1. And Load Serving Entities such as IOUs, POUs, CCAs, Etc.

Senate Bill 49 Requirements

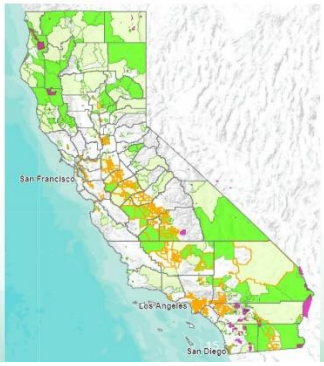
- Requires CEC to develop **Flexible Demand Appliance Standards**, in coordination with LSEs and CPUC
  - ❖ Cost-effective, including GHG and grid benefits
  - ❖ Requires consumer consent
  - ❖ Open source and user-friendly
  - ❖ Cybersecurity
- Report on progress in the Integrated Energy Policy Report

More Info: https://www.energy.ca.gov/proceedings/energy-commission-proceedings/flexible-demand-appliances

Consumer Centric Approach

- Prioritize and invest in community outreach and engagement
- Commitment to Inclusion, Diversity, Equity, Access (IDEA)
- Collaborate with Disadvantaged Communities Advisory Group (DACAG)
- Consult with CA Tribes
- Partner with local community-based organizations (CBOs)

California Tribal Lands, SB 535 Disadvantaged Communities and Low-income Communities



Thank you

MEMORANDUM

DATE: June 10, 2021

SUBJECT: Palm Springs Reach Code Proposal

TO: Sustainability Commission
Patrick Tallarico, Manager, Office of Sustainability

FROM: David Freedman, Solar and Green Building Committee Member

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I. Summary

California and Palm Springs have set ambitious goals to reduce greenhouse gas (GHG) emissions. Although the City has achieved the initial 2020 GHG emissions reduction goal, additional actions are necessary to achieve the 2030 and 2050 goals. A Reach Code requiring residential remodels, re-roofing, and additions to carry out energy efficiency upgrades would save homeowners money and reduce community-wide GHG emissions and energy consumption. City Council should provide direction to continue work on this proposal and bring a draft ordinance to Council for consideration.

II. State and City Energy Policies

A. State Policies

Beginning in 2006, California has set ambitious GHG emission reduction goals as part of the state's efforts to combat and mitigate the impacts of climate change. AB 32, the Global Warming Solutions Act of 2006, required California to reduce its GHG emissions to 1990 levels by 2020. SB 32 enacted in 2016 extends California's commitment to reduce GHG emissions by requiring the state to reduce statewide GHG emissions by 40 percent below 1990 levels by 2030. Executive Order B-30-15 directs state agencies to achieve a goal of an 80 percent GHG reduction from 1990 levels by 2050.

AB 3232 enacted in 2018 requires the California Energy Commission (CEC) to assess the potential for the state to reduce GHG emissions from the state's residential and commercial building stock by at least 40 percent below 1990 levels by January 1, 2030. The bill states that decarbonizing California's buildings is essential to achieve the state's GHG reduction goals at the lowest possible cost. The bill establishes that it is the intent of the Legislature to achieve significant reductions in GHG emissions by the state's residential and commercial building stock by January 1, 2030. Residential and commercial buildings jointly account for 25 percent of GHG emissions in the state when accounting for both fossil fuels consumed onsite and those used to generate electricity for buildings.[1]

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[1] Source: California Building Decarbonization Assessment Draft Staff Report, May 2021, CEC-400-2021-006-SD, page 1.

Pursuant to the Warren-Alquist Act of 1974, the CEC is required to adopt regulations to reduce the wasteful, uneconomic, inefficient, or unnecessary consumption of energy, including the energy associated with the use of water, and to manage energy loads to help maintain electrical grid reliability. This is done through amendments to the Building Energy Efficiency Standards contained in the California Code of Regulations, Title 24, Part 6 (hereinafter, the "Energy Code") on a three-year cycle. The Energy Code includes energy efficiency standards applicable to the construction of new buildings and additions and alterations to existing buildings. The CEC is required to adopt or revise standards that shall be cost-effective when taken in their entirety and when amortized over the economic life of the structure compared with historic practice.

The CEC has released the draft 2022 Energy Code and the related Environmental Impact Report, for approval at the CEC's August 2021 Business Meeting. Once approved, the 2022 Energy Code will become effective on January 1, 2023. As in prior updates to the Energy Code, the proposed 2022 Energy Code updates include numerous changes to the existing 2019 Energy Code. These amendments include new or updated standards to increase efficiency of different building systems and pieces of equipment. In alignment with GHG mitigation as a primary policy driver, the 2022 Energy Code aims to further address building decarbonization through a focus on efficient heat pump technologies and a range of other elements.

In addition to the triennial Energy Code updates, the CEC encourages local governments to adopt energy efficiency standards exceeding the Energy Code, known as reach codes. The CEC considers that these jurisdictions are living laboratories for a clean energy future, reduce state GHG emissions and lead from the grassroots.

Local governments are required to apply to the CEC for approval prior to enforcement of such standards. The CEC must find that the local standards will require buildings to be designed to consume no more energy than permitted by the Energy Code, and the application must include the basis of the local government's determination that its standards are cost-effective. CEC staff reviews the application to confirm these criteria are met and makes a recommendation for CEC approval based on the findings. The CEC has already approved 48 local reach codes from 40 jurisdictions exceeding the 2019 Energy Code. Several more cities, including most recently Sacramento, have approved reach codes that are pending CEC approval. The cost-effective measures discussed below are intended to exceed the requirements of the 2022 Energy Code and go into effect simultaneously with that Code on January 1, 2023. They would require CEC approval prior to their effectiveness.

B. City Policies

Palm Springs has also established ambitious GHG and energy reduction goals, paralleling the state's. In 2016, City Council adopted the Sustainability Plan setting the following goals:

- Develop strategies to reduce community-wide contributions to GHG emissions to 1990 levels by 2020 and 80% below 1990 by 2050;
- Achieve carbon neutrality for municipal emissions by 2030.
- Encourage the building or retrofitting of one million square feet of green buildings;
- Reduce the total energy use by all buildings built before 2012 by 10%;
- Reduce energy use and carbon use from new homes and buildings;
- Supply 50% of all energy from renewable sources by 2030.

In addition, the General Plan adopted by City Council in October 2007 sets the following goals:

- Support and encourage the use of alternative energy in the construction of new buildings and retrofit of existing buildings;
- Encourage and support the incorporation of energy efficiency and conservation practices in subdivision and building design;
- Make the maximum use of solar electric capabilities on an individual and community wide basis.

Finally, the General Plan update priorities approved by the Planning and Sustainability Commissions last year includes the following statement:

Continue to advance Palm Springs' role as a sustainability leader. Promote the sustainable use of materials, energy, land, water, air, and other natural resources to enhance the long-term livability of our community. Reduce greenhouse gas emissions and proactively anticipate and mitigate the impacts of climate change. Reduce wastes going to landfill through source reduction, reuse, recycling, and other methods.

The measures discussed below are intended to further the City's stated policy goals.

II. GHG Data

In support of the General Plan update, the City asked its consultant PlaceWorks to update the GHG inventory and forecasts. PlaceWorks updated the City's 2010 community-wide and City operations GHG emissions inventories and prepared a 2018 community-wide GHG emissions inventory. PlaceWorks has also used these results to prepare projections of the community-wide GHG emissions in 2020 and to identify the reductions achieved by existing State of California efforts and the launch of Desert Community Energy (DCE).

PlaceWorks estimates 2020 community-wide annual GHG emissions at 490,180 $MTCO_{2E}$, a 1.1% reduction from the 1990 baseline of 495,720 $MTCO_{2E}$. Residential energy annual GHG emissions are 111,000 $MTCO_{2E}$, approximately 22.6% of total annual GHG emissions. Palm Springs has thus achieved its 2020 GHG emissions reduction target set out in AB 32 and the City's Sustainability Plan by reducing emissions 15 percent below 2010 levels primarily as a result of the launch of DCE and the commitment by most DCE customers to stay with its Carbon Free program.[2] To achieve the state and City 2030 and 2050 goals noted above, GHG emissions would need to be reduced to 297,430 $MTCO_{2E}$ by 2030 and 99,140 $MTCO_{2E}$ by 2050. Along with the state initiatives noted above, the City will need to take additional actions to achieve those goals.

III. Reach Code Proposal

Among the reach codes approved by the CEC are those in Carlsbad and Chula Vista (San Diego County) and Piedmont (Alameda County) that require certain residential remodels and additions to carry out energy efficiency upgrades when such measures are not already triggered by Energy Code requirements. These measures, which generally track 2019 and 2022 Energy Code provisions, improve the energy efficiency of older homes that can see the most benefits, since these homes were constructed before many of the energy efficiency measures required for new construction and some additions and alterations went into effect with the 2008 Energy Code. Of the 37,735 total residential units in Palm Springs, approximately 80% of the single-family dwelling units (22,518 of 28,326) and 98% of the multifamily units (9,240 of 9,409) were built pre-2006.[3]

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[2] The 1990 baseline is 15% below 2010 community-wide GHG emissions of 583,200 $MTCO_{2E}$. According to the State's Scoping Plan, which identifies local governments as strategic partners in meeting the State's GHG emission-reduction targets, reducing GHG emissions 15 percent below 2005-2010 levels by 2020 would be equivalent to reducing GHG emissions to 1990 levels for local governments.

[3] See Attachment 1, generated from the Codes and Standards Cost-Effectiveness Explorer using data from the US Census, National Landcover Database, California Department of Finance, Southern California Association of Governments parcel data

The Chula Vista and Piedmont ordinances have a list of cost-effective energy efficiency upgrades that homeowners can choose, while Carlsbad lists mandatory upgrades.[4] Similar upgrade measures would also be cost effective in Palm Springs. For example, duct sealing of a pre-1978 single-family home is estimated to have an incremental cost of $683 and would generate 30-year lifecycle savings having a net present value (NPV) of $18,061. A water heating package for a single-family home consisting of a water heater blanket, hot water pipe insulation and low-flow shower and faucet fixtures is estimated to have an incremental cost of $208 and would generate 30-year lifecycle savings having an NPV of $87.[5] To support the state's building decarbonization efforts, prewiring for heat pump water heaters (HPWHs) and space heaters can also be added to the list of eligible measures for homeowners installing a solar PV system at the same time as their home remodel or addition.[6] Exterior lighting controls with photosensors could also be a compliance option to support the Commission's dark sky initiative.

The threshold in the Carlsbad energy efficiency ordinance is $60,000, the same threshold that triggers a local Coastal Development Permit. The Piedmont ordinance requires one upgrade from the list if the stated project value is $25,000 or more and two listed upgrades if the stated project value is $100,000 or more.

(from the Riverside County Assessor's Office) and the CEC. The residential building stock data are only for Climate Zone 15, covering the low-desert areas of southeastern California. The area within the City limits in the Santa Rosa Mountains is in Climate Zone 16 and would not be subject to the reach code proposal. The Cost-Effectiveness Explorer shows seven single-family homes in the Palm Springs portion of Climate Zone 16.

The Codes and Standards Program under the auspices of the California Public Utilities Commission has issued cost-effectiveness studies to help local jurisdictions determine which measures save energy and are cost effective and support the finding required by state law. The Codes and Standards Program has developed the Cost-Effectiveness Explorer as an online tool using data from the cost-effectiveness studies that local jurisdiction staff and other stakeholders could use to simplify initial reach code research. The tool allows users to identify cost-effective reach code options as well as to better understand the impacts on their local communities of different possible scenarios.

