CALIFORNIA ENERGY CODES & STANDARDS
A STATEWIDE UTILITY PROGRAM

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Custom Cost Effectiveness Analysis: City of Riverside

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Acronym List

B/C – Benefit-to-Cost Ratio

CBECC - California Building Energy Code Compliance

CBSC - California Building Standards Commission

CEC - California Energy Commission

CZ – Climate Zone

GHG - Greenhouse Gas

IOU – Investor-Owned Utility

POU – Publicly Owned Utility

PG&E – Pacific Gas & Electric (utility)

SCE – Southern California Edison (utility)

SCG – Southern California Gas (utility)

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

CPAU – City of Palo Alto Utilities

LADWP – Los Angeles Department of Water and Power

kWh – Kilowatt Hour

NPV – Net Present Value

PV - Solar Photovoltaic

TDV - Time Dependent Valuation

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

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1 Introduction

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

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

This report is an addendum to the *2022 Single Family New Construction Cost-effectiveness Study* modified to accurately represent the City of Riverside, California. The study analyzes cost-effectiveness of measures and measure packages that exceed the minimum state requirements, the 2022 Building Energy Efficiency Standards, effective January 1, 2023, in newly constructed buildings. 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 Codes Team.

The prototype building designs analyzed in this study are newly constructed:

- Single Family Home
- Detached Accessory Dwelling Unit (ADU)

The methodology, prototype characteristics, and measure packages are retained from the main studies referenced above except for the energy costs are calculated using local Riverside Public Utilities rates. Measure packages include combinations of energy efficiency, electrification, solar photovoltaics (PV), and battery storage with results evaluated for California Climate Zone 10.

This report presents measures or measure packages that local jurisdictions may consider adopting to achieve energy savings and emissions reductions beyond what will be accomplished by enforcing minimum state requirements, the 2022 Building Energy Efficiency Standards (Title 24, Part 6), effective January 1, 2023.

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

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

2 Methodology and Assumptions

The Reach Codes Team analyzed two residential prototype designs to represent a variety of common building types using the cost-effectiveness methodology detailed in this section below. The general methodology is consistent with analyses of other prototypes, whereas some specifics such as utility rate selection are customized for Riverside Public Utilities rates.

2.1 Reach Codes

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

2.1.1 Benefits

This analysis used both on-bill and time dependent valuation (TDV) of energy-based approaches to evaluate cost-effectiveness. Both on-bill and TDV require estimating and quantifying the energy savings and costs associated with energy measures. The primary difference between on-bill and TDV is how energy is valued:

- On-Bill: Customer-based lifecycle cost approach that values energy based upon estimated site energy usage and customer on-bill savings using electricity and natural gas utility rate schedules over a 30-year duration for residential and 15 years for nonresidential designs, accounting for a three percent discount rate and energy cost inflation per Appendix 7.2.3.
- TDV: TDV was developed by the Energy Commission to reflect the time dependent value of energy including long-term projected costs of energy such as the cost of providing energy during peak periods of demand and other societal costs including projected costs for carbon emissions and grid transmission impacts. This metric values energy use differently depending on the fuel source (gas, electricity, and propane), time of day, and season. Electricity used (or saved) during peak periods has a much higher value than electricity used (or saved) during off-peak periods.

The Reach Codes Team performed energy simulations using the most recent software available for 2022 Title 24 code compliance analysis, CBECC-Res v1.0.

2.1.2 Costs

The Reach Codes Team assessed the incremental costs and savings of the energy packages over the lifecycle of 30 years for the single family and ADU buildings. Incremental costs represent the equipment, installation, replacements, and maintenance costs of the proposed measure relative to the 2019 Title 24 Standards minimum requirements or standard industry practices. The Reach Codes Team obtained measure costs from manufacturer distributors, contractors, literature review, and online sources such as Home Depot and RS Means. Taxes and contractor markups were added as appropriate. Maintenance and replacement costs are included.

2.1.3 Metrics

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

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

indicates the savings over the life of the measure are equivalent to the incremental cost of that measure. A value greater than one represents a positive return on investment.

Improving the energy performance of a building often requires an initial investment. In most cases the benefit is represented by annual on-bill utility or TDV savings, and the cost by incremental first cost and replacement costs. However, some packages result in initial construction cost savings (negative incremental cost), and either energy cost savings (positive benefits), or increased energy costs (negative benefits). In cases where both construction costs and energy-related savings are negative, the construction cost savings are treated as the benefit while the increased energy costs are the cost. In cases where a measure or package is cost-effective immediately (i.e., upfront construction cost savings and lifetime energy cost savings), B/C ratio cost-effectiveness is represented by ">1". Because of these situations, NPV savings are also reported, which, in these cases, are positive values.

2.1.4 Utility Rates

In coordination with the City of Riverside, the Reach Codes Team determined appropriate tariffs for each package, summarized in Table 1, based on the annual load profile of the prototype and the corresponding package, and the most prevalent rate for each building type.

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

Table 1. Riverside Public Utilities Tariffs

Electric / Gas Utility	Electricity	Natural Gas
Residential (Single Family and Detached ADU)		
Riverside Public Utilities / SoCalGas	D	GR
Riverside Public Utilities / SoCalGas	D-TOU	GR

Utility rates are assumed to escalate over time, using assumptions detailed in Appendix 7.2. Please see the main *2022 Single Family New Construction Reach Code Cost Effectiveness Studies* for further details on methodology.

2.2 Greenhouse Gas Emissions

The analysis uses the greenhouse gas (GHG) emissions estimates built-in to CBECC-Res. There are 8760 hourly multipliers accounting for time dependent energy use and carbon emissions based on source emissions, including renewable portfolio standard projections. Natural gas fugitive emissions, which are shown to be substantial, are not included. There are two strings of multipliers—one for Northern California climate zones, and another for Southern California climate zones.[1].

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

3 Prototype Designs and Measure Packages

3.1 Residential Occupancies

Table 2 describes the basic characteristics of each residential prototype design. The prototypes have equal geometry on all walls, windows and roof to be orientation neutral.

Table 2: Residential Prototype Characteristics

Characteristic	Single Family One-Story	Single Family Two-Story	ADU
Conditioned Floor Area	2,100 ft^2	2,700 ft^2	625 ft^2
Num. of Stories	1	2	1
Num. of Bedrooms	3	3	1
Window-to-Floor Area Ratio	20%	20%	20%

The Reach Codes Team evaluated three packages for mixed fuel homes and five packages for all-electric homes for each prototype and climate zone, as described below.

1. All-Electric Code Minimum: This package meets all the prescriptive requirements of the 2022 Title 24 Code.
2. Efficiency Only: This package uses only efficiency measures that don't trigger federal preemption issues including envelope and water heating or duct distribution efficiency measures.
3. Efficiency + NEEA (Preempted): This package was evaluated for the all-electric homes only and shows an alternative design that applies water heating equipment that is more efficient than federal standards meeting the NEEA Tier 3 rating. The Reach Codes Team considers this more reflective of how builders meet above code requirements in practice.
4. Efficiency + PV: Using the Efficiency Package as a starting point, PV capacity was added to offset most of the estimated electricity use.
5. Efficiency + PV + Battery: Using the Efficiency & PV Package as a starting point, a battery system was added. For mixed-fuel homes the package of efficiency measures differed from the Efficiency Package in some climate zones to arrive at a cost effective solution.

