REACH CODE STAKEHOLDER ADVISORY COMMITTEE MEETING

TOWN OF TRUCKEE

DATE: June 20, 2022

SPEAKERS: ID360



WELCOME



Town of Truckee

- Jen Callaway
- Town Manager

Facilitator



Melanie Jacobson, LEED AP, BD&C, ICC CALGreen Inspector/Plans Examiner Principal, ID360

Housekeeping

- There will be a Q&A Session after the presentation, please hold questions until then.
- Questions submitted via the chat function are also welcome.
- Materials will be posted to the Town's Reach Code webpage.







AGENDA



- 1. Climate Action Plan (CAP)
- 2. Reach Code Background
- 3. Introduction to Decarbonization
- 4. Decarbonization Reach Codes
- 5. 2022 Energy Code Highlights
- 6. 2022 Statewide Reach Codes Initiative
- 7. Decarbonization Incentives
- 8. Building Decarbonization Reach Code Strategy
- 9. Discussion Q&A Session
- 10.Next Steps

OBJECTIVES



- Provide educational background on Energy Reach Codes.
- Review Energy Reach Code Adoption Process.
- Respond to your questions and comments regarding the local Energy Reach Code pathways.
- Discuss next steps.

CLIMATE ACTION PLAN



Climate Action Plan (CAP)

Committed to Sustainability

- Formalize the Town's commitment to reducing GHG emissions and mitigating the worst impacts of climate change.
- CAP Element supports goals, policies, and actions from other General Plan elements
- Rely on the innovation, compassion, diversity, and strong networks of Truckee residents.



- Build resiliency during climate change induced, extreme heat events, wildfires and other risks.
- Establish targets and goals for emissions reductions.
- Identify and implement specific measures that reduce GHG emissions to achieve the established State and Town targets.

Climate Action and Adaptation Plan (CAAP)



Figure 2: 2008 & 2016 Community-Wide GHG Emissions (MTCO₂e)

Climate Action Priorities Related to Reach Codes

- Promote and incentivize building decarbonization and energy efficiency in new development.
- Increase low and zero emissions vehicle options to work towards a carbon neutral transportation system.
- Increase energy efficiency in existing developments to reduce energy use in the built environment.
- Decrease Greenhouse Gas Emissions through increasing clean energy use.

REACH CODE BACKGROUND





Global & Domestic Context

- Climate Change in CA: extreme weather, wildfires, coastal erosion, and sea level rise
- Efforts related to climate action and decarbonization:
 - Paris 2015: 192 Parties agreed to limit the temperature increase and reduce GHG emissions
 - President Biden signed EO 14008: "government-wide approach to the climate change"
 - Gov. Brown issued EO B-30-15: reduce GHG emissions 40% below 1990 levels by 2030
 - Gov. Newsom issued EO N-79-20: 100% in-state sales of new passenger cars/trucks to be zero-emission by 2035
 - California is committed to becoming carbon-neutral by 2045
- CA jurisdictions are adopting local reach codes in support of climate goals



Why Reach Codes?

- Supports local governments reach various policy goals.
- Benefits:
 - Save energy
 - Reduce greenhouse gas emissions
 - Contribute to climate goals
- Furthers decarbonization efforts when clean energy is available



What is a Reach Code?

- Statewide Code updated every three years. (2022 code will take effect 1/1/23)
- Reach Code is a voluntary code that "reaches" beyond baseline requirements
- Based on local prototypes built within
 CEC-approved energy modeling software
- Requires cost-effectiveness studies that outline modeling assumptions
- Must not preempt federal appliance efficiency standards





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Reach Code Process: Development to Implementation



Introduction to Building Decarbonization





What is Building Decarbonization?

- Energy efficiency measures that reduce energy usage (i.e. weatherization measures, insulation, LED lights).
- Uses efficient appliances and equipment in homes and businesses.
 - Induction cooktops
 - Heat pump water heaters
 - Heat pump heating and air ventilation (HVAC) systems



Photo Credit: City of Palo Alto Utilities

Why Building Decarbonization?