The most recent Codes and Standards Program cost-effectiveness study for single-family home upgrades considered three unique building vintages: pre-1978, 1978-1991, and 1992-2010. The vintages were defined based on review of historic Energy Code requirements and selecting year ranges with distinguishing features. Homes built under the 2001 Energy Code are subject to prescriptive envelope code requirements very similar to homes built under the 2005 Energy Code, which was in effect until January 1, 2010. Source: 2019 Cost-Effectiveness Study: Existing Low-rise Residential Building Efficiency Upgrades, 2021-03-02, pages 3-4. The Cost-Effectiveness Explorer housing stock data are being updated to reflect these building vintages.

[4] See summary of the Chula Vista Existing Home Energy Sustainability Ordinance (Attachment 2).

[5] The various energy efficiency measures and packages are described in the Cost-Effectiveness Study referred to in footnote 3 (see Attachment 3). Cost-effectiveness data for Climate Zone 15 from this study for single-family homes are set out in Attachment 4. Cost-effectiveness data for multifamily homes are set out in Attachment 5 using the Cost-Effectiveness Explorer. These data are derived from the 2020 edition of the Cost-Effectiveness Study, which covered both single-family and multifamily homes.

The Cost-Effectiveness Study prototypes for existing single-family residential buildings are 1,665 ft^2 for a single-family home and 960 ft^2 per unit for a multifamily building. Costs for initial installation and annual operation, and on-bill benefits from reduced energy costs, are calculated over a 30-year period of analysis. The NPV and benefit / cost calculations generally assume an escalation of utility rates, a real discount rate of 3 percent and first incremental costs being financed into a mortgage or loan of 30 years at a rate of 4% for single-family homes and 10 years at a rate of 4% for multifamily homes. Maintenance costs were not included for any measures because there are no incremental maintenance costs expected for any of the measures evaluated. Replacement costs were factored in for lighting measures.

The Cost-Effectiveness Study uses electricity rates from Southern California Edison (SCE) effective April 13 to May 31, 2020, and gas rates from Southern California Gas for the 12-month period ending January 2020 (see pages 54-57). Those rates have since increased. Utility savings could potentially be higher for DCE customers on its Carbon Free product and slightly lower for customers on its Desert Saver product. The on-bill cost data do not include either the social cost of higher GHG emissions leading to air and water pollution, droughts and wildfires or the non-energy benefits of improved public health and a sustainable economy.

[6] The 2019 Energy Code already requires prewiring for a future HPWH for new homes with a gas water heater. See Section 150.0(n)(1)(A). Under the draft 2022 Energy Code, HPWHs will be required for new single-family residences in Climate Zone 15 See Section 150.1(c)8. Prewiring will also be required in new single-family residences for HPWHs (if not installed), battery storage, space heaters, cooktops, and clothes dryers. See Section 150.0(n), (s), (t), (u) and (v).

The Chula Vista ordinance does not have a monetary threshold. Two to four energy efficiency upgrades are required based on the age of the home and the climate zone where the home is located.[7] If the cost of completing required energy efficiency measures exceeds 20% of the overall project cost without those measures, applicants can propose a more limited set from among the required measures that does not exceed 20%. Other exemptions exist, including for low-income households and homes with on-site solar PV systems offsetting at least 95% of the annual electricity and gas-equivalent usage.

A combination of features from the Chula Vista and Piedmont ordinances would produce the greatest flexibility and GHG emission reductions. LED lighting would be required (if not already installed) regardless of permit value. All remodels, additions and reroofing having a permit value of at least $10,000 would be required to install the water heating package described above. Further thresholds can be set for remodels and additions on single-family and multifamily residential buildings built before 2010 having a permit value of $25,000 (one additional measure), $50,000 (two additional measures) and $100,000 (three additional measures). Various exceptions in the Chula Vista ordinance could apply. DCE Carbon Free customers could be given a compliance credit for certain measures where GHG emission reductions result primarily from electricity savings, such as for LED lighting, as their electricity usage does not contribute to citywide GHG emissions.

For re-roofing or an addition of a steep-sloped roof on an existing pre-2010 residence with a permit value of at least $25,000, one compliance option would be installation of a roofing product rated by the Cool Roof Rating Council (CRCC) with an aged solar reflectance of 0.25 or higher and thermal emittance of 0.85 or higher.[8] This measure is highly cost effective. For a pre-1978 single-family home, a steep-sloped cool roof is estimated to have an incremental cost of $778 and would generate 30-year lifecycle savings having an NPV of $5,788. Roof repair, photovoltaic roofs, and replacements of 50% or less of the roof area would be exempt but the homeowner would need to choose another measure.

A model shows the aggregate effect of this proposal.[9] Over the five-year period that it would be in effect (based on CEC guidance that cost-effectiveness data would need updating after five years), aggregate compliance costs would be approximately $2.052 million. Over that five-year effectiveness period plus the 30-year lifecycle, aggregate lifecycle on-bill savings would be approximately $6.464 million. Over that same time frame, electricity consumption would be reduced by approximately 14.964 million kilowatt hours, and natural gas consumption would be reduced by approximately 1.58 million therms. Residential GHG emissions would be reduced by 8,942 $MTCO_{2E.}$ Most of the GHG emissions reductions would come from the water heating package, while most of the on-bill and energy savings

[7] Four measures are required for all pre-2006 homes in the inland portion of Chula Vista in Climate Zone 10, which is the climate zone also covering western Riverside County.

[8] A steep-sloped roof is a roof that has a ratio of rise to run of greater than or equal to 2:12 (9.5 degrees from the horizontal). The requirement for steep-sloped roof replacements is an aged solar reflectance of 0.20 or higher and thermal emittance of 0.75 or higher under both the 2019 Energy Code (Section 150.2(b)1Ii) and the draft 2022 Energy Code (Section 150.2(b)1Ii for single-family homes and Section 180.2(b)1Aii for multifamily homes). See Attachment 6 for an analysis of cool roof cost-effectiveness and energy savings for both existing and new homes in Climate Zone 15 prepared by the Codes and Standards Program for this memo and using more recent SCE and SCG utility rates. The Building Division does not have data on how many residential roofs are steep-sloped, so this compliance option is not modeled.

[9] See Attachment 7. The model was developed by local energy policy consultant Eric Engelman, who developed the Cost-Effectiveness Explorer for the Codes and Standards Program and whose assistance was provided by the Codes and Standards Program at no cost to the City. The model is derived from the calculations reflected in the Codes and Standards Program 2020 and 2021 residential retrofit cost-effectiveness studies, residential permit data from January 1, 2015, to May 25, 2021, provided by the Building Division and assumptions on how many residences would be required to carry out the various energy efficiency upgrades and which measures they would choose based on work Mr. Engelman carried out as a consultant for the City of Chula Vista on its Existing Home Energy Sustainability Ordinance.

would come from duct and air sealing and attic insulation because of the large number of DCE customers using carbon-free electricity.

IV. Request to Sustainability Commission and Office of Sustainability

Request to Commission to recommend to City Council that it provide direction to the Commission and Office of Sustainability that they continue to research a Palm Springs Reach Code with the provisions proposed above (and any other provisions on which Council would provide direction), conduct community outreach, and bring a draft ordinance to Council for consideration and adoption effective January 1, 2023, simultaneously with 2022 Energy Code.

Request to Office of Sustainability to include this memo as an attachment to the staff report accompanying the GHG inventory be presented to City Council.