4 Results

Results are presented as per the prototype-specific Measure Packages described in Section 4. Overarching factors impacting the results include:

- Designation of a **'benefit'** or a **'cost'** varies with the scenarios because both energy savings, and incremental construction costs may be negative depending on the package. Typically, utility bill savings are categorized as a 'benefit' while incremental construction costs are treated as 'costs.' In cases where both construction costs are negative and utility bill savings are negative, the construction cost savings are treated as the 'benefit' while the utility bill negative savings are the 'cost.'
- All-electric packages will have lower **GHG emissions** than equivalent mixed-fuel packages in all cases, due to the clean power sources currently available from California's power providers.
- The Reach Codes Team coordinated with the City of Riverside to select the most prevalent tariffs for each prototype given the annual energy demand profile. The Reach Codes Team **did not compare a variety of tariffs** to determine their impact on cost-effectiveness although utility rate changes or updates can effect on-bill cost-effectiveness results.

4.1 Residential Occupancies

Table 3 and Table 4 show results for the single family and ADU prototypes, respectively, for the D rate. Table 5 and Table 6 show results for the single family and ADU prototypes, respectively, for the D-TOU rate. Most of the packages are cost-effective based on TDV, except for two of the ADU mixed fuel packages. All of the single family all-electric packages are On-Bill cost-effective with the exception of the Efficiency + PV + Battery case. None of the ADU packages are On-Bill cost-effective.

Table 3: D Rate Single Family Cost-Effectiveness Summary

Case	Efficiency EDR2 Margin	Annual Elec Savings (kWh)	Annual Gas Savings (therms)	Average Annual GHG Reductions (metric tons)	Utility Cost Savings		Incremental Cost		On-Bill		TDV	
					First Year	Lifecycle (2022$)	First Year	Lifecycle (2022$)	B/C Ratio	NPV	B/C Ratio	NPV
All-Electric												
Code Minimum	1.1	-1,777	107	0.3	($53)	$236	($5,288)	($5,234)	>1	$5,470	3.5	$3,285
Efficiency Only	4.6	-1,540	107	0.3	($19)	$1,013	($3,944)	($3,674)	>1	$4,687	>1	$3,475
Efficiency + NEEA	6.3	-1,392	107	0.4	$2	$1,520	($3,944)	($3,674)	>1	$5,194	>1	$4,260
Efficiency + PV	4.6	939	107	0.4	$283	$8,077	$24	$1,634	4.9	$6,444	5.5	$6,432
Efficiency + PV + Battery	10.1	805	107	0.9	$268	$7,724	$5,516	$13,182	0.6	($5,458)	1.7	$7,804
Mixed Fuel												
Efficiency Only	3.7	197	4	0.1	$29	$732	$1,344	$1,561	0.5	($828)	1.2	$263
Efficiency + PV	3.7	939	4	0.1	$113	$2,691	$2,531	$3,149	0.9	($458)	1.4	$1,140
Efficiency + PV + Battery	8.3	854	2	0.5	$99	$2,340	$7,139	$13,724	0.2	($11,384)	1.2	$2,863

Table 4: D Rate ADU Cost-Effectiveness Summary

Case	Efficiency EDR2 Margin	Annual Elec Savings (kWh)	Annual Gas Savings (therms)	Average Annual GHG Reductions (metric tons)	Utility Cost Savings		Incremental Cost		On-Bill		TDV	
					First Year	Lifecycle (2022$)	First Year	Lifecycle (2022$)	B/C Ratio	NPV	B/C Ratio	NPV
All-Electric												
Code Minimum	0.4	-962	43	0.1	($154)	($2,945)	($3,216)	($2,908)	1.0	($37)	1.7	$1,055
Efficiency Only	3.8	-861	43	0.1	($142)	($2,680)	($2,956)	($1,402)	0.5	($1,278)	1.4	$280
Efficiency + NEEA	6.4	-750	43	0.2	($130)	($2,386)	($2,956)	($1,402)	0.6	($984)	4.9	$828
Efficiency + PV	3.8	722	43	0.2	$37	$1,502	($421)	$1,988	0.8	($487)	2.1	$2,156
Efficiency + PV + Battery	9.1	703	43	0.6	$34	$1,451	$5,147	$13,638	0.1	($12,186)	1.2	$2,118
Mixed Fuel												
Efficiency Only	3.8	12	7	0.0	$13	$398	$304	$1,555	0.3	($1,156)	0.5	($750)
Efficiency + PV	3.8	722	7	0.1	$93	$2,274	$1,441	$3,075	0.7	($801)	1.0	$71
Efficiency + PV + Battery	9.0	729	7	0.4	$94	$2,286	$7,005	$14,720	0.2	($12,434)	0.96	($473)

Table 5: D-TOU Rate Single Family Cost-Effectiveness Summary

Case	Efficiency EDR2 Margin	Annual Elec Savings (kWh)	Annual Gas Savings (therms)	Average Annual GHG Reductions (metric tons)	Utility Cost Savings		Incremental Cost		On-Bill		TDV	
					First Year	Lifecycle (2022$)	First Year	Lifecycle (2022$)	B/C Ratio	NPV	B/C Ratio	NPV
All-Electric												
Code Minimum	1.1	-1,777	107	0.3	($81)	($422)	($5,288)	($5,234)	12.4	$4,812	3.5	$3,285
Efficiency Only	4.6	-1,540	107	0.3	($44)	$443	($3,944)	($3,674)	>1	$4,117	>1	$3,475
Efficiency + NEEA	6.3	-1,392	107	0.4	($21)	$981	($3,944)	($3,674)	>1	$4,654	>1	$4,260
Efficiency + PV	4.6	939	107	0.4	$287	$8,164	$24	$1,634	5.0	$6,531	5.5	$6,432
Efficiency + PV + Battery	10.1	805	107	0.9	$298	$8,418	$5,516	$13,182	0.6	($4,764)	1.7	$7,804
Mixed Fuel												
Efficiency Only	3.7	197	4	0.1	$35	$875	$1,344	$1,561	0.6	($686)	1.2	$263
Efficiency + PV	3.7	939	4	0.1	$127	$3,032	$2,531	$3,149	1.0	($117)	1.4	$1,140
Efficiency + PV + Battery	8.3	854	2	0.5	$123	$2,905	$7,139	$13,724	0.2	($10,818)	1.2	$2,863

Table 6: D-TOU Rate ADU Cost-Effectiveness Summary

Case	Efficiency EDR2 Margin	Annual Elec Savings (kWh)	Annual Gas Savings (therms)	Average Annual GHG Reductions (metric tons)	Utility Cost Savings		Incremental Cost		On-Bill		TDV	
					First Year	Lifecycle (2022$)	First Year	Lifecycle (2022$)	B/C Ratio	NPV	B/C Ratio	NPV
All-Electric												
Code Minimum	0.4	-962	43	0.1	($165)	($3,220)	($3,216)	($2,908)	0.9	($313)	1.7	$1,055
Efficiency Only	3.8	-861	43	0.1	($151)	($2,882)	($2,956)	($1,402)	0.5	($1,480)	1.4	$280
Efficiency + NEEA	6.4	-750	43	0.2	($138)	($2,574)	($2,956)	($1,402)	0.5	($1,172)	4.9	$828
Efficiency + PV	3.8	722	43	0.2	$44	$1,671	($421)	$1,988	0.8	($317)	2.1	$2,156
Efficiency + PV + Battery	9.1	703	43	0.6	$44	$1,671	$5,147	$13,638	0.1	($11,966)	1.2	$2,118
Mixed Fuel												
Efficiency Only	3.8	12	7	0.0	$18	$509	$304	$1,555	0.3	($1,046)	0.5	($750)
Efficiency + PV	3.8	722	7	0.1	$100	$2,444	$1,441	$3,075	0.8	($632)	1.0	$71
Efficiency + PV + Battery	9.0	729	7	0.4	$101	$2,456	$7,005	$14,720	0.2	($12,265)	0.96	($473)

5 Summary

The Reach Codes Team developed packages of energy efficiency measures as well as packages combining energy efficiency with solar PV generation, simulated them in building modeling software, and gathered costs to determine the cost-effectiveness of multiple scenarios. The Reach Codes Team coordinated with multiple utilities, cities, and building community experts to develop a set of assumptions considered reasonable in the current market. Changing assumptions, such as the period of analysis, measure selection, cost assumptions, energy escalation rates, or utility tariffs are likely to change results.