- Offers financial, health, and environmental benefits.
 - Better for indoor air quality
 - More efficient appliances save money
 - Electric appliances can be powered by clean energy (carbon-free/renewable)



ID 360°

Decarbonization

- Carbon-free
- Lowest-cost, lowest-risk pathway
- Healthier indoor air
- Job creation



California Buildings Gas Usage



2006 California Commercial End Use Survey

Electric is already the majority

Of national new construction homes:

- 60% use electric space heating
 - 40% of which are heat pumps
- 55% use electric water heating
- 62% use electric cooking
- 75% use electric clothes drying



Sources: 1) <u>2017 American Community Survey</u> 2) <u>2017 IEA Heat Pump</u> <u>Conference Proceedings</u>

Equipment Efficiency

Energy Efficiency Comparison of Technology





Space Heating



Water Heating





Residential





Cooking





Clothes Drying





DECARBONIZATION REACH CODES





Adoption of Decarbonization Reach Codes

- 54 California Jurisdictions (as of 12/10/21)
- Variety of policy approaches to reach codes:
 - All-Electric Only Whole Building
 - All-Electric Only Specific Systems
 - Electric-Preferred
 - Efficiency
 - Electric Vehicle Charging Infrastructure



Neighbors with Local Reach Codes



• Sacramento is the closest city that has adopted a Local Reach Code.

2022 CALIFORNIA ENERGY CODE HIGHLIGHTS



2022 California Energy Code: Highlights

New Construction

- Heat pumps = prescriptive baseline
 - Residential: space heating or water heating
 - Nonresidential: water and/or space heating for most building types
 - Performance credit for all-electric design
- Residential
 - Pre-wiring required for gas appliances
 - Higher ventilation rate for gas stoves
 - Energy storage readiness
- Nonresidential
 - Solar PV and Battery Storage prescriptive

Existing Buildings

- Restricts newly installed electric resistance heating
- Simplified language for heat pump retrofits



2022 STATEWIDE REACH CODES INITIATIVE



2022 Statewide Reach Codes: Updates

- Draft results for Single-Family and Nonresidential Cost-Effectiveness Studies released
- Final results anticipated to be available during Q3 2022
- Multifamily New Construction Cost-Effectiveness Study results webinar 7/7/22
- Accessory Dwelling Unit (ADU) and Electric Pool Heating analyses underway
- Simulations will be updated as necessary based on the new software versions
- Statewide Reach Codes Webinar Series:
- Reach code implementation webinar on 9/27

Ordinance Pathways: New Construction

	Efficiency	Electric- Preferred	Electric Only	Electric Only	Electric Only Plus Efficiency
			Electric Only	Natural Gas Moratorium	
Mechanism	Energy Code	Energy Code	CALGreen	Jurisdictional authority	Jurisdictional authority or CALGreen plus Energy Code
Requires	All new construction exceeds minimum energy code	Only mixed fuel buildings exceed minimum energy code	All new construction is electric only	No new gas infrastructure (Hookups or Piping)	All new construction is electric only AND exceeds minimum
Considerations	Simplicity, preserves choice, specific measures	Preserves choice, lower GHG savings	Must be renewed	Longest lasting	Biggest impact, must be renewed

2022 SINGLE FAMILY NEW CONSTRUCTION PRELIMINARY RESULTS



2022 Reach Code Compliance Metrics: Single Family

- Energy Design Ratings (3 metrics)
 - EDR1 Hourly Source Energy (proxy for GHG)
 - EDR2 Time Dependent Value (TDV)
 - EDR2 Efficiency efficiency measures
 - EDR2 Total efficiency, PV, storage combined

- Reach Code Policy Options
 - Set requirements based on EDR margins
 - Focus on EDR2 Efficiency to encourage better design
 - EDR1 All-electric designs receive credit sufficient to allow reduction in efficiency
 - EDR2 Total Adding PV (or storage) reduces score

Residential Building Prototypes

• Single Family (SF): Blended 2,400 ft²

- 50% 1-story / 2100 ft²
- 50% 2-story / 2700 ft²

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Single Family Analysis: Baseline

- 2022 Prescriptive requirements used as starting point
 - Slab on grade
 - Vented attic
 - Heat pump baseline
 - Minimum efficiency equipment
 - PV prescriptive standard
 - No change from 2019 (sized to offset electric loads in mixed-fuel home)



Single Family Analysis: Packages

- All-Electric
 - Prescriptive
 - Efficiency
 - Efficiency & NEEA HPWH
 - Efficiency & PV
 - Efficiency, PV, & Battery