Cost Effectiveness Explorer

EXPLORER.LOCALENERGYCODES.COM

Residential Building Stock

City of Palm Springs

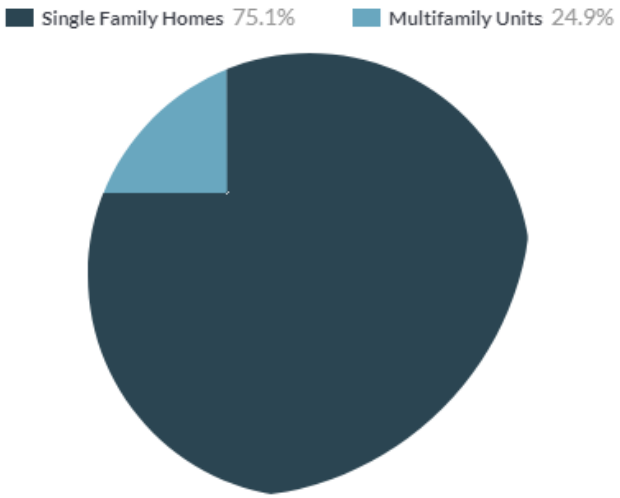
Zone 15

CALIFORNIA ENERGY CODES & STANDARDS
A STATEWIDE UTILITY PROGRAM

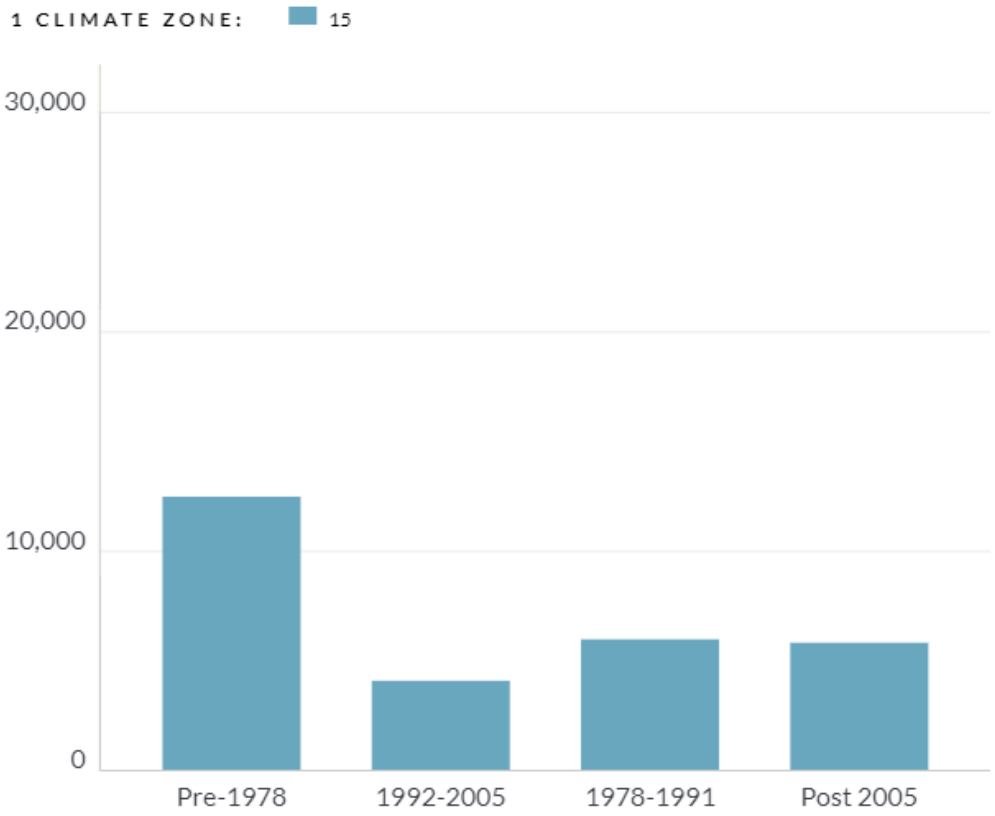
TOTAL RESIDENTIAL UNITS

37,735

DISTRIBUTION BY BUILDING TYPE



Single Family Dwelling Units 28,326



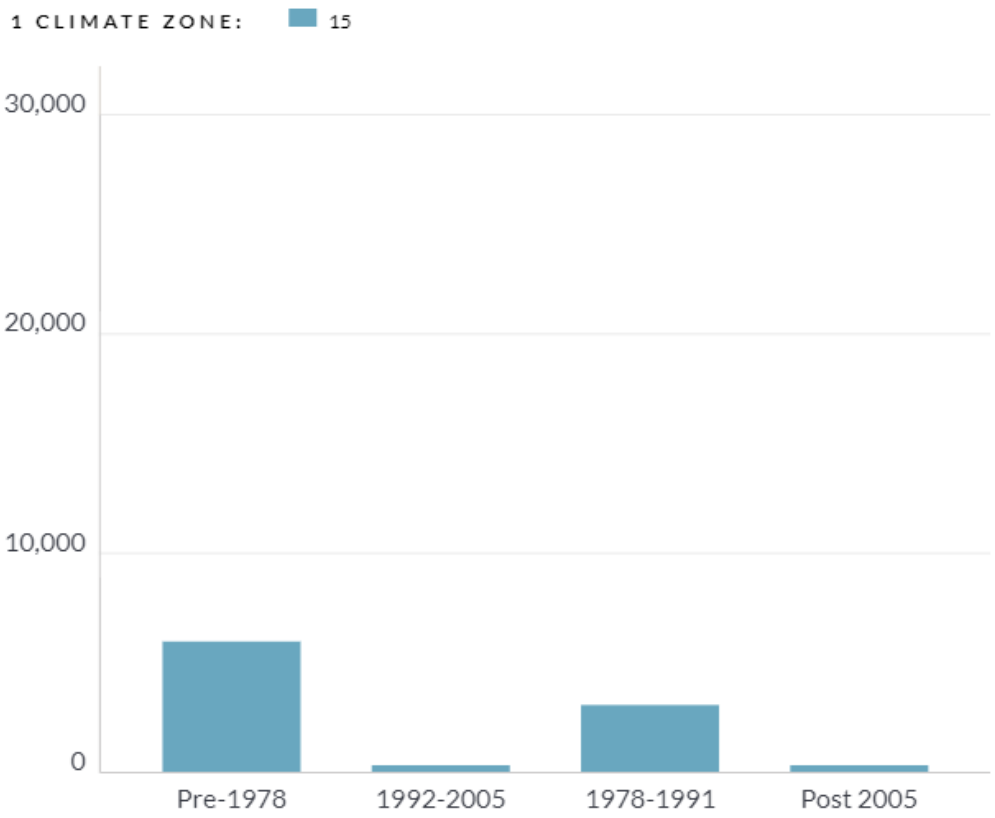
Number of Single Family Dwelling Units

Climate Zone	Pre-1978	1978-1991	1992-2005	Post 2005	Total
15	12,485	5,964	4,069	5,808	28,326

Percentage of Single Family Dwelling Units

Climate Zone	Pre-1978	1978-1991	1992-2005	Post 2005	Total
15	44.1%	21.1%	14.4%	20.5%	100.0%

Multifamily Dwelling Units 9,409



Number of Multifamily Dwelling Units

Climate Zone	Pre-1978	1978-1991	1992-2005	Post 2005	Total
15	5,956	3,053	231	169	9,409

Percentage of Multifamily Dwelling Units

Climate Zone	Pre-1978	1978-1991	1992-2005	Post 2005	Total
15	63.3%	32.4%	2.5%	1.8%	100.0%

Cost Effectiveness Explorer

EXPLORER.LOCALENERGYCODES.COM

Sources

Source and Methodology notes are under construction.

This document has been generated from https://explorer.localenergycodes.com/palm-springs-city/building-stock

Find more reach code resources at localenergycodes.com

CALIFORNIA ENERGY CODES & STANDARDS
A STATEWIDE UTILITY PROGRAM

City of Chula Vista Existing Home Energy Sustainability Ordinance (EHSO) Overview

Background: Homes in Chula Vista have been built over the years to meet the applicable energy related building codes which were first put in place in 1978. Since then new homes have gotten healthier and more efficient while some existing homes have gotten left behind. To help address these older homes the City is educating residents about retrofit opportunities and requiring older homes undergoing additions or remodels to make certain targeted upgrades, where applicable and feasible, to bring them closer to current codes.

Who Needs to Comply: These energy saving improvements are something most homes can benefit from but because newer homes have already been built to meet more recent energy code the focus of this policy is homes built in Chula Vista before 2006. Any home that does not have these measures should evaluate if they would benefit their home, but this ordinance is focused on homes that are doing alterations or remodels. Under this ordinance the definition of "remodel" is tied to structural changes that trigger the need for a permit. Please review the potential examples below to better understand what projects need to comply.

What projects trigger this requirement?

- Adding square footage
- Moving interior walls
- Adding or moving windows and doors

Location	Year Home Was Built	Required Energy Efficiency Measures
All City	2006	0
All zip codes except 91914	2005 to 1979	2
All zip codes except 91914	1978 or older	3
91914	2005 or older	4

These projects do NOT trigger this requirement:

- Adding new tile or flooring
- Bathroom fixtures
- Lighting fixtures
- Appliances
- Adding or moving a kitchen island
- Adding or changing counters
- Adding an Accessory Dwelling Unit (ADU/JADU)
- Projects that are medically necessary
- Projects that are repairing without changing elements

Based on the age and location of the home, different energy saving measures will be required. Please use the table above to determine how many of the energy efficiency measures listed in the table below will be required if your home undergoes an alteration or addition. The City recommends all homes in Chula Vista implement some level of the energy measures listed below to reduce their energy bill and improve home air quality. For more information on cost effectiveness or other detail please review "Chula Vista Energy Efficiency Fact Sheet" at https://www.chulavistaca.gov/departments/clean/retrofit.

What Energy Efficiency Actions Could Be Included? Below is a table that reviews the home energy efficiency standards that the City is trying to ensure homes meet.

Name	Description	Benefit	Implementation Notes
LED Lighting	Replace screw-in halogen, incandescent or CFL light bulbs with LED light bulbs	LED lights can use up to 75% less energy than incandescent bulbs and are 15% more efficient than average Compact Florescent Light (CFL) Bulbs.	Not applicable to lights plugged into outlets, recommend Energy Star bulbs. Historic fixtures exempt if not compatible with LED bulbs.
Water Heating Package	A. Water Heater Blanket - Insulate exterior of storage water heaters manufactured before April 2015. B. Hot Water Pipe Insulation - Insulate all **accessible** hot water pipes with R-3 pipe insulation. C. Low Flow Fixtures - Upgrade sink and shower fittings to maximum flow rates of 1.8 gallons per minute (gpm) for showerheads and kitchen faucets, and 1.2 gpm for bathroom faucets.	Water heating can account for up to 50% of an average home's natural gas usage. By insulating the tank (if not already insulated) and exposed piping you can minimize the amount of heat that is lost on its way to you. By utilizing low flow faucets, aerators and low flow showerheads you not only save water but also save the energy used to heat up that water.	Only accessible hot water pipes need to be insulated. Historic fixtures exempt if not compatible with water efficiency measures.
Attic Insulation	Add attic insulation in buildings with vented attic spaces to meet R-38.	Attic insulation helps your home maintain a stable temperature.	Homes with existing insulation greater than R-5 in Climate Zone 7 or greater than R-19 in Climate Zone 10 are exempt. Homes without vented attics are exempt.
Duct Sealing	Air seal all **accessible** ductwork with a goal of reducing duct leakage to be equal to or less than 15% of system airflow.	Duct leakage can be as high as 30% in average California homes. This means that up to 30% of the air you are paying to heat or cool is being lost before it reaches its destination. Additionally, leaky ducts can allow a pathway for dust or other indoor air quality concerns to enter your rooms.	
Air Sealing	Apply air sealing practices throughout all **accessible** areas of the building. Homes with one or more vented combustion appliances MUST have a BPI Combustion Appliance Safety Inspection performed after air sealing.	Houses built over the past five years are over 20 percent tighter than those built a decade earlier. This means the air you paid to heat or cool can escape and increases your energy bills and outside pollutants can enter your home. By sealing your home you can make it safer and healthier.	Only accessible areas need to be sealed. Attics with crawl space are considered accessible.

Cool Roof	Only applicable if project includes re-roofing or addition of steep slope roofs. Install a roofing product rated by the Cool Roof Rating Council (CRRC) with an aged solar reflectance of 0.25 or higher and thermal emittance of 0.75 or higher.	Cool roofs help save energy by increasing the amount of solar energy that get reflected away from your home and minimize the need for cooling on hot summer days.	Only for steep slope roofs (shallow slope roofs already covered).
Windows	Replace existing single pane windows with a dual pane product.	Energy efficiency windows not only reduce heating and cooling costs they can also reduce the ability of moisture and noise to enter your home.	Look for U-factor equal to 0.32 or lower and a Solar Heat Gain Coefficient (SHGC) equal to 0.25 or lower
Water Heater Replacement	High Efficiency Heat Pump Water Heater: Replace natural gas storage water heater, or, tankless water heater having an Energy Factor of .81 or less, with Heat Pump Water Heater -or- High Efficiency Tankless Water Heater: Replace natural gas storage water heater, or, less efficient tankless water with tankless water heater.	About 18% of average homes energy is used for heating water. Heat Pump Water heaters are on average 200% to 300% more efficient than traditional water heaters while tankless units are 8% to 34% more efficient. Additionally because heat pump water heaters store their hot water they can minimize energy usage during peak periods.	Heat Pump Water Heater with Uniform Energy Factor (UEF) of at least 3.1 (Northwest Energy Efficiency Alliance Tier 3). -or- Tankless water heater with a minimum Energy Factor of 0.96.
Air Conditioner Replacement	High Efficiency Air Conditioner: Replace an existing air conditioner with an high efficiency air conditioner. -or- High Efficiency Heat Pump: Replace an existing air conditioner with a Heat Pump	When running air conditioners can be the biggest energy user in a home so installing high efficiency units can prevent higher bills. It is also important to ensure ducting is sealed and installed and filters are regularly changed.	Install an air conditioner or heat pump rated to at least 18 SEER

Benefits: As mentioned in the table above, there are numerous benefits that these upgrades can provide depending on your home. Below is more information about the main benefits.

- Energy Bill Reductions – Over the expected life of the products, all of the measures are expected to reduce the home's energy bills by more than the cost of installing them.
- Improved Indoor Air Quality – Leaky homes and ducts are one of the largest ways that outdoor pollutants like dust and pollen can enter a home. Properly sealing homes and ducts can help increase indoor air quality. But all homes need ventilation, especially homes using fuel-fired appliances – gas water heaters, heating systems and stoves need ventilation, but homes can be sealed up too tight to allow this. If you seal your home beyond the recommended 15% of

system airflow you may need mechanical ventilation to ensure you are still receiving fresh air. Residents can have a third party verify their homes air leakage.

- Reduce Carbon Emissions – Home energy use is one of the largest contributors to climate change in Chula Vista. By saving energy residents will also reduce greenhouse gas (GHG) emissions. For more ways to reduce GHG emissions please visit www.cvclimatechallenge.com.