Table 7 (all-electric) and Table 8 (mixed fuel) summarize results for each prototype and depict the efficiency EDR2 compliance margins achieved for each climate zone and package. Because local reach codes must both exceed the Energy Commission performance budget (i.e., have a positive compliance margin) and be cost-effective, the Reach Codes Team highlighted cells meeting these two requirements to help clarify the upper boundary for potential reach code policies. All results presented in this study have a positive compliance margin.

- Cells highlighted in **green** depict a positive compliance margin and cost-effective results using both On-Bill and TDV approaches.
- Cells highlighted in **yellow** depict a positive compliance and cost-effective results using either the On-Bill or TDV approach.
- Cells **not highlighted** depict a package that was not cost effective using either the On-Bill or TDV approach.

The Reach Codes Team found all-electric code compliant new construction to be feasible and cost effective based on TDV and Riverside Public Utilities electricity rates for the single family prototype, under both the D and D-TOU rates. For the ADU prototype the all-electric code compliant package was not found to be On-Bill cost-effective. Combining higher capacity PV systems and all-electric construction does reduce utility costs, increasing utility savings.

For a reach code that allows for mixed fuel buildings the mixed fuel efficiency, PV, and battery package was found to be cost effective based on TDV for the single family prototype only with an EDR2 margin of 8.3.

Table 7: Summary of All-Electric Efficiency EDR2 Margins and Cost-Effectiveness

Single Family				ADU			
Code	EE	EE+PV	EE+PV/Batt	Code Min	EE	EE+PV	EE+PV/Batt
1.1	4.6	4.6	10.1	0.4	3.8	3.8	9.1

Table 8: Summary of Mixed Fuel Efficiency EDR2 Margins and Cost-Effectiveness

Single Family			ADU		
EE	EE+PV	EE+PV/Batt	EE	EE+PV	EE+PV/Batt
3.7	3.7	8.3	3.8	3.8	9.0

6 References

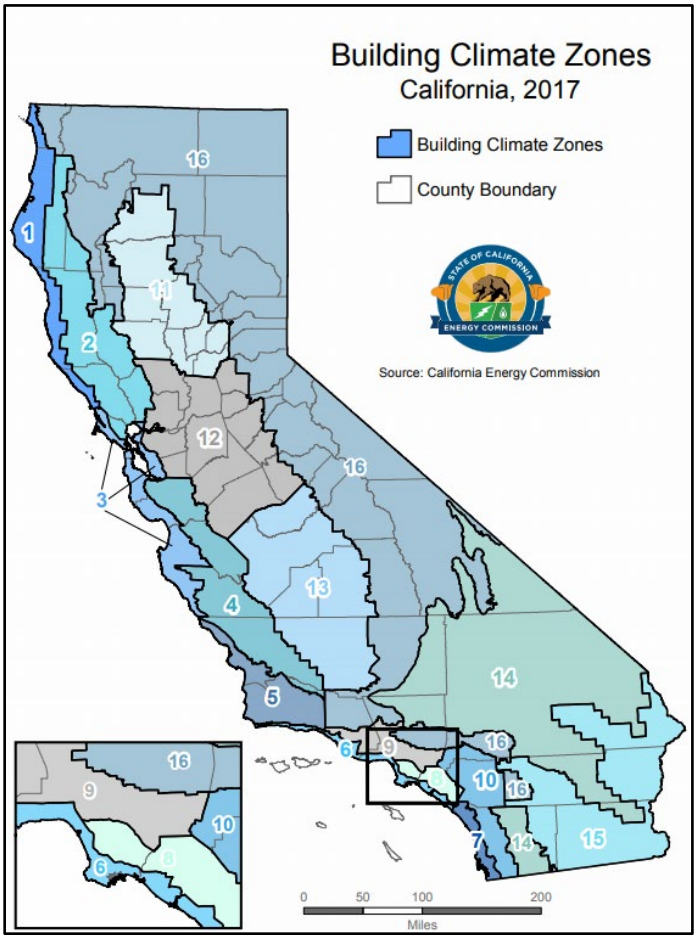
California Public Utilities Commission. (2021a). *Utility Costs and Affordability of the Grid of the Future: An Evaluation of Electric Costs, Rates, and Equity Issues Pursuant to P.U. Code Section 913.1.* Retrieved from https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/office-of-governmental-affairs-division/reports/2021/senate-bill-695-report-2021-and-en-banc-whitepaper_final_04302021.pdf

7 Appendices

7.1 Map of California Climate Zones

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

Figure 1. Map of California climate zones.



7.2 Utility Rate Schedules

The Reach Codes Team used the City of Riverside tariffs detailed below to determine the On-Bill savings for each package.

7.2.1 City of Riverside

7.2.1.1 Residential

Following are the Riverside Public Utilities electricity tariffs applied in this study. Both electric rates D and D-TOU are evaluated for all cases. A public benefits charge was included representing 2.85% of the total electricity bill. The sum of the customer, Reliability, and Networks Access charges are applied as a minimum bill.

Microsoft Word - Electric Schedule D - Effective 01-1-19 (riversideca.gov)

Microsoft Word - Electric Schedule DTOU - Effective 01-1-19 Updated clean (riversideca.gov)

SCHEDULE D
DOMESTIC SERVICE

1. **Flat Rates:**

		Per Meter, Per Month Effective January 1,				
		2019	2020	2021	2022	2023
Customer Charge	Flat Charge	$8.86	$9.66	$10.46	$11.26	$12.06
Reliability Charge	Flat Charge					
Small Residence	< or = 100 Amp	$10.00	$10.00	$10.00	$10.00	$10.00
Medium Residence	101 - 200 Amp	$20.00	$20.00	$20.00	$20.00	$20.00
Large Residence	201 - 400 Amp	$40.00	$40.00	$40.00	$40.00	$40.00
Very Large Residence	>400 Amp	$60.00	$60.00	$60.00	$60.00	$60.00
Network Access Charge	Flat Charge					
Tier 1	< or = 12 Daily Avg kWh Usage	$0.55	$0.97	$1.38	$1.94	$2.49
Tier 2	>12 - 25 Daily Avg kWh Usage	$1.33	$2.32	$3.32	$4.65	$5.97
Tier 3	>25 Daily Avg kWh Usage	$2.92	$5.12	$7.31	$10.24	$13.16

The Network Access Charge is billed based on daily average kWh usage. Daily Average kWh usage is determined by dividing the energy usage (kWh) in the billing period by the days of service in the billing period. The Network Access Charge is then applied to the daily average kWh usage. Billing periods with 1 to 14 days of service will receive the Tier 1 Network Access Charge.