- Mixed-Fuel (2022 Baseline)
 - Efficiency
 - Efficiency & PV
 - Efficiency, PV, & Battery
2022 NONRESIDENTIAL NEW CONSTRUCTION PRELIMINARY RESULTS



Nonresidential Preliminary Results: Overview

- Challenging for electrification alone to be cost-effective
- Load Flexibility improves cost-effectiveness considerably for Medium Office
- TDV metric generally found to be cost-effective more often
- Many building types and climate zones can cost-effectively construct all-electric
- Restaurant all-electric cooking not yet cost-effective
- PG&E rates, electricity costs about \$0.218 / kwh from PG&E and about \$0.132 from TDPUD

2022 Reach Code Compliance Metrics: NonRes

- Three metrics (comply with all 3)
- Time Dependent Valuation (TDV energy)
 - TDV Efficiency efficiency measures
 - TDV Total efficiency, PV, storage combined
- Source Energy Use (proxy for GHG)

- Reach Code Policy Options
 - Set requirements based on compliance margins
 - Focus on Efficiency and Load
 Flexibility to improve cost-effectiveness

Nonresidential Prototypes

	Medium Office (MO)	Medium Retail (RE)	Quick Service Restaurant (QSR)	Small Hotel (SH)
CFA	53,628 ft ²	24,692 ft ²	2,501 ft ²	42,552 ft ²
Stories	3	1	1	4
WWR	33%	7.1%	14%	11%
Thermal zoning	Large core, 4 perimeter zones	Large core, 4 very small zones	Dining, Kitchen	77 Guest rooms, laundry, NR areas



Nonresidential Analysis: Packages

	Mixed Fuel		All-Electric			
	Code Minimum Efficiency (Baseline)	Energy Efficiency	Code Minimum Efficiency	Energy Efficiency	Energy Efficiency + Load Flexibility	
MO	Y	Y	Y	Y	Y	
RE	Y	Y	Y	Y	Ν	
QSR	Y	Y	Y*	Y*	Y	
SH	Y	Y	Y**	Y**	Ν	

* Two scenarios: HVAC and water heating electrification only, with and without cooking electrification ** Includes electrification of laundry water heating and dryer



Load Flexibility

- Medium Office (MO): Smart Thermostat + Demand Response Lighting
- Quick Service Restaurant (QSR): Heat Pump Water Heater (HPWH) Load Shift

Table Summary – Climate Zone 16 Residential

Packages Cost-effective for Climate Zone 16		
Packages	Method	
All-Electric Prescriptive	TDV	
All-Electric Efficiency & PV	On-Bill	
All-Electric Efficiency, PV, & Battery	On-Bill	
Mixed-Fuel Efficiency	On-Bill	
Mixed-Fuel Efficiency & PV	On-Bill	
Mixed-Fuel Efficiency, PV, & Battery	TDV	

Packages NOT Cost-effective for Climate Zone 16		
Packages	Method	
All-Electric Prescriptive	On-Bill	
All-Electric Efficiency	On-Bill	
All-Electric Efficiency & NEEA	On-Bill	
Mixed-Fuel Efficiency PV, & Battery	On-Bill	

Table Summary – Climate Zone 16 Non-Residential

	Packages Cost-effective for Climate Zone 16	
Prototype	Packages	Method
Retail	All-Electric Minimum Efficiency	TDV
Retail	All-Electric + Efficiency	TDV
Quick Service Restaurant	All-Electric + Efficiency + Mixed Fuel Cooking	On-Bill
Quick Service Restaurant	All-Electric + Efficiency + Load Flexibility	On-Bill & TDV
Hotel	All-Electric Minimum Efficiency	TDV
Hotel	All-Electric + Efficiency Measures	TDV

Table Summary – Climate Zone 16 Non-Residential

Packages N	Packages NOT Cost-effective for Climate Zone 16			
Prototype	Packages	Method		
Medium Office	All-Electric Minimum Efficiency	On-Bill & TDV		
Medium Office	All-Electric + Efficiency	On-Bill & TDV		
Medium Office	All-Electric + Efficiency+ Load Flexibility	On-Bill & TDV		
Retail	All-Electric Minimum Efficiency	On-Bill		
Retail	All-Electric + Efficiency	On-Bill		
Quick Service Restaurant	All-Electric Minimum Efficiency	On-Bill & TDV		
Quick Service Restaurant	All-Electric Minimum Efficiency + Mixed Fuel Cooking	On-Bill & TDV		
Quick Service Restaurant	All-Electric + Efficiency + Mixed-Fuel Cooking	TDV		
Hotel	All-Electric Minimum Efficiency	On-Bill		
Hotel	All-Electric Efficiency Measures	On-Bill		