What if I have already Made Similar Upgrades: If you have already made these, or similar, upgrades or they will be a part of your home project, you will be benefiting from a more energy efficient home and do not need to make any additional upgrades. Please review the list of exemptions below:

- Similar measures have already been completed
    - Including participation in a low-income weatherization program (a deferment will be provided to qualifying applicants that have applied for weatherization programs but not received the work yet)
- Home achieves a Home Energy Score (HES) score of at least 8 out of 10
- Home has on-site photovoltaics (PV) offsetting at least 95% of the annual electricity and gas-equivalent usage
- An alternative, voluntary, set of energy measures is concurrently being completed that will achieve equivalent energy savings to the prescriptive packages

What if These Upgrades Will Not Work for My Project: Due to unique characteristics of some homes, these upgrades may not work as intended for all residents. To help ensure that residents are not negatively impacted by this requirement the following additional exemptions are also allowed.

- Low-Income Resident – Applicants who can demonstrate they qualify as a low-income household are exempt
- Project Value Cutoff - If the cost of completing energy efficiency measures required under this policy exceeds 20% of the overall project cost without those measures, permit applicants can propose a more limited set from among the required measures which does not exceed 20%
- A measure is beyond the authority of the homeowner due to HOA covenant
- Prescribed measures would be technically infeasible or not be cost-effective due to unique characteristics of home or other special circumstances

Resources: Please review the resources listed below for information about home energy performance or energy efficiency resources.

- SDG&E Energy Savings Assistance Program – The ESAP is an income qualified program that can make minor improvements to your home at no cost to you, such as insulation and appliance replacement, to help save energy. For full ESAP program eligibility requirements and application information, please visit www.sdge.com/esap or call 619-387-4757.
- Federal Weatherization Assistance – A income qualified program can provide you with no cost weatherization to help you save energy and make your home more energy efficient. If you would like to find out if you qualify for this program please call (619) 409-7588 or visit MAAC's website www.maacproject.org/main/impact/healthy-homes-health-services/weatherization-services/.

- Home Energy Score – Developed by the Department of Energy (DOE) and its national laboratories, the Home Energy Score provides homeowners, buyers and renters directly comparable and credible information about a home's energy use. Like a miles-per-gallon rating for a car, the Home Energy Score is based on a standard assessment of energy-related assets to easily compare energy use across the housing market. For more information please visit: www.homeenergyscore.gov.
- Go Green Financing – To help residents find financing for energy saving projects the state created the Go Green Financing website: www.gogreenfinancing.com. This allows California residents and businesses to create a custom energy action plan, find rebates and incentives and find a financing option.

Questions? Contact the City of Chula Vista's Conservation Section at 619-409-3893 or conservation@chulavistaca.gov.

3.2 Efficiency Measures

The methodology used in the analyses for each of the prototypical building types begins with a design that matches the specifications as described in Table 2 for each of the three vintages. Prospective energy efficiency measures were modeled in each of the prototypes to determine the projected electricity and natural gas energy savings relative to the baseline vintage. In some cases, where logical, measures were packaged together. Unless specified otherwise, all measures were evaluated using CBECC-Res.

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

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

3.2.1 Building Envelope/Non-Preempted Measures

Attic Insulation: Add attic insulation in buildings with vented attic spaces to meet R-49. For pre-1992 vintage homes this measure was also evaluated to include retrofitting of existing recessed can luminaires that are not rated for insulation contact (IC) to be airtight and allow for insulation contact. This can be accomplished by installing a recessed light cover over existing non-compliant luminaires and sealing the covers to the ceiling plane with foam or replacing non-IC-rated luminaires with IC-rated luminaires. The energy analysis includes savings from adding insulation and upgrading compact fluorescent lamp (CFL) recessed cans to LED lighting but does not include any reduced infiltration benefits. Newer vintage homes are assumed to have IC-rated recessed light luminaires that can be covered in insulation.

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

Cool Roof: For steep slope roofs, install a roofing product rated by the Cool Roof Rating Council (CRRC) with an aged solar reflectance of 0.25 or higher and thermal emittance of 0.75 or higher. This measure only applies to buildings that are installing a new roof as part of the scope of the remodel; the cost and energy savings associated with this upgrade reflects the incremental step between a standard roofing product with one that is CRRC rated with an aged solar reflectance of 0.25. This is similar to cool roof requirements in 2019 Title 24 Section 150.2(b)1Ii but assumes a higher solar reflectance.

Raised Floor Insulation: In existing homes with raised floors and no insulation, add R-19 insulation.

Wall Insulation: Blow-in R-13 wall insulation in existing homes that currently have no insulation in the walls (pre-1978 vintages).

Window Replacement: Replace existing metal-frame windows with a non-metal dual-pane product, which has a U-factor equal to 0.30 Btu/hour-ft^2-°F or lower and a Solar Heat Gain Coefficient (SHGC) equal to 0.23 or lower, except in heating dominated climates (Climate Zones 1, 3, 5, and 16) where an SHGC of 0.35 was evaluated. This measure was only evaluated for the two older vintages, pre-1992, which are assumed to have either single- or dual-pane, metal-frame windows. This aligns with new window requirements in 2019 Title 24.

Duct Sealing, New Ducts, and Duct Insulation: Air seal all ductwork to meet the requirements of the 2019 Title 24, Part 6 Section 150.2(b)1E. For this analysis, final duct leakage values of both 15 percent (which corresponds to Option i in the Title 24 section referenced), and ten percent (proposed revised leakage rate for 2022 Title 24) were evaluated. Replacing existing ductwork with entirely new ductwork to meet Sections 150.2(b)1Di and 150.2(b)1Diia of the 2019 Title 24 was also evaluated. This assumed new ducts meet five percent duct leakage and R-8 duct insulation in all climates.

Water Heater Blanket: Add R-6 insulation to the exterior of existing residential tank storage water heaters. For the analysis, the water heater was modeled within conditioned space, which is a typical configuration for older homes. This assumption is conservative since a water heater located in unconditioned space will tend to have higher tank losses and installing a water heater blanket in those situations will result in additional savings. The energy savings for this measure reflect water heating energy savings only, and do not include any impacts to the space conditioning load, which reduces space cooling loads and increases space heating loads. The impact on space conditioning energy used is minimal and in most climate zones, except for heating dominated ones, the combination of these two impacts results in net energy savings. This measure was evaluated using EnergyPlus for individual water heaters only and does not apply to central water heating systems.

Hot Water Pipe Insulation: Insulate all accessible hot water pipes with R-3 pipe insulation. In certain buildings such as those with slab on grade construction where the majority of pipes are located either underground or within the walls, most of the pipes are inaccessible. For the purposes of this analysis a conservative assumption that only ten percent of the pipes could be insulated was applied. In buildings where pipes are located in the attic, crawlspace, or are otherwise more accessible, energy savings will be higher than those presented in this analysis. This measure was evaluated using BEopt and EnergyPlus.

Low-Flow Fixtures: Upgrade sink and shower fittings to meet current Title 24, Part 11 (CALGreen) requirements, which require maximum flow rates of 1.8 gallons per minute (gpm) for showerheads and kitchen faucets, and 1.2 gpm for bathroom faucets. Baseline whole house hot water use was based on BEopt assumptions and this measure assumed the upgraded fixtures reduce flow rates by ten percent for showerheads and 20 percent for all faucets based on a 2010 water use study (ConSol, 2010). This measure was evaluated using BEopt and EnergyPlus.

LED Lighting: Replace screw-in (A-based for lamps) incandescent lamps and CFLs with light-emitting diode (LED) A-lamps. This analysis was conducted external to the energy model and evaluated replacement of a 13 W CFL lamp with an 11 W LED lamp operating 620 hours annually. Annual hour estimates were based on whole building average hours of operation from a 2010 lighting study by KEMA (KEMA, 2010). Lifetime assumptions were 10,000 hours for CFLs and 25,000 hours for LED lamps. For incremental cost calculations it was assumed CFLs have a lifetime of 15 years, are installed five years prior to the retrofit, and would need to be replaced at year ten and 25.

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

3.2.2 Equipment Fuel Substitution Measures – Heat Pump Replacements

The baseline for the retrofit analysis assumed a mixed-fuel baseline for all cases, with natural gas-fired furnaces for space heating and natural gas storage tank water heaters for domestic hot water (DHW). For fuel substitution cases, the natural gas appliances were assumed to be replaced with heat pump technology at the end of equipment life, when the equipment is being replaced.

Ducted Heat Pump: Replace existing ducted natural gas furnace and air conditioner (AC) with an electric heat pump. Minimum federal efficiency (14 SEER, 11.7 EER, 8.2 HSPF) and higher efficiency (16 SEER, 13 EER, 9 HSPF) heat pumps were evaluated as replacements to existing equipment. Savings are relative to a new ducted natural gas furnace/AC (14 SEER, 11.7 EER, 80 AFUE).

Heat Pump Water Heater (HPWH): Replace existing natural gas storage tank water heater with either a minimum efficiency (UEF 2.0) 50-gallon HPWH, or a HPWH that meets the Northwest Energy Efficiency Alliance

(NEEA)[3] Tier 3 rating. The evaluated NEEA HPWH is an 80-gallon unit with a UEF of 3.45. Savings are relative to a new 50-gallon natural gas storage water heater (UEF 0.63).

3.2.3 Photovoltaics (PV) and Battery Measures

PV: Installation of on-site PV is required in the 2019 residential code for new construction but not for additions or alterations to existing buildings. This report does not focus on optimizing PV system sizing for each prototype and climate zone. For this study, a PV system sized to the 2019 new construction standards for a 1,665 ft^2 home was evaluated. Based on prior studies, PV system cost effectiveness was not sensitive to system sizing up to 90 percent of annual electricity use (Statewide Reach Codes Team, 2019). The system is sized to offset annual building electricity use for a new construction home and avoid oversizing which would violate net energy metering (NEM) rules. In all cases, PV is evaluated in CBECC-Res according to the California Flexible Installation (CFI) assumptions. Table 3 summarizes the PV sizing used in the analysis.

Table 3: Single Family PV Sizing for 1,665 ft^2 home by Climate Zone (kW$_{DC}$)

CA Climate Zone	PV Capacity (kW$_{DC}$)[a]	CA Climate Zone	PV Capacity (kW$_{DC}$)[a]
1	2.59	**9**	2.38
2	2.25	**10**	2.45
3	2.17	**11**	2.83
4	2.19	**12**	2.42
5	2.03	**13**	3.00
6	2.22	**14**	2.49
7	2.10	**15**	4.07
8	2.35	**16**	2.20

[a] PV system sized using residential new construction sizing methodology based on climate zone and house size.

Energy Storage (Batteries): This measure includes installation of batteries to allow energy generated through PV to be stored and used later, providing energy cost and resiliency benefits. This report does not focus on optimizing battery sizes or controls for each prototype and climate zone. A ten kWh battery system was evaluated in CBECC-Res in conjunction with a PV system sized to the 2019 new construction standards, with control type set to "Time of Use" (TOU) and with default efficiencies of 95 percent for both charging and discharging (round trip efficiency of 90 percent). The TOU option assumes batteries are charged anytime PV generation is greater than the house load but controls when the battery storage system discharges. During the summer months (July – September) the battery begins to discharge at the beginning of the peak period at a maximum rate until fully discharged. During discharge the battery first serves the house load but will discharge to the electric grid if there is excess energy available. During other months, the battery discharges whenever the PV system does not cover the entire house load and does not discharge to the electric grid. This control option is considered to be most reflective of the current products on the market. This control option requires an input for the "First Hour of the Summer Peak" and the Statewide Reach Codes Team applied the default hour in CBECC-Res which differs by climate zone (either a 6pm or 7pm start).