2. **Energy Charge *** (To be added to customer, Reliability, and Network Access charges):

		Per kWh Effective January 1,				
		2019	2020	2021	2022	2023
Winter Season						
Tier 1	0-350 kWh	$0.1047	$0.1059	$0.1073	$0.1087	$0.1102
Tier 2	351-750 kWh	$0.1665	$0.1684	$0.1706	$0.1729	$0.1753
Tier 3	Over 750 kWh	$0.1889	$0.1910	$0.1936	$0.1961	$0.1988
Summer Season						
Tier 1	0-750 kWh	$0.1047	$0.1059	$0.1073	$0.1087	$0.1102
Tier 2	751-1,500 kWh	$0.1665	$0.1684	$0.1706	$0.1729	$0.1753
Tier 3	Over 1,500 kWh	$0.1889	$0.1910	$0.1936	$0.1961	$0.1988

SCHEDULE D-TOU
DOMESTIC TIME-OF-USE SERVICE

Rates:

1. Flat Rates:

		Per Meter, Per Month Effective January 1,				
		2019	2020	2021	2022	2023
Customer Charge	Flat Charge	$8.86	$9.66	$10.46	$11.26	$12.06
Reliability Charge	Flat Charge					
Small Residence	< or = 100 Amp	$10.00	$10.00	$10.00	$10.00	$10.00
Medium Residence	101 - 200 Amp	$20.00	$20.00	$20.00	$20.00	$20.00
Large Residence	201 - 400 Amp	$40.00	$40.00	$40.00	$40.00	$40.00
Very Large Residence	>400 Amp	$60.00	$60.00	$60.00	$60.00	$60.00
Network Access Charge	Flat Charge					
Tier 1	< or = 12 Daily Avg kWh Usage	$0.55	$0.97	$1.38	$1.94	$2.49
Tier 2	< 12 - 25 Daily Avg kWh Usage	$1.33	$2.32	$3.32	$4.65	$5.97
Tier 3	>25 Daily Avg kWh Usage	$2.92	$5.12	$7.31	$10.24	$13.16

The Network Access Charge is billed based on daily average kWh usage. The energy usage (kWh) is the sum of the on-peak, mid-peak and off-peak periods energy usage (kWh). Daily Average kWh usage is determined by dividing the energy usage (kWh) in the billing period by the days of service in the billing period. The Network Access Charge is then applied to the daily average kWh usage. Billing periods with 1 to 14 days of service will receive the Tier 1 Network Access Charge.

2. Energy Charge (to be added to customer, Reliability, and Network Access charges):

		Per kWh Effective January 1,				
Item		2019	2020	2021	2022	2023
Winter Season						
On-Peak Tier 1	0-135 kWh	$0.1325	$0.1340	$0.1358	$0.1376	$0.1395
On-Peak Tier 2	Over 135 kWh	$0.2120	$0.2144	$0.2173	$0.2202	$0.2232
Mid-Peak Tier 1	0-250 kWh	$0.1060	$0.1072	$0.1086	$0.1100	$0.1116
Mid-Peak Tier 2	Over 250 kWh	$0.1696	$0.1715	$0.1738	$0.1760	$0.1786
Off-Peak Tier 1	0-115 kWh	$0.0883	$0.0972	$0.0985	$0.0998	$0.1012
Off-Peak Tier 2	Over 115 kWh	$0.1413	$0.1429	$0.1448	$0.1467	$0.1488
Summer Season						
On-Peak Tier 1	0-330 kWh	$0.1766	$0.1786	$0.1810	$0.1834	$0.1860
On-Peak Tier 2	Over 330 kWh	$0.2826	$0.2858	$0.2896	$0.2934	$0.2976
Mid-Peak Tier 1	0-550 kWh	$0.1148	$0.1161	$0.1177	$0.1192	$0.1209
Mid-Peak Tier 2	Over 550 kWh	$0.1837	$0.1858	$0.1883	$0.1907	$0.1934
Off-Peak Tier 1	0-220 kWh	$0.0883	$0.0972	$0.0985	$0.0998	$0.1012
Off-Peak Tier 2	Over 220 kWh	$0.1413	$0.1429	$0.1448	$0.1467	$0.1488

Metering:

Net Energy Metering shall be accomplished using a Required Meter. The Utility shall own, operate and maintain the Required Meter on the Customer's premises. If the existing meter at Customer's premises is not capable of measuring the flow of energy in two directions, Customer shall be responsible for all expenses involved in the Utility's purchase and installation of the Required Meter. The Utility, at its expense, may purchase and install additional meters with the consent of the Customer to provide the information necessary to accurately credit or bill the Customer or to collect generating system performance information for research purposes. If an additional meter or meters are installed, the net metering calculation shall yield a result identical to that of a single meter.

7.2.2 SCG

Refer to the statewide study 2022 Single Family New Construction Cost-effectiveness Study for details on the gas rates applied.

7.2.3 Fuel Escalation Rates

7.2.3.1 Residential Occupancies

The average annual escalation rates reported in Table 9 were used in this study. The electricity and natural gas rates are based on assumptions from the CPUC 2021 En Banc hearings on utility costs through 2030 (California Public Utilities Commission, 2021a). Escalation rates through the remainder of the 30-year evaluation period are based on the escalation rate assumptions within the 2022 TDV factors. No data was available to estimate electricity escalation rates for GWP, therefore electricity escalation rates for SCE and statewide natural gas escalation rates were applied.

Table 9: Real Utility Rate Escalation Rate Assumptions

Year	Statewide Natural Gas Average Rate (%/year, real)	SCE Electric Average Rate (%/year, real)
2023	4.6%	1.6%
2024	4.6%	1.6%
2025	4.6%	1.6%
2026	4.6%	1.6%
2027	4.6%	1.6%
2028	4.6%	1.6%
2029	4.6%	1.6%
2030	4.6%	1.6%
2031	2.0%	0.6%
2032	2.4%	0.6%
2033	2.1%	0.6%
2034	1.9%	0.6%
2035	1.9%	0.6%
2036	1.8%	0.6%
2037	1.7%	0.6%
2038	1.6%	0.6%
2039	2.1%	0.6%
2040	1.6%	0.6%
2041	2.2%	0.6%
2042	2.2%	0.6%
2043	2.3%	0.6%
2044	2.4%	0.6%
2045	2.5%	0.6%
2046	1.5%	0.6%
2047	1.3%	0.6%
2048	1.6%	0.6%
2049	1.3%	0.6%
2050	1.5%	0.6%
2051	1.8%	0.6%
2052	1.8%	0.6%

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

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CALIFORNIA ENERGY CODES & STANDARDS
A STATEWIDE UTILITY PROGRAM

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2022 CODE CYCLE:

Custom Cost Effectiveness Analysis: City of Riverside

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Pacific Gas and Electric Company®
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Legal Notice

Acronym List

B/C – Benefit-to-Cost Ratio

BSC – Buildings Standards commission

CBECC – California Building Energy Code Compliance

CBSC – California Building Standards Commission

CEC – California Energy Commission

C&S – Codes and Standards

CZ – Climate Zone

GHG - Greenhouse Gas

IOU – Investor-Owned Utility

PG&E – Pacific Gas & Electric (utility)

SCE – Southern California Edison (utility)

SCG – Southern California Gas (utility)

kWh – Kilowatt Hour

NPV – Net Present Value

PV - Solar Photovoltaic

TDV - Time Dependent Valuation

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

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1 Introduction

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

The California Building Energy Efficiency Standards Title 24, Part 6 (Title 24) (CEC, 2022) is maintained and updated every three years by two state agencies: the California Energy Commission (the Energy Commission) and the Building Standards Commission (BSC). In addition to enforcing the code, local jurisdictions have the authority to adopt local energy efficiency ordinances—or reach codes—that exceed the minimum standards defined by Title 24 (as established by Public Resources Code Section 25402.1(h)2 and Section 10-106 of the Building Energy Efficiency Standards). Local jurisdictions must demonstrate that the requirements of the proposed ordinance are cost-effective and do not result in buildings consuming more energy than is permitted by Title 24. In addition, the jurisdiction must obtain approval from the Energy Commission and file the ordinance with the BSC for the ordinance to be legally enforceable.