DECARBONIZATION INCENTIVES







About the BUILD Initiative

- The Building Initiative for Low-Emissions Development (BUILD) Program is a residential building decarbonization program.
- BUILD provides incentives and technical assistance to support the adoption of advanced building design and all-electric technologies in new, low-income all-electric homes.
- BUILD encourages adoption of clean energy technologies in affordable housing developments.





Why Participate in BUILD?

- Receive up to \$2,000,000 in incentives to reduce construction costs
- Reduce long-term utility costs for both developer and residents
- Build applicant's in-house capacity for all electric buildings
- Prepare for current and future state and local building decarbonization policies
- Layer funds with other programs and incentives
- Eliminate costs for gas infrastructure

Who is Eligible?

- Building owners or developers of low-income housing with:
 - Five years' development experience
 - At least one completed lowincome project



What Projects are Eligible?

- Low-income residential housing (single-family and multifamily)
- Building must be all-electric and no hookups to the gas distribution grid
- Demonstrate modeled resident utility cost savings
- Project located in one of four gas service territories:
 - Southern California Gas, Pacific Gas & Electric, San Diego Gas & Electric, and Southwest Gas Corporation



Eligible Residential Buildings

- Newly constructed buildings
- Existing buildings repurposed for housing
- Building additions or renovations where 50% or more of the exterior weight bearing walls are removed or demolished

Sample Eligible Building Types

 Single-family homes • Duplexes/triplexes/ quadplexes • Multifamily apartments • Condominiums • Dormitories • Residence hotels • Assisted living facilities • Homeless/transitional housing
 Farmworker housing • Mixed-use buildings (incentive for residential portion)



TECH Initiative

ABOUT the TECH Initiative

- TECH Clean California is a \$120 million initiative designed to help advance the state's mission to achieve carbon neutrality by 2045.
- Driving the market adoption of low-emissions space and water heating technologies for existing single and multifamily homes across California—a notable source of the state's carbon footprint.
- 40% of program benefits will be targeted towards low-income and disadvantaged communities.





TECH Initiative

Key Activities

- Provide comprehensive guidance on product incentives, pilots, workforce development and training opportunities and local and state policies that impact the market.
- Expand the reach of consumer awareness campaign, <u>The Switch is On</u>, in markets with TECH initiatives in place.
- Develop custom messaging and outreach for low-income customers and disadvantaged communities through low-income facilitators and CBOs.
- Collect and publish sales data, energy and GHG impacts to inform California's long-term decarbonization strategy.

Budget

Remaining Funding Allocation for TECH Clean California General Incentives

	Total Incentives Paid (\$)	Total Paid + In Process (\$)	Reserved Funds (Total Paid + In Process + Unsubmitted) (\$)	Allocated Incentive Budget (\$)	Non-Reserved Budget Remaining (\$)	% of Budget Remaining
Total	9,572,250	30,069,250	47,485,350	40,000,000	-7,485,350	-18.7%
Single Family HPWH & HP HVAC	9,497,550	23,287,950	36,280,950	28,000,000	-8,280,950	-29.6%
Southern California Gas Territory HPWH Incentives	157,750	277,250	349,250	1,500,000	1,150,750	76.7%
Southern California Gas Territory HP HVAC Incentives	Suspended - All Incentives Reserved (\$12,292,800)					
Pacific Gas & Electric Territory	Suspended - All Incentives Reserved (\$11,855,200)					
San Diego Gas & Electric Territory		Sus	pended - All Incentives	Reserved (\$1,89	5,600)	
Southwest Gas Territory	16,500	79,700	130,700	456,400	325,700	71.4%
Multifamily HPWH & HP HVAC	74,700	6,781,300	11,204,400	12,000,000	795,600	6.6%
Southern California Gas Territory	70,700	888,100	5,311,200	5,911,200	600,000	10.2%
Pacific Gas & Electric Territory	Suspended - All Incentives Reserved (\$5,080,800)					
San Diego Gas & Electric Territory	Suspended - All Incentives Reserved (\$812,400)					
Southwest Gas Territory	-	-	-	195,600	195,600	100%