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

3.2.4 Additional Measures: High Efficiency Equipment – Federally Preempted Measures

The following additional measures were evaluated, but because these measures require upgrading appliances that are federally regulated to high-efficiency models, they cannot be used to show cost effectiveness in a local ordinance. In addition, an ordinance cannot specifically require installation of high efficiency equipment. Although the ordinance may not require it, many applicants use high efficiency equipment to comply in practice. The measures and packages are presented here to show that there are several options for builders to meet the performance targets. Heating and cooling capacities are auto-sized by CBECC-Res in all cases.

High Efficiency Gas Furnace: Replace existing natural gas furnace with a 90 AFUE gas furnace.

High Efficiency AC: In climates with cooling, replace existing AC with a single-speed 16 SEER, 13 EER unit.

High Efficiency Gas Water Heater: Replace existing natural gas storage tank water heater with either a condensing tankless water heater with a UEF of 0.92, or condensing storage water heater with a UEF of 0.83.

3.3 Efficiency Packages

Some of the measures described above were also evaluated as packages.

3.3.1 Envelope and Duct Packages

Five envelope and duct packages were developed as described below. Air sealing and attic insulation are very often applied as a package in building retrofits. From a performance perspective, air sealing of the boundary between the attic and living space should be addressed any time there is significant work in the attic, such as adding attic insulation and sealing or replacing ductwork. When the building shell is being improved, air sealing is an important component to be addressed. The boundary between the living space and vented attics is where a significant amount of building air leakage can occur and sealing these areas prior to covering the attic floor with insulation is both practical and effective. These measures also directly address occupant comfort, as they reduce heat transfer, and result in more even temperatures within the building. When ductwork is located in the attic there are synergies with addressing all three of these building aspects at the same time.

1. **R-49 Attic Insulation and Air Sealing:** This package includes attic insulation and air sealing measures, as described below:
   - R-49 attic insulation installed in attic.
   - Air sealing and weatherstripping to reduce total building air leakage by 30 percent. Target air leakage assumptions are ten ACH50 for pre-1978 vintage, seven ACH50 for 1978 to 1991 vintage, and five ACH50 for the 1992 to 2010 vintage.
   - Retrofitting all non-IC-rated recessed light luminaires to be airtight and allow for coverage by insulation. This submeasure only applies to homes without IC-rated recessed can luminaires.
2. **R-49 Attic Insulation and Duct Sealing:** This package includes attic insulation and duct sealing measures, as described below:
   - R-49 attic insulation installed in attic.
   - Ductwork sealed to ten percent of nominal airflow.
   - Retrofitting all non-IC-rated recessed light luminaires to be airtight and allow for coverage by insulation. This submeasure only applies to homes without IC-rated recessed can luminaires.
3. **R-49 Attic Insulation, Air Sealing, and Duct Sealing:** This package includes attic insulation, air sealing, and duct sealing measures, as described below:
   - R-49 attic insulation installed in attic.
   - Ductwork sealed to ten percent of nominal airflow.
   - Air sealing and weatherstripping to reduce total building air leakage by 30 percent. Target air leakage assumptions are ten ACH50 for pre-1978 vintage, seven ACH50 for 1978 to 1991 vintage, and five ACH50 for the 1992 to 2010 vintage.

- Retrofitting all non-IC-rated recessed light luminaires to be airtight and allow for coverage by insulation. This submeasure only applies to homes without IC-rated recessed can luminaires.
- This combination of measures is common when a whole building performance upgrade is done in combination with HVAC equipment replacement. Incorporating these measures can allow for contractor to downsize HVAC equipment by lowering heating and cooling loads in the house.

4. **R-49 Attic Insulation, Air Sealing, and Entirely New Ducts:** This package is similar to Package 3 above but assumes that all existing ductwork is replaced with new R-8 ducts and sealed to new construction standards (five percent total leakage). This package assumes that if an existing HVAC system is being replaced with new ductwork, the area between the vented attic and conditioned space be air sealed and insulation added to the attic.
   - R-49 attic insulation installed in attic.
   - New R-8 ductwork sealed to five percent of nominal airflow.
   - Air sealing and weatherstripping to reduce total building air leakage by 30 percent. Target air leakage assumptions are ten ACH50 for pre-1978 vintage, seven ACH50 for 1978 to 1991 vintage, and five ACH50 for the 1992 to 2010 vintage.
   - Retrofitting all non-IC-rated recessed light luminaires to be airtight and allow for coverage by insulation. This submeasure only applies to homes without IC-rated recessed can luminaires.
   - This combination of measures is common when a whole building performance upgrade is done in combination with HVAC equipment replacement. Incorporating these measures can allow for contractor to downsize HVAC equipment by lowering heating and cooling loads in the house.
5. **Advanced Envelope Package: Attic Insulation, Recessed Cans, Air and Duct Sealing, plus Wall Insulation and New Windows:** This package includes all the measures in Package 3, in addition to insulating exterior walls, and replacing existing single-pane windows with improved high-performance windows. This package only applies to older vintage homes with no wall cavity insulation and single-pane windows.
   - R-49 attic insulation installed in attic.
   - Ductwork sealed to ten percent of nominal airflow.
   - Air sealing and weatherstripping to reduce total building air leakage by 30 percent. Target air leakage assumptions are ten ACH50 for pre-1978 vintage, seven ACH50 for 1978 to 1991 vintage, and five ACH50 for the 1992 to 2010 vintage.
   - Retrofitting all non-IC-rated recessed light luminaires to be airtight and allow for coverage by insulation. This submeasure only applies to homes without IC-rated recessed can luminaires.
   - Insulate exterior walls to R-13.
   - New windows with 0.30 U-factor and 0.23 SHGC (0.35 SHGC in Climate Zones 1, 3, 5, and 16).
   - This combination of measures is common when a whole building performance upgrade is done in combination with HVAC equipment replacement. Incorporating these measures can allow for contractor to downsize HVAC equipment by lowering heating and cooling loads in the house.

3.3.2 Additional Packages

Water Heating Package: Includes water heater blanket, hot water pipe insulation, and low-flow fixtures: These three water heating measures are all relatively low cost and work together to reduce building hot water energy use. Additional water savings measures and model language are documented on the LocalEnergyCodes.com website.[4]

[4] https://localenergycodes.com/

PV plus Batteries: PV sized to Residential New Construction Standards and a ten kWh battery system with TOU control.

PV plus Electric Ready Measures: Includes adding electric ready measures for future replacement of natural gas furnace and water heater with heat pumps, along with installation of an on-site PV system. The electric ready measures include prewiring 240 V power to the furnace location in the attic and the water heater location in the garage, and panel upgrade to allow for installation of future electric appliances at a future date.

3.4 Measure Cost

Measure costs were obtained from various sources, including prior reach code studies, past Title 24 Codes and Standards Enhancement (CASE) work, local contractors, internet searches, past projects, and technical reports.

3.4.1 Building Envelope/Non-Preempted Measures

Table 4 summarizes the cost assumptions for the building envelope and non-preempted HVAC measures evaluated.

3.4.2 PV and Battery Measures

The costs for installing PV and batteries are summarized in Table 5. For PV, they include first cost to purchase and install the system, inverter replacement costs, and annual maintenance costs. Upfront solar PV system costs are reduced by the federal income tax credit (ITC) by 26 percent based on renewal of the credit through the year 2023.

Costs for batteries include first cost and replacement at year 10 and 20, assuming a 10 year battery life. Batteries are also eligible for the ITC if they are installed at the same time as the renewable generation source and at least 75 percent of the energy used to charge the battery comes from a renewable source.

Climate Zone 15:

Note: Values in red and grey rows indicate option is not cost-effective with B/C ratio less than 1. Cells with "n/a" reflect lighting and water heating efficiency measures and packages that did not look at TDV cost effectiveness or GHG impacts.

Table 104: CZ 15 - Single Family Efficiency Upgrade Cost-Effectiveness Results

Measure	Vintage	Measure Cost ($)	Electricity Savings (kWh)	Gas Savings (therm)	GHG Savings (lb CO_2e)	Utility Cost Savings		Customer On-Bill		2019 TDV		2022 TDV	
						Year 1	Avg Annual	B/C Ratio	NPV	B/C Ratio	NPV	B/C Ratio	NPV
R-49 Attic Insulation	Pre-1978	$3,332	1,824	10	257	$536	$424	3.40	$8,992	3.33	$7,766	3.26	$7,518
	1978-1991	$2,874	996	5	140	$293	$232	2.16	$3,738	2.12	$3,206	1.98	$2,803
	1992-2010	$1,852	296	2	44	$89	$70	1.01	$23	1.09	$167	1.03	$60
Reduced Infiltration	Pre-1978	$1,474	219	3	38	$65	$52	0.94	-$96	1.15	$214	1.12	$179
	1978-1991		142	2	42	$43	$34	0.62	-$635	0.79	-$313	0.56	-$642
	1992-2010		84	1	22	$25	$20	0.36	-$1,060	0.51	-$728	0.38	-$918
Duct Sealing	Pre-1978	$683	2,634	4	325	$795	$628	24.55	$18,061	27.36	$18,002	25.02	$16,407
	1978-1991	$683	1,696	1	243	$519	$410	16.03	$11,531	18.21	$11,758	16.21	$10,389
	1992-2010	$423	356	0	63	$109	$86	5.44	$2,107	6.99	$2,532	5.97	$2,100
New Ducts	Pre-1978	$3,986	4,230	7	577	$1,285	$1,015	6.80	$25,977	7.53	$26,043	6.90	$23,514
	1978-1991		3,252	4	486	$1,002	$791	5.30	$19,264	6.01	$19,985	5.40	$17,537
	1992-2010		1,016	1	178	$313	$247	1.66	$2,933	2.08	$4,324	1.84	$3,356
Cool Roof	Pre-1978	$778	883	-1	56	$257	$203	6.96	$5,208	6.20	$4,044	6.13	$3,992
	1978-1991		659	-1	65	$196	$154	5.31	$3,761	4.85	$2,996	4.58	$2,785
	1992-2010		311	0	26	$93	$74	2.53	$1,334	2.52	$1,184	2.61	$1,250
R-13 Wall Insulation	Pre-1978	$3,360	1,020	10	259	$310	$246	1.95	$3,596	2.40	$4,717	2.02	$3,432
Windows	Pre-1978	$9,810	3,358	2	347	$978	$772	2.10	$12,145	2.15	$11,315	1.88	$8,668
	1978-1991		2,702	2	284	$792	$625	1.70	$7,749	1.71	$6,989	1.52	$5,108
LED lamp vs CFL	All	$2.26	1.2	0	n/a	$0.32	$0.25	3.37	$5.34	n/a	n/a	n/a	n/a
Exterior Photosensor	All	$42.58	12.1	0	n/a	$2.00	$1.58	1.11	$4.84	n/a	n/a	n/a	n/a