This report is an addendum to the *2022 Multifamily New Construction Cost-effectiveness Study* (Statewide Reach Codes Team, 2023) modified to accurately represent the City of Riverside, California. The study analyzes cost-effectiveness of measures and measure packages that exceed the minimum state requirements, the 2022 Building Energy Efficiency Standards, effective January 1, 2023, in newly constructed buildings. 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 Codes Team.

The prototype building design analyzed in this study is the newly constructed 3-story, 36-unit, loaded corridor. The methodology, prototype characteristics, and measure packages are retained from the main studies referenced above except for the energy costs are calculated using local Riverside Public Utilities rates. Measure packages include combinations of energy efficiency, electrification, solar photovoltaics (PV), and battery storage with results evaluated for California Climate Zone 10.

This report presents measures or measure packages that local jurisdictions may consider adopting to achieve energy savings and emissions reductions beyond what will be accomplished by enforcing minimum state requirements, the 2022 Building Energy Efficiency Standards (Title 24, Part 6), effective January 1, 2023.

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

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

2 Methodology and Assumptions

The Reach Codes Team analyzed the 3-story prototype as requested by the City of Riverside. The analysis uses cost-effectiveness methodology detailed in this section below. The general methodology is consistent with other reach code analysis, whereas some specifics such as utility rate selection are customized for Riverside Public Utilities rates.

2.1 Reach Codes

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

2.1.1 Benefits

This analysis used both on-bill and time dependent valuation (TDV) of energy-based approaches to evaluate cost-effectiveness. Both on-bill and TDV require estimating and quantifying the energy savings and costs associated with energy measures. The primary difference between on-bill and TDV is how energy is valued:

- On-Bill: Customer-based lifecycle cost approach that values energy based upon estimated site energy usage and customer on-bill savings using electricity and natural gas utility rate schedules over a 30-year duration for residential and 15 years for nonresidential designs, accounting for a three percent discount rate and energy cost inflation per Appendix 7.2.3.
- TDV: TDV was developed by the Energy Commission to reflect the time dependent value of energy including long-term projected costs of energy such as the cost of providing energy during peak periods of demand and other societal costs including projected costs for carbon emissions and grid transmission impacts. This metric values energy use differently depending on the fuel source (gas, electricity, and propane), time of day, and season. Electricity used (or saved) during peak periods has a much higher value than electricity used (or saved) during off-peak periods.

The Reach Codes Team performed energy simulations using the most recent software available for 2022 Title 24 code compliance analysis, CBECC 2022.2.0.

2.1.2 Costs

The Reach Codes Team assessed the incremental costs and savings of the energy packages over the lifecycle of 30 years for the multifamily buildings. Incremental costs represent the equipment, installation, replacements, and maintenance costs of the proposed measure relative to the 2022 Title 24 Standards minimum requirements or standard industry practices. The Reach Codes Team obtained measure costs from manufacturer distributors, contractors, literature review, and online sources such as Home Depot and RS Means. Taxes and contractor markups were added as appropriate. Maintenance and replacement costs are included.

2.1.3 Metrics

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

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

Improving the energy performance of a building often requires an initial investment. In most cases the benefit is represented by annual on-bill utility or TDV savings, and the cost by incremental first cost and replacement costs. However, some packages result in initial construction cost savings (negative incremental cost), and either energy cost savings (positive benefits), or increased energy costs (negative benefits). In cases where both construction costs and energy-related savings are negative, the construction cost savings are treated as the benefit while the increased energy costs are the cost. In cases where a measure or package is cost-effective immediately (i.e., upfront construction cost savings and lifetime energy cost savings), B/C ratio cost-effectiveness is represented by ">1". Because of these situations, NPV savings are also reported, which, in these cases, are positive values.

2.1.4 Utility Rates

In coordination with the City of Riverside, the Reach Codes Team determined appropriate tariffs for each scenario, summarized in Table 1, based on the annual load profile of the prototype and the corresponding package.

Gas costs for central water heating were evaluated under SoCalGas' relevant master metered gas tariff, GM. The water heating utility bill was calculated separately from the in-unit electricity bill. Apartment unit electricity costs were calculated using both the residential D and D-TOU tariffs. Electricity use for central water heating was evaluated using commercial rates. Utility costs were calculated using both the Schedule A Flat tariff and the Schedule A Demand tariff. The impacts of each are presented in this study.

Photovoltaic (PV) and battery energy storage benefits were applied assuming virtual net energy metering (VNEM). PV was first assigned to the central water heating meter to offset 100 percent of the electricity use. The remaining PV and all of the battery impacts were then split evenly across the apartment meters.

The multifamily prototypes include common area spaces that serve the residents (lobby, leasing office, corridors, etc.). Most of the energy use for these spaces could not be separated from that for the dwelling units within the CBECC model. As a result, average per dwelling unit hourly energy use was calculated to include both the dwelling unit and common space energy use.

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

Table 1. Riverside Public Utilities Tariffs

Electric / Gas Utility	Electricity	Natural Gas
Riverside Public Utilities / SoCalGas: Apartment Units	D & D-TOU	GR
Riverside Public Utilities / SoCalGas: Central Water Heating	Schedule A - Flat & Schedule A - Demand	GR

Utility rates are assumed to escalate over time, using assumptions detailed in Appendix 7.2. Please see the main *2022 Multifamily New Construction Reach Code Cost Effectiveness Studies* for further details on methodology (Statewide Reach Codes Team, 2023).

2.2 Greenhouse Gas Emissions

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

3 Prototype Designs and Measure Packages

3.1 Residential Occupancies

Table 2 describes the basic characteristics of the 3-story loaded corridor multifamily prototype design used in this analysis. The 5-story mixed use prototype was not evaluated at the request of the City of Riverside. The prototype has equal geometry on all walls, windows and roof to be orientation neutral.

Table 2: Residential Prototype Characteristics

Characteristic	3-Story Loaded Corridor
Conditioned Floor Area	39,372 ft^2
Num. of Stories	3
Num. of Bedrooms	(6) Studio (12) 1-bed (12) 2-bed (6) 3-bed
Window-to-Wall Area Ratio	25%
Wall Type	Wood framed
Roof Type	Flat roof
Foundation	Slab-on-grade

The Reach Codes Team evaluated two packages for mixed fuel homes and two packages for all-electric homes, as described below.

1. All-Electric Prescriptive Code: This package meets all the prescriptive requirements of the 2022 Energy Code.
2. All-Electric Prescriptive Code + PV: Using the code minimum package as a starting point, PV capacity was added to offset 100 percent of the estimated annual electricity use.
3. Mixed Fuel Efficiency Only: This package uses only efficiency measures that do not trigger federal preemption including envelope and duct distribution efficiency measures.
4. Mixed Fuel Efficiency + PV + Battery: Using the Efficiency Package as a starting point, PV capacity was added to offset 100 percent of the estimated annual electricity use. A battery system was also added.

4 Results

Cost-effectiveness results are presented per prototype and measure packages described in Section 3. The TDV and On-Bill based cost-effectiveness results are presented in terms of B/C ratio and NPV. Energy savings, compliance margin, utility bill savings, and incremental costs are also shown.