TECH: Single-Family Incentives

Heat Pump HVAC Incentives

Equipment Type	Minimum Efficiency Requirements	Total Incentive Per Unit
Package, split, mini/multi-split	Title 24 code minimum	\$1,000

Heat Pump HVAC Incentives – Quality Installation

Quality Installation Measure	Qualifier	Total Incentive (TECH + Local Program Combined)
Manual J completed	Provide calculations	\$300
Duct sealing/replacement and testing	5% Total leakage or less	\$300
Field Measured Performance (based on ASHRAE 221-2020)	Heating System Performance Ratio (HSPr) or Cooling System Performance Ratio (CSPr) = 80% or better	\$400

Note: The above installation incentives are available to be kept or passed on to the customer at the contractor's discretion.



TECH: Single-Family Incentives

Heat Pump Water Heater Incentives

Replacement Scenario	Measure Criteria	Total Incentive Per Unit By Utility Territory
Gas/propane to HPWH	All HPWH sizes	\$2,100 for PG&E \$3,100 for SCG and SWG
Electric resistance to HPWH	All HPWH sizes	\$1,000 for all

Note: The Demand Response Program enrollment bonus is \$50 and is available in all territories and can be kept by contractor



TECH: Multifamilv Incentives

Incentives for Heat Pump HVAC Systems Serving Individual Apartments

	System T	/pe		
Heat Source	Description	AHRI Test Standard	Total Incentive Per System	
Non-heat pump systems	Split or rooftop heat pump (ducted or ductless)	210/240	\$2,000	
All except PTHPs	PTHP, SPVHP, or unitary through the wall/ceiling heat pump	310/380, 390	\$500 (Single or two-stage compressor) \$1,000 (Variable capacity/inverter-driven)	

Incentives for Heat Pump HVAC Systems Serving Multiple Apartments

Previous Space Heat Source	System Type	Total Incentive (Per Apartment Served)
Non-heat pump systems	HP HVAC equipment serving multiple apartments	\$1,000



TECH: Multifamily Incentives

Incentives for Heat Pump HVAC Systems Serving Common Areas

Previous Space Heat Source	System Type	Total Incentive Per System
Non-heat pump systems	Split or rooftop heat pump (ducted or ductless)	\$1,800
	PTHP, SPVHP, or unitary through the wall/ceiling heat pump	\$300 (Single or two-stage compressor) \$800 (Variable capacity/inverter-driven)



TECH: Multifamily Incentives

Incentives for Electrical Panel Upgrades

Previous Equipment	System Type	Total Incentive (Per Apartment Receiving Electrical Upgrade)
Undersized apartment electrical infrastructure that is upgraded as part of an apartment's HPWH or HP HVAC installation	Apartment panel or sub panel upgrades, feeder upgrades, or service disconnect upgrades	\$1,400 Apartment unit must have received a TECH-funded HP HVAC or HPWH and must be all-electric after the electrical upgrade



TECH: Multifamily Incentives

Incentives for Unitary Heat Pump Water Heaters

Previous Water Heater Heat Source	HPWH Tank Size	Total Incentive Per System
Gas or propane	< 55 gallons	\$1,400
	>= 55 gallons	\$2,100
Electric resistance	All	\$700

Incentives for Central Heat Pump Water Heaters Serving Two or More Apartments

Previous Water Heater Heat Source	HPWH Storage Volume ¹	Total Incentive (Per Apartment Served)
Non-heat pump systems	< 15 gallons per bedroom served	\$1,200
	>= 15 gallons per bedroom served	\$1,800

¹ Storage volume only includes storage volume of water that can be heated directly by the heat pump components of the plant.

Incentives for Multifamily Heat Pump Pool or Spa Heating

Previous Space Heat Source	System Type	Total Incentive Per System
Non-heat pump systems	Heat pump pool heating	\$2,500



California Electric Homes Program - CalEHP

- Program currently under development, not yet accepting applications.
- Program will provide incentives for the construction of all-electric market-rate residential buildings.
- Program will provide incentives for installation of energy storage systems to encourage deployment of near-zeroemission building technologies.