Table 105: CZ 15 - Single Family Efficiency Packages Cost-Effectiveness Results

Measure	Vintage	Measure Cost ($)	Electricity Savings (kWh)	Gas Savings (therm)	GHG Savings (lb CO_2e)	Utility Cost Savings		Customer On-Bill		2019 TDV		2022 TDV	
						Year 1	Avg Annual	B/C Ratio	NPV	B/C Ratio	NPV	B/C Ratio	NPV
R49 Attic & Air Sealing Package	Pre-1978	$4,806	2,056	13	322	$606	$480	2.67	$9,000	2.70	$8,167	2.55	$7,450
	1978-1991	$4,348	1,133	6	154	$335	$265	1.63	$3,062	1.64	$2,764	1.57	$2,469
	1992-2010	$3,326	379	3	67	$113	$90	0.72	-$1,044	0.83	-$564	0.74	-$881
R49 Attic & Duct Sealing Package	Pre-1978	$4,015	4,283	13	617	$1,285	$1,016	6.76	$25,963	7.23	$25,008	6.65	$22,669
	1978-1991	$3,557	2,574	6	374	$780	$616	4.63	$14,486	5.06	$14,449	4.54	$12,581
	1992-2010	$2,275	636	2	108	$193	$153	1.79	$2,021	2.15	$2,627	1.89	$2,019
R49 Attic, Air Sealing & Duct Sealing Package	Pre-1978	$5,489	4,496	15	676	$1,350	$1,067	5.19	$25,850	5.64	$25,467	5.12	$22,592
	1978-1991	$5,031	2,706	7	408	$819	$648	3.44	$13,780	3.81	$14,138	3.38	$11,986
	1992-2010	$3,749	710	3	123	$216	$170	1.21	$904	1.50	$1,862	1.31	$1,159
R49 Attic, Air Sealing & New Ducts Package	Pre-1978	$8,792	6,122	18	920	$1,856	$1,467	4.46	$34,131	4.90	$34,297	4.49	$30,658
	1978-1991	$8,334	4,241	8	648	$1,300	$1,027	3.29	$21,450	3.71	$22,585	3.32	$19,312
	1992-2010	$7,312	1,353	3	242	$411	$325	1.19	$1,537	1.49	$3,607	1.31	$2,285
Advanced Envelope Package	Pre-1978	$18,659	7,579	28	1,156	$2,277	$1,801	2.58	$33,078	2.87	$34,978	2.55	$28,977
Water Heating Package	All Vintages	$208	n/a	n/a	n/a	$32	$321	1.37	$87	n/a	n/a	n/a	n/a

Cost Effectiveness Explorer

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Cost-Effectiveness Results Summary

City of Palm Springs

Climate Zone 15

CALIFORNIA ENERGY CODES & STANDARDS
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EXISTING LOW-RISE RESIDENTIAL BUILDINGS (2019)

Multifamily Units | Built before 1978 (5,956 units)

Table 1 of 2

	Cost-Effectiveness		Per Home Results			
Measure	**On-Bill Benefit/Cost Ratio**	**Simple Payback**	**Incremental Cost**	**Annual Bill Savings**	**Emissions Savings**	**Lifecycle Savings**
Envelope & Duct Package	9.67	2.37	$1,054	$445.25	0.44 (9.95%)	$10,568
R38 Attic Insulation	6	3.82	$593.78	$155.58	0.155 (3.49%)	$3,695
Duct Sealing	57.1	0.401	$120.00	$299.43	0.289 (6.53%)	$7,101
Cool Roof	14	1.63	$183.74	$112.77	0.103 (2.32%)	$2,666
Windows	2.26	10.1	$5,873	$581.09	0.559 (12.6%)	$13,772
Water Heating Package	2.92	8.91	$168.20	$18.87	0.088 (1.98%)	$508.68
LED Lamp vs. CFL	4.52	5.05	$9.12	$1.81	0.002 (0.007%)	$42.77
LED Lamp vs. Incandescent	∞	Immediate	-$29.94	$31.64	0.03 (0.115%)	$749.09

EXISTING LOW-RISE RESIDENTIAL BUILDINGS (2019)

Multifamily Units | Built before 1978 (5,956 units)

Table 2 of 2

	Per Home Results	
Measure	**Electricity Savings**	**Gas Savings**
Envelope & Duct Package	1,663	7.44
R38 Attic Insulation	574	3.07
Duct Sealing	1,128	3.33
Cool Roof	455	-1.23
Windows	2,237	3.83
Water Heating Package	0	16.1
LED Lamp vs. CFL	7.23	0
LED Lamp vs. Incandescent	127	0

EXISTING LOW-RISE RESIDENTIAL BUILDINGS (2019)

Multifamily Units | Built from 1978 to 1991 (3,053 units)

Table 1 of 2

	Cost-Effectiveness		Per Home Results			
Measure	**On-Bill Benefit/Cost Ratio**	**Simple Payback**	**Incremental Cost**	**Annual Bill Savings**	**Emissions Savings**	**Lifecycle Savings**
Envelope & Duct Package	5.26	4.35	$986.62	$226.99	0.219 (6.38%)	$5,382
R38 Attic Insulation	3.33	6.87	$525.92	$76.54	0.074 (2.16%)	$1,816
Duct Sealing	28.2	0.812	$120.00	$147.81	0.138 (4.01%)	$3,501
Cool Roof	10.9	2.09	$183.74	$87.91	0.082 (2.38%)	$2,080
Water Heating Package	2.92	8.91	$168.20	$18.87	0.088 (2.55%)	$508.68
LED Lamp vs. CFL	4.52	5.05	$9.12	$1.81	0.002 (0.008%)	$42.77
LED Lamp vs. Incandescent	∞	Immediate	-$29.94	$31.64	0.03 (0.148%)	$749.09

EXISTING LOW-RISE RESIDENTIAL BUILDINGS (2019)

Multifamily Units | Built from 1978 to 1991 (3,053 units)

Table 2 of 2

	Per Home Results	
Measure	**Electricity Savings**	**Gas Savings**
Envelope & Duct Package	863	2.09
R38 Attic Insulation	285	1.02
Duct Sealing	565	0.336
Cool Roof	351	-0.493
Water Heating Package	0	16.1
LED Lamp vs. CFL	7.23	0
LED Lamp vs. Incandescent	127	0

EXISTING LOW-RISE RESIDENTIAL BUILDINGS (2019)

Multifamily Units | Built from 1992 to 2005 (231 units)

Table 1 of 2

	Cost-Effectiveness		Per Home Results			
Measure	**On-Bill Benefit/Cost Ratio**	**Simple Payback**	**Incremental Cost**	**Annual Bill Savings**	**Emissions Savings**	**Lifecycle Savings**
Envelope & Duct Package	4.51	5.07	$986.62	$194.60	0.191 (6.27%)	$4,613
R38 Attic Insulation	2.79	8.2	$525.92	$64.13	0.066 (2.15%)	$1,521
Duct Sealing	24.5	0.931	$120.00	$128.84	0.122 (3.99%)	$3,051
Cool Roof	9	2.54	$183.74	$72.46	0.069 (2.26%)	$1,714
Water Heating Package	2.92	8.91	$168.20	$18.87	0.088 (2.87%)	$508.68
LED Lamp vs. CFL	4.52	5.05	$9.12	$1.81	0.002 (0.009%)	$42.77
LED Lamp vs. Incandescent	∞	Immediate	-$29.94	$31.64	0.03 (0.166%)	$749.09

EXISTING LOW-RISE RESIDENTIAL BUILDINGS (2019)

Multifamily Units | Built from 1992 to 2005 (231 units)

Table 2 of 2

	Per Home Results	
Measure	**Electricity Savings**	**Gas Savings**
Envelope & Duct Package	762	1.45
R38 Attic Insulation	254	0.853
Duct Sealing	501	0.203
Cool Roof	296	-0.452
Water Heating Package	0	16.1
LED Lamp vs. CFL	7.23	0
LED Lamp vs. Incandescent	127	0

Cost Effectiveness Explorer

EXPLORER.LOCALENERGYCODES.COM

Sources

2019 Cost-Effectiveness Study: Existing Low-Rise Residential Building Efficiency Upgrade
California Energy Codes and Standards Program, PG&E. Produced by: Frontier Energy, Inc, Misti Bruceri & Associates.

2019 Cost-Effectiveness Study: Low-Rise Residential New Construction
California Energy Codes and Standards Program, PG&E. Produced by: Frontier Energy, Inc, Misti Bruceri & Associates.

2019 Nonresidential New Construction Reach Code Cost-Effectiveness Study
California Energy Codes and Standards Program, SoCal Edison. Produced by: TRC, EnergySoft.

This document has been generated from https://explorer.localenergycodes.com/palm-springs-city/forecast/15-SCE/studies/1,2,3?exclude_prototypes=5,

Find more reach code resources at localenergycodes.com

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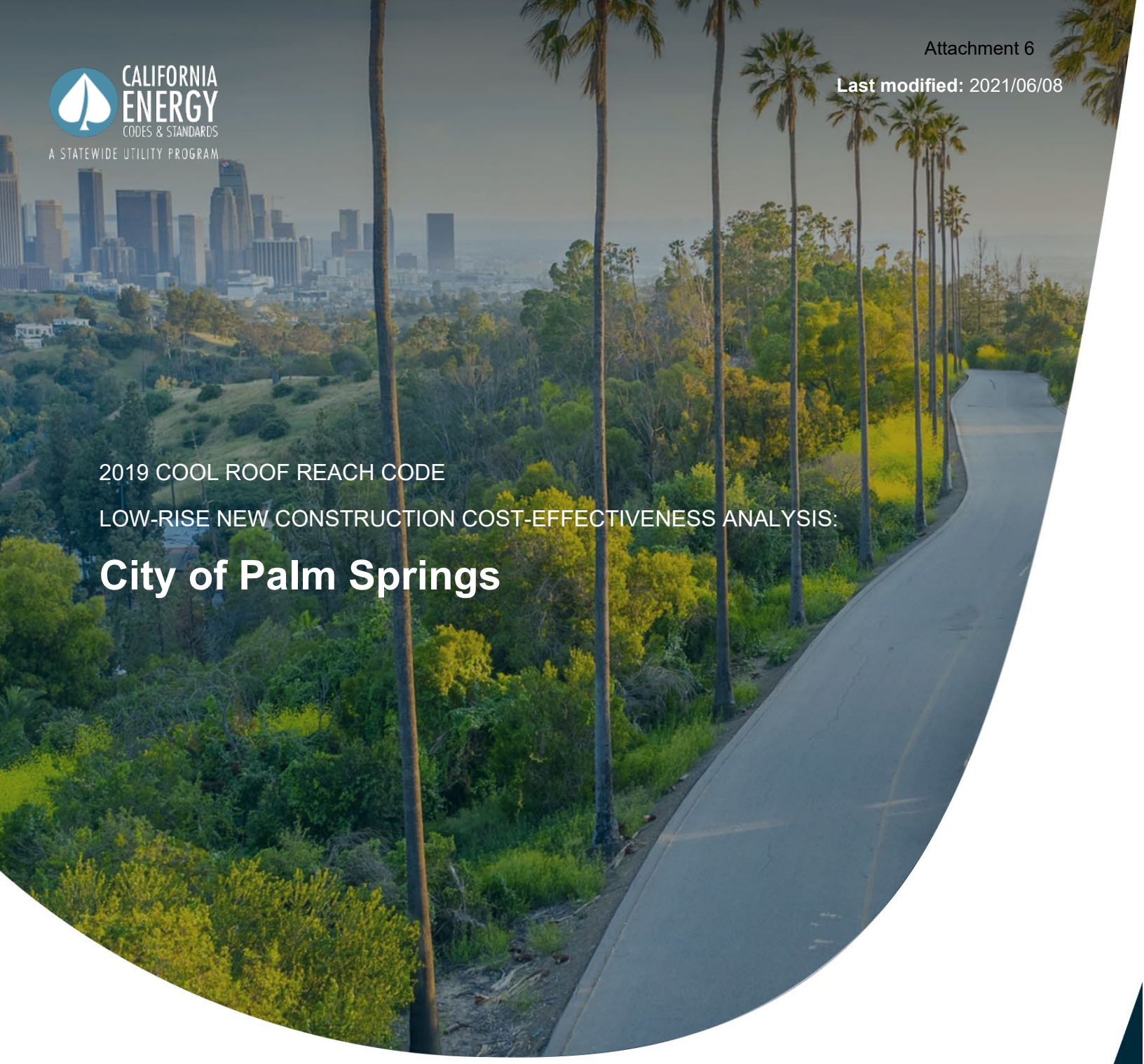