In the following figures, green highlighting indicates that the case is cost-effective with a B/C ratio greater than or equal to 1 and a NPV greater than or equal to 0. Red highlighting indicates the case is not cost-effective.

Compliance margins are presented as percentages both for the efficiency TDV and the source energy metrics. A compliance margin that is equal to or greater than 0 indicates the case is code compliant.

4.1 Residential Occupancies

Table 3 and Table 4 show results for the D and D-TOU rates applied to the apartment unit meters combined with the A Flat rate applied to the central water heating meter. All of the packages are cost-effective based on TDV. All of the all-electric packages are On-Bill cost-effective while most of the mixed fuel packages are not.

Table 5 and Table 6 show results for the D and D-TOU rates applied to the apartment unit meters combined with the A Demand rate applied to the central water heating meter. All of the packages are cost-effective based on TDV. The only packages that are On-Bill cost-effective are the Mixed Fuel Efficiency package when the TOU-D rate is used and the All-Electric Prescriptive Code + PV package when used with either the D-TOU rate or D rate.

Table 3: D & A Flat Tariffs 3-Story Multifamily Cost-Effectiveness Results per Dwelling Unit

Case	Efficiency TDV Comp Margin	Source Comp Margin	Annual Elec Savings (kWh)	Annual Gas Savings (therms)	Utility Cost Savings		Incremental Cost		On-Bill		TDV	
					First Year	Lifecycle (2022$)	First Year	Lifecycle (2022$)	B/C Ratio	NPV	B/C Ratio	NPV
All-Electric												
Prescriptive Code	14%	7%	-701	83	$25	$1,437	$446	$649	2.2	$788	>1	$1,953
Code + PV	14%	18%	1,381	83	$260	$6,905	$2,237	$2,978	2.3	$3,927	4.1	$7,006
Mixed Fuel												
Efficiency Only	3%	1%	65	0	$7	$172	$190	$199	0.9	($27)	2.4	$275
Efficiency + PV + Battery	3%	19%	1,342	0	$152	$3,528	$3,321	$5,254	0.7	($1,726)	1.5	$2,567

Table 4: D-TOU & A Flat Tariffs 3-Story Multifamily Cost-Effectiveness Results per Dwelling Unit

Case	Efficiency TDV Comp Margin	Source Comp Margin	Annual Elec Savings (kWh)	Annual Gas Savings (therms)	Utility Cost Savings		Incremental Cost		On-Bill		TDV	
					First Year	Lifecycle (2022$)	First Year	Lifecycle (2022$)	B/C Ratio	NPV	B/C Ratio	NPV
All-Electric												
Prescriptive Code	14%	7%	-701	83	$13	$1,179	$446	$649	1.8	$529	>1	$1,953
Code + PV	14%	18%	1,381	83	$278	$7,317	$2,237	$2,978	2.5	$4,339	4.1	$7,006
Mixed Fuel												
Efficiency Only	3%	1%	65	0	$10	$222	$190	$199	1.1	$23	2.4	$275
Efficiency + PV + Battery	3%	19%	1,342	0	$174	$4,029	$3,321	$5,254	0.8	($1,225)	1.5	$2,567

Table 5: D & A Demand Tariffs 3-Story Multifamily Cost-Effectiveness Results per Dwelling Unit

Case	Efficiency TDV Comp Margin	Source Comp Margin	Annual Elec Savings (kWh)	Annual Gas Savings (therms)	Utility Cost Savings		Incremental Cost		On-Bill		TDV	
					First Year	Lifecycle (2022$)	First Year	Lifecycle (2022$)	B/C Ratio	NPV	B/C Ratio	NPV
All-Electric												
Code Minimum	14%	7%	-701	83	($117)	($1,846)	$446	$649	0.0	($2,495)	>1	$1,953
Efficiency + PV	14%	18%	1,381	83	$119	$3,622	$2,237	$2,978	1.2	$643	4.1	$7,006
Mixed Fuel												
Efficiency Only	3%	1%	65	0	$7	$172	$190	$199	0.9	($27)	2.4	$275
Efficiency + PV + Battery	3%	19%	1,342	0	$152	$3,528	$3,321	$5,254	0.7	($1,726)	1.5	$2,567

Table 6: D-TOU & A Demand Tariffs 3-Story Multifamily Cost-Effectiveness Results per Dwelling Unit

Case	Efficiency TDV Comp Margin	Source Comp Margin	Annual Elec Savings (kWh)	Annual Gas Savings (therms)	Utility Cost Savings		Incremental Cost		On-Bill		TDV	
					First Year	Lifecycle (2022$)	First Year	Lifecycle (2022$)	B/C Ratio	NPV	B/C Ratio	NPV
All-Electric												
Code Minimum	14%	7%	-701	83	($128)	($2,105)	$446	$649	0.0	($2,754)	>1	$1,953
Efficiency + PV	14%	18%	1,381	83	$137	$4,033	$2,237	$2,978	1.4	$1,055	4.1	$7,006
Mixed Fuel												
Efficiency Only	3%	1%	65	0	$10	$222	$190	$199	1.1	$23	2.4	$275
Efficiency + PV + Battery	3%	19%	1,342	0	$174	$4,029	$3,321	$5,254	0.8	($1,225)	1.5	$2,567

5 Summary

The Reach Codes Team developed packages of energy efficiency measures as well as packages combining energy efficiency with solar PV generation, simulated them in building modeling software, and gathered costs to determine the cost-effectiveness of multiple scenarios. The Reach Codes Team coordinated with multiple utilities, cities, and building community experts to develop a set of assumptions considered reasonable in the current market. Changing assumptions, such as the period of analysis, measure selection, cost assumptions, energy escalation rates, or utility tariffs are likely to change results.

Table 7 summarizes results for each prototype and depicts the efficiency compliance margins achieved for each climate zone and package. Because local reach codes must both exceed the Energy Commission performance budget (i.e., have a positive compliance margin) and be cost-effective, the Reach Codes Team highlighted cells meeting these two requirements to help clarify the upper boundary for potential reach code policies. All results presented in this study have a positive compliance margin.

- Cells highlighted in **green** depict a positive compliance margin and cost-effective results using both On-Bill and TDV approaches.
- Cells highlighted in **yellow** depict a positive compliance and cost-effective results using either the On-Bill or TDV approach.
- Cells **not highlighted** depict a package that was not cost effective using either the On-Bill or TDV approach.

The Reach Codes Team found all-electric prescriptive code new construction to be feasible and cost effective based on TDV and Riverside Public Utilities electricity rates when the Schedule A Flat tariff was applied for central water heating. When demand at the central water heating meter is high enough to require using the Schedule A Demand tariff, annual electricity costs are higher, and the package is no longer cost-effective On-Bill. Combining higher capacity PV systems and all-electric construction does reduce utility costs, increasing utility savings.

For a reach code that allows for mixed fuel buildings the mixed fuel efficiency, PV, and battery package was found to be cost effective based on TDV only with an efficiency compliance margin of 3 percent.