DECARBONIZATION REACH CODE STRATEGY



Building Permit Data

Building Permit Applications Received In Last Two Years (2020-2021)

- New Residential Construction Permits
 - CY 2020 = 81 | CY 2021 = 150
 - Average = 116 New Residential Construction Permits
- New Commercial Construction Permits
 - CY 2020 = 12 | CY 2021 = 2
 - Average = 7 New Commercial Construction Permits
- Photovoltaic (PV) Permits
 - CY 2020 = 28 | CY 2021 = 58
 - Average = 43 PV Permits

Total Projects Currently Undergoing Planning Entitlement

• 70 projects currently undergoing planning entitlement.

Reach Code Policy Considerations

- Reach Code Adoption Approach
 - Natural Gas Moratorium
 - All-Electric Reach Code
 - Electric Preferred Reach Code
 - Electric Only Plus Efficiency Reach Code
 - Efficiency Reach Code

- Applicable Systems and Appliances
 - Whole Building
 - Specific Appliances
 - Heat Pump Water Heater
 - Cooking Appliance
 - Electric Dryer
 - Heat Pump Space Heating and Cooling

Reach Code Policy Considerations

- Building Types Impacted
 - New Residential Single-family and ADUs
 - New Multi-family
 - New Non-residential
 - Hotel
 - Office
 - Retail
 - Restaurant
- Exemptions for building types
 - H or I Occupancy Types
 - Existing Buildings

- Nonresidential Specific Exemptions
 - Commercial Kitchen
 - Laboratory
 - Generator
- Residential Specific Exemptions
 - Attached ADU/JADU
 - Fireplaces
 - Swimming Pool
 - Generator

DISCUSSION



Next Steps

- Develop local code based on statewide model code language and community and industry feedback. (ongoing)
- State finalizes the cost-effectiveness studies. (July 2022)
- Bring reach code to Town Council.
- Undergo state approvals and begin local enforcement.
- Second poll will be sent to schedule second committee meeting.

THANK YOU.

Speakers:

ID360



SUPPLEMENTAL SLIDES



Cost Effectiveness Studies: Overview

- Cost-effectiveness study required for local amendments to the California Energy Code
- Must demonstrate greater benefits (savings) than costs over the lifecycle of building
- Jurisdiction makes final determination if reach code is cost-effective
- "On-bill" (individual consumer) and Time Dependent Valuation (code, societal) methodologies used in studies
- Cost-effectiveness studies can be acquired in different ways:
 - Statewide cost-effectiveness studies (all climate zones)
 - New studies can be requested (e.g., electric pool heating)
 - Jurisdiction can complete a separate analysis

Cost Effectiveness Studies: How it's measured

- Payback: How many years will it take to recoup incremental capital costs?
 - First cost divided by annual savings
- Benefit-to-Cost Ratio (BCR): Do the benefits exceed the costs?
 - NPV of benefits divided by costs (must be ≥ 1.0)
- Net Present Value (NPV): Do the benefits exceed the costs?
 - NPV of benefits minus costs (must be positive value)

Cost Effectiveness Studies: Benefits (On-Bill, TDV)

On-bill

- Site energy
- Utility rates
 - Time of Use
 - Net Energy Metering (current tariff)
 - Escalation factors

Time Dependent Value

- Energy use valued differently depending on
 - Fuel source
 - Time of day
 - Season
- Cost of providing service
- Electricity used or saved during peak periods has higher value than electricity used or saved during off-peak periods

Cost Effectiveness Studies: Costs

- Initial costs
 - Gas service extension (credit for All-Electric design)
 - Equipment and materials purchase/installation
- Operation and maintenance costs
- Replacement costs/residual value
- Financing



Cost-Effectiveness Studies: 2022 Code Cycle

- New Construction
 - Single Family & ADUs
 - Multifamily (three- and five-story)
 - Non-Residential (office, retail, hotel, restaurant)
- Existing Buildings (additions, alterations)
 - Single Family
 - Low-Rise Multifamily
- Electric Pool and Spa Heating


Cost-Effectiveness Studies: Measures & Packages

- Measures assembled into packages
 - Taken together, packages are cost-effective
 - Individual measures may not be cost-effective
- Maximize energy savings and GHG reductions and maintain BCR greater or equal to 1.0
- Measures are conservative
 - Does not require major innovations or specialized design
 - Additional savings possible with design and equipment selection
- May not preempt Federal appliance standards