Attachment 6

Last modified: 2021/06/08

CALIFORNIA ENERGY CODES & STANDARDS
A STATEWIDE UTILITY PROGRAM

2019 COOL ROOF REACH CODE

LOW-RISE NEW CONSTRUCTION COST-EFFECTIVENESS ANALYSIS:

City of Palm Springs

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

SDGE A Sempra Energy utility
SoCalGas A Sempra Energy utility
Southern California Edison An EDISON INTERNATIONAL Company
PG&E Pacific Gas and Electric Company

Legal Notice

Acronym List

ASR – Aged Solar Reflectance

B/C – Benefit-to-Cost Ratio

BSC –Building Standards Commission

CASE - Codes and Standards Enhancement

CBECC – California Building Energy Code Compliance

CEC – California Energy Commission

CZ – Climate Zone

GHG – Greenhouse Gas

IOU – Investor-Owned Utility

kWh – Kilowatt Hour

NPV – Net Present Value

PG&E – Pacific Gas & Electric (utility)

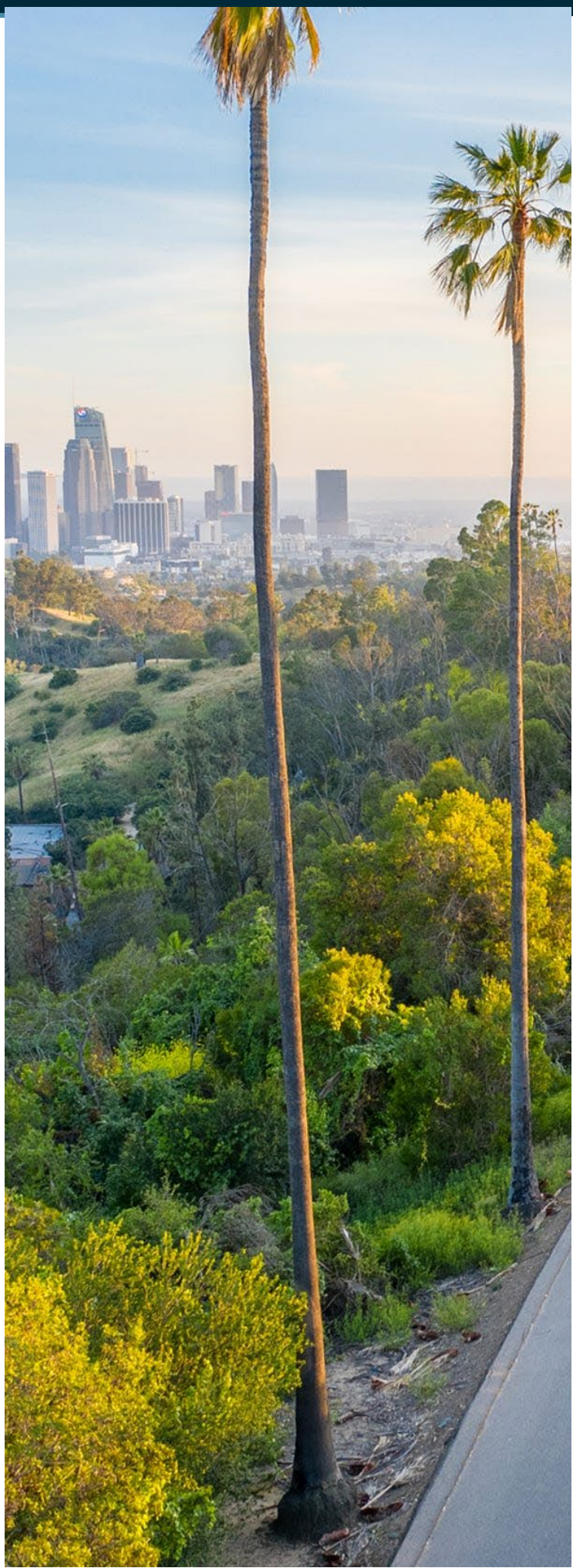
SCE – Southern California Edison (utility)

SCG – Southern California Gas (utility)

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

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 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 and greenhouse gas (GHG) reduction goals. The program facilitates adoption and implementation of the code when requested by local jurisdictions by providing resources such as cost-effectiveness studies, model language, sample findings, and other supporting documentation. Local jurisdictions that are considering adopting ordinances may contact the program for support through its website, LocalEnergyCodes.com.

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 analysis builds upon the results of the 2019 Cost-effectiveness Study: Low-Rise Residential New Construction (Statewide Reach Code Team, 2019), last modified August 1, 2019, which evaluated the feasibility and cost-effectiveness of upgrade measures in new homes built to the 2019 California Building Energy Efficiency Standards Title 24, Part 6 (Title 24) (California Energy Commission, 2018). This report presents results from analysis conducted in response to a request from the City of Palm Springs to evaluate the cost effectiveness of cool roofs in new construction homes as a stand-alone efficiency measure. Results are also reported here for existing single family homes based on the 2019 Cost-Effectiveness Study: Existing Single Family Residential Building Upgrades (Statewide Reach Code Team, 2021)

Cost-effectiveness is reported for California Climate Zone 15. 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 Reach Code Team.

2 Methodology and Assumptions

For the new construction analysis, the same methodology used in the statewide analysis (Statewide Reach Code Team, 2019) is applied to this analysis with the following exceptions:

- Energy analysis was re-evaluated using the most recent approved version of CBECC-Res for the 2019 Title 24 code, CBECC-Res 2019.1.3 SP1.
- Utility costs were calculated based on recent utility costs for Southern California Edison (SCE) and Southern California Gas (SoCalGas). See Appendix 5.1 for details.
- Incremental costs were updated based on more recent information.

Analysis evaluated a steep-sloped cool roof that is rated by the Cool Roof Rating Council to have an aged solar reflectance (ASR) of 0.25 and a thermal emittance of 0.85. This is higher performance than the Title 24 prescriptive cool roof requirement in Climate Zone 15 for an ASR of 0.20 and emittance of 0.75.[1]

Incremental costs were updated based on data from the 2022 Codes and Standards Enhancement (CASE) report on Nonresidential High Performance Envelope (Statewide CASE Team, 2020). The report evaluated incremental costs for a 0.25 ASR versus a 0.20 ASR steep-sloped roof. Even though the report analysis was for nonresidential buildings, steep-sloped roofing products for residential and small commercial buildings are the same (large commercial buildings are not typically steep-sloped). Table 1 presents incremental cost data by roofing product. Tile roofing products were not found to have cost variation within the ASR range of 0.20 to 0.25. An incremental first cost of $0.07/square foot was found for asphalt shingle products. Total lifecycle costs include replacement at year 20 and the value of the remaining useful life of the roof at the end of the analysis period at year 30. The costs for asphalt shingles were used in this analysis to demonstrate the results based on the product with a higher incremental cost.

Table 1: New Construction Cool Roof Incremental Cost

	Tile	Asphalt Shingle
First Cost	$0.00/square foot	$0.07/square foot
Effective Useful Life	20 years	20 years
Total Lifecycle Cost	$0.00/square foot	$0.094/square foot

No additional analysis was done for the 1,665 square foot existing home. Results are copied directly from the statewide report. The existing home analysis evaluated a steep-sloped cool roof that is rated by the Cool Roof Rating Council to have an ASR of 0.25 compared to an existing non-cool roof with an ASR of 0.10. Table 2 presents incremental cost data for replacing an existing roof assuming an asphalt roofing product and assumes replacement at year 20 and the value of the remaining useful life at year 30. This retrofit measure applies to buildings that are installing a new roof as part of the scope of the remodel; the cost and energy savings associated with this upgrade reflects the incremental step between a standard non-cool roof product with one that is CRRC rated with an ASR of 0.25.

Table 2: Retrofit Cool Roof Incremental Cost

	Asphalt Shingle
First Cost	$0.32/square foot
Effective Useful Life	20 years
Total Lifecycle Cost	$0.431/square foot

Refer to the statewide studies for further details.

[1] The base case Standard Design in the CBECC-Res software applies an ASR of 0.20 and emittance of 0.85. Therefore, the energy savings reported are from increasing the ASR from 0.20 to 0.25 and no change in emittance.

3 Results

Table 3 and Table 4 summarize cost-effectiveness of the cool roof measures for new construction and existing homes, respectively. For new homes, upgrading from a cool roof with an ASR of 0.20 to one with an ASR of 0.25 was found to be cost effective for both single family and multifamily buildings. For existing single family homes, at time of roof replacement, upgrading from a non-cool roof to one with an ASR of 0.25 was also found to be cost effective for all vintages.

Table 3: New Construction Cool Roof Cost-Effectiveness Results per Dwelling Unit

Prototype	Fuel Type	Measure Cost	Electricity Savings (kWh)	Gas Savings (therm)	GHG Savings (lb CO_2e)	Utility Cost Savings		Customer On-Bill	
						Year 1	Avg Annual	B/C Ratio	NPV
Single Family	Mixed Fuel	$197	42.6	-0.40	16.28	$12	$9	1.40	$78
	All-Electric	$197	39.16	0.00	20.22	$12	$9	1.39	$77
Multifamily	Mixed Fuel	$49	21.6	0.00	9.89	$6	$5	2.90	$93
	All-Electric	$49	21.5	0.00	9.82	$6	$4	2.65	$81

Note: Values shaded in **red** indicate option is not cost-effective with B/C ratio less than 1. Values shaded in **green** indicate option is cost-effective with B/C ratio greater than or equal to 1.

Table 4: Existing Home Cool Roof Cost-Effectiveness Results per Dwelling Unit

Vintage	Measure Cost	Electricity Savings (kWh)	Gas Savings (therm)	GHG Savings (lb CO_2e)	Utility Cost Savings		Customer On-Bill	
					Year 1	Avg Annual	B/C Ratio	NPV
Pre-1978	$778	883	-1	56	$280	$221	7.82	$5,788
1978-1991		659	-1	65	$214	$169	5.96	$4,209
1992-2010		311	0	26	$102	$81	2.85	$1,568

4 References

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5 Appendices

5.1 Utility Tariff Details

SoCalGas

Following are the SoCalGas natural gas tariffs applied in this study. Table 5 describes the baseline territories that were assumed for each climate zone.

Table 5: SoCalGas Baseline Territory by Climate Zone

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

The SoCalGas monthly gas rate in $/therm was applied on a monthly basis for the 12-month period ending March 2021 according to the rates shown in Table 6. Historical natural gas rate data was only available for SoCalGas' procurement charges.[2] To estimate total costs by month, the baseline and excess transmission charges were assumed to be relatively consistence and applied for the entire year based on January 2021 costs.