Table 7: Summary of Efficiency TDV Compliance Margins and Cost-Effectiveness

Scenario	All-Electric Prescriptive Code	All-Electric + PV	Mixed Fuel Efficiency	Mixed Fuel Efficiency + PV + Battery
D & A Flat	14%	14%	3%	3%
D-TOU & A Flat	14%	14%	3%	3%
D & A Demand	14%	14%	3%	3%
D-TOU & A Demand	14%	14%	3%	3%

6 References

California Public Utilities Commission. (2021a). *Utility Costs and Affordability of the Grid of the Future: An Evaluation of Electric Costs, Rates, and Equity Issues Pursuant to P.U. Code Section 913.1.* Retrieved from https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/office-of-governmental-affairs-division/reports/2021/senate-bill-695-report-2021-and-en-banc-whitepaper_final_04302021.pdf

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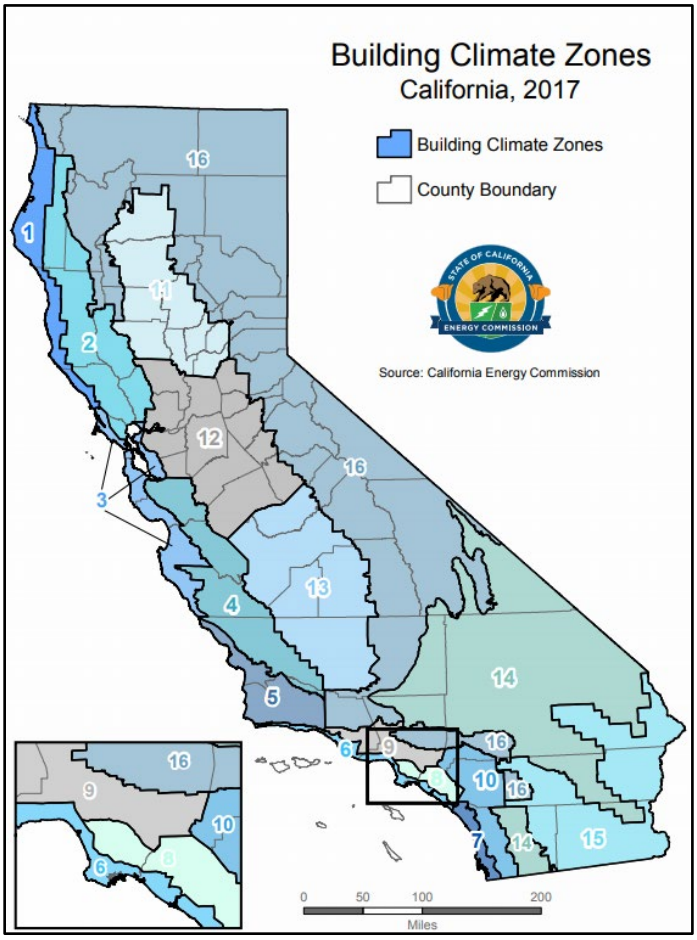
7 Appendices

7.1 Map of California Climate Zones

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

Figure 1. Map of California climate zones.



7.2 Utility Rate Schedules

The Reach Codes Team used the Riverside Public Utilities and SoCalGas tariffs detailed below to determine the On-Bill savings for each package.

7.2.1 City of Riverside

7.2.1.1 Residential

Following are the Riverside Public Utilities electricity tariffs applied in this study. Both electric rates D[1] and D-TOU[2] were evaluated for the apartment unit electricity use. A public benefits charge was included representing 2.85% of the total electricity bill. The sum of the customer, Reliability, and Networks Access charges are applied as a minimum bill. Electric service to the multifamily apartments was assumed to be between 101 and 200 Amp (medium residence). Electricity costs for central water heating were evaluated with the Schedule A commercial tariff.

SCHEDULE D
DOMESTIC SERVICE

1. **Flat Rates:**

		Per Meter, Per Month Effective January 1,				
		2019	2020	2021	2022	2023
Customer Charge	Flat Charge	$8.86	$9.66	$10.46	$11.26	$12.06
Reliability Charge	Flat Charge					
Small Residence	< or = 100 Amp	$10.00	$10.00	$10.00	$10.00	$10.00
Medium Residence	101 - 200 Amp	$20.00	$20.00	$20.00	$20.00	$20.00
Large Residence	201 - 400 Amp	$40.00	$40.00	$40.00	$40.00	$40.00
Very Large Residence	>400 Amp	$60.00	$60.00	$60.00	$60.00	$60.00
Network Access Charge	Flat Charge					
Tier 1	< or = 12 Daily Avg kWh Usage	$0.55	$0.97	$1.38	$1.94	$2.49
Tier 2	>12 - 25 Daily Avg kWh Usage	$1.33	$2.32	$3.32	$4.65	$5.97
Tier 3	>25 Daily Avg kWh Usage	$2.92	$5.12	$7.31	$10.24	$13.16

The Network Access Charge is billed based on daily average kWh usage. Daily Average kWh usage is determined by dividing the energy usage (kWh) in the billing period by the days of service in the billing period. The Network Access Charge is then applied to the daily average kWh usage. Billing periods with 1 to 14 days of service will receive the Tier 1 Network Access Charge.

2. **Energy Charge *** (To be added to customer, Reliability, and Network Access charges):

		Per kWh Effective January 1,				
		2019	2020	2021	2022	2023
Winter Season						
Tier 1	0-350 kWh	$0.1047	$0.1059	$0.1073	$0.1087	$0.1102
Tier 2	351-750 kWh	$0.1665	$0.1684	$0.1706	$0.1729	$0.1753
Tier 3	Over 750 kWh	$0.1889	$0.1910	$0.1936	$0.1961	$0.1988
Summer Season						
Tier 1	0-750 kWh	$0.1047	$0.1059	$0.1073	$0.1087	$0.1102
Tier 2	751-1,500 kWh	$0.1665	$0.1684	$0.1706	$0.1729	$0.1753
Tier 3	Over 1,500 kWh	$0.1889	$0.1910	$0.1936	$0.1961	$0.1988

[1] https://riversideca.gov/utilities/sites/riversideca.gov.utilities/files/pdf/rates-electric/Electric%20Schedule%20D%20-%20Effective%2001-1-19.pdf
[2] https://riversideca.gov/utilities/sites/riversideca.gov.utilities/files/pdf/rates-electric/Electric%20Schedule%20DTOU%20-%20Effective%2001-1-19%20Updated%20clean.pdf

SCHEDULE D-TOU
DOMESTIC TIME-OF-USE SERVICE

Rates:

1. Flat Rates:

		Per Meter, Per Month Effective January 1,				
		2019	2020	2021	2022	2023
Customer Charge	Flat Charge	$8.86	$9.66	$10.46	$11.26	$12.06
Reliability Charge	Flat Charge					
Small Residence	< or = 100 Amp	$10.00	$10.00	$10.00	$10.00	$10.00
Medium Residence	101 - 200 Amp	$20.00	$20.00	$20.00	$20.00	$20.00
Large Residence	201 - 400 Amp	$40.00	$40.00	$40.00	$40.00	$40.00
Very Large Residence	>400 Amp	$60.00	$60.00	$60.00	$60.00	$60.00
Network Access Charge	Flat Charge					
Tier 1	< or = 12 Daily Avg kWh Usage	$0.55	$0.97	$1.38	$1.94	$2.49
Tier 2	< 12 - 25 Daily Avg kWh Usage	$1.33	$2.32	$3.32	$4.65	$5.97
Tier 3	>25 Daily Avg kWh Usage	$2.92	$5.12	$7.31	$10.24	$13.16

The Network Access Charge is billed based on daily average kWh usage. The energy usage (kWh) is the sum of the on-peak, mid-peak and off-peak periods energy usage (kWh). Daily Average kWh usage is determined by dividing the energy usage (kWh) in the billing period by the days of service in the billing period. The Network Access Charge is then applied to the daily average kWh usage. Billing periods with 1 to 14 days of service will receive the Tier 1 Network Access Charge.

2. Energy Charge (to be added to customer, Reliability, and Network Access charges):

		Per kWh Effective January 1,				
Item		2019	2020	2021	2022	2023
Winter Season						
On-Peak Tier 1	0-135 kWh	$0.1325	$0.1340	$0.1358	$0.1376	$0.1395
On-Peak Tier 2	Over 135 kWh	$0.2120	$0.2144	$0.2173	$0.2202	$0.2232
Mid-Peak Tier 1	0-250 kWh	$0.1060	$0.1072	$0.1086	$0.1100	$0.1116
Mid-Peak Tier 2	Over 250 kWh	$0.1696	$0.1715	$0.1738	$0.1760	$0.1786
Off-Peak Tier 1	0-115 kWh	$0.0883	$0.0972	$0.0985	$0.0998	$0.1012
Off-Peak Tier 2	Over 115 kWh	$0.1413	$0.1429	$0.1448	$0.1467	$0.1488
Summer Season						
On-Peak Tier 1	0-330 kWh	$0.1766	$0.1786	$0.1810	$0.1834	$0.1860
On-Peak Tier 2	Over 330 kWh	$0.2826	$0.2858	$0.2896	$0.2934	$0.2976
Mid-Peak Tier 1	0-550 kWh	$0.1148	$0.1161	$0.1177	$0.1192	$0.1209
Mid-Peak Tier 2	Over 550 kWh	$0.1837	$0.1858	$0.1883	$0.1907	$0.1934
Off-Peak Tier 1	0-220 kWh	$0.0883	$0.0972	$0.0985	$0.0998	$0.1012
Off-Peak Tier 2	Over 220 kWh	$0.1413	$0.1429	$0.1448	$0.1467	$0.1488

SCHEDULE A
GENERAL SERVICE

1. Flat Rate:

Applicable to single-and three-phase alternating-current general service including lighting, power and heating or any combination thereof. Applicable to existing commercial customers with a monthly maximum demand not exceeding 20 kW in any two of the preceding 12 months. Applicable to new commercial customers with a monthly demand level less than 20 kW as determined by the Department. Customers exceeding the monthly maximum demand under this schedule shall be transferred to the applicable rate schedule.

		Per Meter, Per Month Effective January 1,				
		2019	2020	2021	2022	2023
Customer Charge	Flat Charge	$20.50	$20.50	$20.50	$20.50	$20.50
Reliability Charge	Flat Charge					
Tier 1	0 – 500 kWh	$10.00	$10.00	$10.00	$10.00	$10.00
Tier 2	501 – 1,500 kWh	$30.00	$30.00	$30.00	$30.00	$30.00
Tier 3	> 1,500 kWh	$60.00	$60.00	$60.00	$60.00	$60.00
Network Access Charge	Flat Charge					
Tier 1	0 – 500 kWh	$1.12	$1.67	$2.23	$2.79	$3.35
Tier 2	501 – 1,500 kWh	$3.17	$4.75	$6.33	$7.91	$9.50
Tier 3	1,501 – 3,000 kWh	$5.63	$8.45	$11.26	$14.08	$16.89
Tier 4	> 3,000 kWh	$13.54	$20.32	$27.09	$33.86	$40.63

Energy Charge (To be added to customer, Reliability, and Network Access charges):

		Per kWh Effective January 1,				
		2019	2020	2021	2022	2023
Tier 1	0-15,000 kWh	$0.1366	$0.1390	$0.1418	$0.1450	$0.1486
Tier 2	Over 15,000 kWh	$0.2087	$0.2124	$0.2166	$0.2215	$0.2270

2. Demand Basis:

Applicable to single-and three-phase alternating-current general service including lighting, power and heating or any combination thereof. Applicable to existing commercial customers with a billing demand equal or exceeding 20 kW but less than 150 kW in any two of the preceding 12 months. Applicable to new commercial customers with a monthly demand level equal to or exceeding 20 kW but less than 150 kW as determined by the Department. Customers that do not meet the monthly minimum or exceed the monthly maximum demand under this schedule shall be transferred to the applicable rate schedule.

		Per Meter, Per Month Effective January 1,				
		2019	2020	2021	2022	2023
Customer Charge	Flat Charge	$4.42	$8.84	$13.26	$17.68	$22.10
Reliability Charge	Flat Charge	$90.00	$90.00	$90.00	$90.00	$90.00
Network Access Charge	$ Per kW	$0.35	$0.70	$1.05	$1.40	$1.75
Demand Charge	First 15 kW or less of billing demand, flat charge	$157.95	$158.70	$159.45	$160.20	$160.95
Demand Charge	All excess kW of billing demand, per kW	$10.53	$10.58	$10.63	$10.68	$10.73

Energy Charge (to be added to customer, Reliability, Network Access, and demand charges):

		Per kWh Effective January 1,				
		2019	2020	2021	2022	2023
Tier 1	0-30,000 kWh	$0.1131	$0.1157	$0.1183	$0.1212	$0.1242
Tier 2	Over 30,000 kWh, per kWh	$0.1239	$0.1267	$0.1296	$0.1328	$0.1360

Metering:

Net Energy Metering shall be accomplished using a Required Meter. The Utility shall own, operate and maintain the Required Meter on the Customer's premises. If the existing meter at Customer's premises is not capable of measuring the flow of energy in two directions, Customer shall be responsible for all expenses involved in the Utility's purchase and installation of the Required Meter. The Utility, at its expense, may purchase and install additional meters with the consent of the Customer to provide the information necessary to accurately credit or bill the Customer or to collect generating system performance information for research purposes. If an additional meter or meters are installed, the net metering calculation shall yield a result identical to that of a single meter.

7.2.2 SCG

Refer to the statewide study 2022 Multifamily New Construction Cost-effectiveness Study for details on the gas rates applied.

7.2.3 Fuel Escalation Rates

7.2.3.1 Residential Occupancies

The average annual escalation rates reported in Table 9 were used in this study. The electricity and natural gas rates are based on assumptions from the CPUC 2021 En Banc hearings on utility costs through 2030 (California Public Utilities Commission, 2021a). Escalation rates through the remainder of the 30-year evaluation period are based on the escalation rate assumptions within the 2022 TDV factors. No data was available to estimate electricity escalation rates for Riverside Public Utilities, therefore electricity escalation rates for SCE and statewide natural gas escalation rates were applied.

Table 8: Real Utility Rate Escalation Rate Assumptions

Year	Statewide Natural Gas Average Rate (%/year, real)	SCE Electric Average Rate (%/year, real)
2023	4.6%	1.6%
2024	4.6%	1.6%
2025	4.6%	1.6%
2026	4.6%	1.6%
2027	4.6%	1.6%
2028	4.6%	1.6%
2029	4.6%	1.6%
2030	4.6%	1.6%
2031	2.0%	0.6%
2032	2.4%	0.6%
2033	2.1%	0.6%
2034	1.9%	0.6%
2035	1.9%	0.6%
2036	1.8%	0.6%
2037	1.7%	0.6%
2038	1.6%	0.6%
2039	2.1%	0.6%
2040	1.6%	0.6%
2041	2.2%	0.6%
2042	2.2%	0.6%
2043	2.3%	0.6%
2044	2.4%	0.6%
2045	2.5%	0.6%
2046	1.5%	0.6%
2047	1.3%	0.6%
2048	1.6%	0.6%
2049	1.3%	0.6%
2050	1.5%	0.6%
2051	1.8%	0.6%
2052	1.8%	0.6%

Get In Touch

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

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

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

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

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