Table 6: SoCalGas Monthly Gas Rate ($/therm)

Month	Procurement Charge	Transportation Charge		Total Charge	
		Baseline	Excess	Baseline	Excess
Jan 2021	$0.39764	$0.82358	$1.21382	$1.22122	$1.61146
Feb 2021	$0.36766	$0.82358	$1.21382	$1.19124	$1.58148
Mar 2021	$0.36982	$0.82358	$1.21382	$1.19340	$1.58364
Apr 2020	$0.20307	$0.82358	$1.21382	$1.02665	$1.41689
May 2020	$0.25654	$0.82358	$1.21382	$1.08012	$1.47036
June 2020	$0.2758	$0.82358	$1.21382	$1.09938	$1.48962
July 2020	$0.26816	$0.82358	$1.21382	$1.09174	$1.48198
Aug 2020	$0.26239	$0.82358	$1.21382	$1.08597	$1.47621
Sept 2020	$0.25498	$0.82358	$1.21382	$1.07856	$1.4688
Oct 2020	$0.25268	$0.82358	$1.21382	$1.07626	$1.4665
Nov 2020	$0.3432	$0.82358	$1.21382	$1.16678	$1.55702
Dec 2020	$0.36159	$0.82358	$1.21382	$1.18517	$1.57541

[2] The SoCalGas procurement and transmission charges were obtained from the following site: https://www.socalgas.com/for-your-business/energy-market-services/gas-prices

SOUTHERN CALIFORNIA GAS COMPANY Revised CAL. P.U.C. SHEET NO. 57456-G
LOS ANGELES, CALIFORNIA CANCELING Revised CAL. P.U.C. SHEET NO. 57430-G

Schedule No. GR Sheet 1
RESIDENTIAL SERVICE
(Includes GR, GR-C and GT-R Rates)

APPLICABILITY

The GR rate is applicable to natural gas procurement service to individually metered residential customers.

The GR-C, cross-over rate, is a core procurement option for individually metered residential core transportation customers with annual consumption over 50,000 therms, as set forth in Special Condition 10.

The GT-R rate is applicable to Core Aggregation Transportation (CAT) service to individually metered residential customers, as set forth in Special Condition 11.

The California Alternate Rates for Energy (CARE) discount of 20%, reflected as a separate line item on the bill, is applicable to income-qualified households that meet the requirements for the CARE program as set forth in Schedule No. G-CARE.

TERRITORY

Applicable throughout the service territory.

RATES	GR	GR-C	GT-R
Customer Charge, per meter per day:	16.438¢	16.438¢	16.438¢
For "Space Heating Only" customers, a daily Customer Charge applies during the winter period from November 1 through April 30[1/]:	33.149¢	33.149¢	33.149¢

Southern California Edison

Following are the SCE electricity tariffs applied in this study for non-generation rates. The electricity baseline territory used for Climate Zone 15 is 15.

Table 7: SCE Baseline Territory by Climate Zone

Climate Zone	Baseline Territory
6	6
8	8
9	9
10	10
14	14
15	15

Summer Daily Allocations (June through September)

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

Winter Daily Allocations (October through May)

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

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

Sheet 12 (T)

SPECIAL CONDITIONS

1. Applicable rate time periods are defined as follows:

Option 4-9 PM, Option 4-9 PM-CPP, Option PRIME, Option PRIME-CPP : (T)

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

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

Revised Cal. PUC Sheet No. 70277-E
Cancelling Revised Cal. PUC Sheet No. 69597-E

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

Sheet 2

RATES

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

	Delivery Service	Generation[2]	
Option 4-9 PM / Option 4-9 PM-CPP	Total[1]	UG***	DWREC[3]
Energy Charge - $/kWh			
Summer Season - On-Peak	0.24845 (I)	0.18143 (R)	0.00000 (I)
Mid-Peak	0.24845 (I)	0.10036 (R)	0.00000 (I)
Off-Peak	0.19495 (I)	0.07403 (R)	0.00000 (I)
Winter Season - Mid-Peak	0.24845 (I)	0.12593 (R)	0.00000 (I)
Off-Peak	0.19495 (I)	0.08893 (R)	0.00000 (I)
Super-Off-Peak	0.18859 (I)	0.06926 (R)	0.00000 (I)
Baseline Credit**** - $/kWh	(0.07228) (R)	0.00000	
Basic Charge - $/day			
Single-Family Residence	0.031		
Multi-Family Residence	0.024		
Minimum Charge** - $/day			
Single Family Residence	0.346		
Multi-Family Residence	0.346		
Minimum Charge (Medical Baseline)** - $/day			
Single Family Residence	0.173		
Multi-Family Residence	0.173		
California Climate Credit[4]	(29.00) (R)		
California Alternate Rates for			
Energy Discount - %	100.00*		
Family Electric Rate Assistance Discount - %	100.00		
Option 4-9 PM-CPP			
CPP Event Energy Charge - $/kWh		0.80000	
Summer CPP Non-Event Credit			
On-Peak Energy Credit - $/kWh		(0.15170)	
Maximum Available Credit - $/kWh*****			
Summer Season		(0.58115) (I)	

* Represents 100% of the discount percentage as shown in the applicable Special Condition of this Schedule.
** The Minimum Charge is applicable when the Delivery Service Energy Charge, plus the applicable Basic Charge is less than the Minimum Charge.
*** The ongoing Competition Transition Charge CTC of ($0.00002) per kWh is recovered in the UG component of Generation. (R)
**** The Baseline Credit applies up to 100% of the Baseline Allocation, regardless of Time of Use. The Baseline Allocation is set forth in Preliminary Statement, Part H.
***** The Maximum Available Credit is the capped credit amount for CPP Customers dual participating in other demand response programs.
1 Total = Total Delivery Service rates are applicable to Bundled Service, Direct Access (DA) and Community Choice Aggregation Service (CCA Service) Customers, except DA and CCA Service Customers are not subject to the DWRBC rate component of this Schedule but instead pay the DWRBC as provided by Schedule DA-CRS or Schedule CCA-CRS.
2 Generation = The Gen rates are applicable only to Bundled Service Customers.
3 DWREC = Department of Water Resources (DWR) Energy Credit – For more information on the DWR Energy Credit, see the Billing Calculation Special Condition of this Schedule.
4 Applied on an equal basis, per household, semi-annually. See the Special Conditions of this Schedule for more information.

(Continued)

(To be inserted by utility)
Advice 4377-E-A
Decision

Issued by
Carla Peterman
Senior Vice President

(To be inserted by Cal. PUC)
Date Submitted Jan 11, 2021
Effective Feb 1, 2021
Resolution

2C11

Get In Touch

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

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

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

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

Visit LocalEnergyCodes.com to access our resources and sign up for newsletters	Contact info@localenergycodes.com for no-charge assistance from expert Reach Code advisors	Follow us on Twitter

Policy Impacts	Affected Units Per Year	Total Affected Units	Aggregate Compliance Cost	Aggregate Bill Savings	Net Emissions Savings (mtco2e)	Net Emissions Savings from Gas (mtco2e)	Net Emissions Savings from Electricity (mtco2e)	Gas Saved (therms) All	Electricity Saved (kWh) All
[+] Single Family Measures									
LED vs. CFL	833	4,163	$56,455	$59,952	5	0	5	0	224,820
Water Heating Package	750	3,749	$780,868	$1,732,972	7,151	7,151	0	1,311,031	0
Duct Sealing	151	753	$468,477	$3,197,669	318	72	246	13,111	10,554,809
[NET] Duct Sealing + R-49 Attic Insulation	19	93	$265,768	$641,765	100	66	34	12,087	2,158,383
[NET] Duct Sealing + R-49 Attic Insulation + Air Sealing	34	172	$286,094	$172,140	38	29	9	5,363	566,633
SF Total	*833*	*7,912*	$1,857,662	$5,804,498	7,612	7,318	295	1,341,592	13,504,644
[+] Multifamily Measures									
LED vs. CFL	320	1,598	$14,571	$21,689	2	0	2	0	86,638
Water Heating Package	144	719	$120,845	$272,818	1,270	1,270	0	232,770	0
Duct Sealing	29	144	$17,336	$265,238	37	13	23	2,452	1,003,677
[NET] Duct Sealing + R-49 Attic Insulation	7	36	$21,013	$75,821	14	10	4	1,827	278,890
[NET] Duct Sealing + R-49 Attic Insulation + Air Sealing	13	66	$21,040	$24,271	7	6	1	1,017	90,372
MF Total	*320*	*1,598*	$194,805	$659,838	1,330	1,299	31	238,065	1,459,578
[+] Combined Measures									
LED vs. CFL	1152	5,761	$71,026	$81,641	7	0	7	0	311,457
Water Heating Package	894	4,468	$901,713	$2,005,790	8,421	8,421	0	1,543,801	0
Duct Sealing	179	897	$485,814	$3,462,907	354	85	269	15,563	11,558,487
[NET] Duct Sealing + R-49 Attic Insulation	26	128	$286,781	$717,586	115	76	39	13,914	2,437,273
[NET] Duct Sealing + R-49 Attic Insulation + Air Sealing	48	238	$307,134	$196,411	45	35	10	6,380	657,005
SF & MF Total	*1152*	*9,510*	$2,052,467	$6,464,336	8,942	8,616	326	1,579,658	14,964,222

Assumptions

Building Stock Values (dwelling units, zone 15)	Pre-1978	1978-1991	1992-2010	2011+	All
Single Family	12,485	5,964	5,628	4248.9	28,326
Multifamily	5,956	3,053	231	169	9,409
Total					37,735

Global Assumptions	
Policy Takes Effect	2023
Active Policy Duration (years)	5
Current Renewable Electricity Share	88.26%
Natural Gass Emissions Factor (mtco2e)	0.0054544

Measure Assumptions	Cost Effectiveness	Policy Trigger	Penetration Rate	Applicability Rate	Baseline Installation Rate		
					Yrs 1-10	Yrs 11-20	Yrs 21-30
Single Family Measures							
LED vs. CFL	3 vintages	All Permits	6.92%	50%	50%	75%	100%
Water Heating Package	3 vintages	$10K+	6.23%	50%	0%	33%	66%
Duct Sealing	3 vintages	$25K+ (WH + Lighting + 1 measures)	0.78%	80%	50%	75%	100%
[NET] Duct Sealing + R-49 Attic Insulation	3 vintages	$50K+ (WH + Lighting + 2 measures)	0.38%	20%	15%	30%	50%
[NET] Duct Sealing + R-49 Attic Insulation + Air Sealing	3 vintages	$100K+ (WH + Lighting + 3 measures)	0.16%	90%	15%	30%	50%
Multifamily Measures							
LED vs. CFL	3 vintages	All Permits	6.92%	50%	50%	75%	100%
Water Heating Package	3 vintages	$10K+	6.23%	25%	0%	33%	66%
Duct Sealing	3 vintages	$25K+ (WH + Lighting + 1 measures)	0.78%	40%	50%	75%	100%
[NET] Duct Sealing + R-49 Attic Insulation	3 vintages	$50K+ (WH + Lighting + 2 measures)	0.38%	20%	15%	30%	50%
[NET] Duct Sealing + R-49 Attic Insulation + Air Sealing	3 vintages	$100K+ (WH + Lighting + 3 measures)	0.16%	90%	15%	30%	50%