Cost-Effectiveness Studies: Climate Zones

- All California jurisdictions can adopt reach codes!
- Reach code must work for that climate zone (CZ)
 - Measure cost-effective in one city in particular CZ = good indicator it will be for entire CZ
 - Measure cost-effective in one CZ may not be cost-effective in another

Truckee = Climate Zone 16



Source: California Energy Code Figure 100.1-A

All Electric Prescriptive

Climate	Electric/	Total EDR1	Efficiency EDR2	On-	Bill	2022	TDV
Zone	Gas Utility	Margin	Margin	B/C Ratio	NPV	B/C Ratio	NPV
1	PGE	24.3	7.3	0.4	(\$6,807)	>1	\$5,997
2	PGE	12.8	5.6	0.4	(\$5,589)	>1	\$6,140
3	PGE	7.8	4.3	0.5	(\$4,789)	27.0	\$5,174
4	PGE	8.1	3.7	0.5	(\$3,709)	>1	\$5,816
4	CPAU	8.1	3.7	>1	\$6,396	>1	\$5,816
5	PGE	5.4	0.9	0.5	(\$4,607)	2.9	\$3,495
5	PGE/SCG	5.4	0.9	0.5	(\$4,596)	2.9	\$3,495
6	SCE/SCG	3.8	2.5	0.9	(\$645)	3.7	\$3,942
7	SDGE	2.4	2.1	0.4	(\$5,771)	3.5	\$3,846
8	SCE/SCG	1.8	0.6	0.9	(\$421)	3.3	\$3,740
9	SCE/SCG	3.0	1.1	0.9	(\$654)	3.8	\$3,965
10	SCE/SCG	4.2	1.2	0.8	(\$1,219)	4.2	\$4,087
10	SDGE	4.2	1.2	0.3	(\$10,212)	4.2	\$4,087
11	PGE	10.5	3.5	0.6	(\$2,566)	>1	\$5,960
12	PGE	10.5	4.1	0.6	(\$2,711)	>1	\$5,812
12	SMUD/PGE	10.5	4.1	>1	\$9,050	>1	\$5,812
13	PGE	7.5	2.1	0.7	(\$1,586)	>1	\$5,811
14	SCE/SCG	7.7	1.7	0.7	(\$2,048)	>1	\$5,421
14	SDGE	7.7	1.7	0.3	(\$12,617)	>1	\$5,421
15	SCE/SCG	0.4	0.2	0.9	(\$229)	3.2	\$3.593
16	PGE	23.0	5.2	0.3	(\$4,901)	>1	\$3,269

Source: California Energy Codes & StZ5dards, Draft Residential Cost-Effectiveness Results

On-Bill Comparison: All-Electric, PV, & Battery

		Prescr	<u>iptive</u>	Effici	ency	<u>& N</u>	EEA	&	PV	<u>PV, &</u>	Bat
Climate	Electric/	On-	Bill	On-	Bill	On-	Bill	On-	Bill	On-	Bill
Zone	Gas offinty	B/C Ratio	NPV	B/C Ratio	NPV	B/C Ratio	NPV	B/C Ratio	NPV	B/C Ratio	NPV
1	PGE	0.4	(\$6,807)	0.6	(\$1,968)	2.5	\$1,434	>1	\$30,417	2.8	\$18,551
2	PGE	0.4	(\$5,589)	0.4	(\$2,908)	0.7	(\$944)	>1	\$18,933	1.7	\$7,179
3	PGE	0.5	(\$4,789)	0.4	(\$3,539)	0.7	(\$846)	>1	\$13,682	1.2	\$1,935
4	PGE	0.5	(\$3,709)	0.4	(\$3,281)	0.5	(\$2,007)	>1	\$11,570	1.0	(\$53)
4	CPAU	>1	\$6,396	>1	\$5,635	>1	\$6,241	>1	\$11,371	1.0	\$76
5	PGE	0.5	(\$4,607)	0.5	(\$3,356)	0.8	(\$625)	>1	\$13,398	1.2	\$1,653
5	PGE/SCG	0.5	(\$4,596)	0.5	(\$3,345)	0.8	(\$614)	>1	\$13,409	1.2	\$1,663
6	SCE/SCG	0.9	(\$645)	0.7	(\$1,152)	0.9	(\$301)	>1	\$7,261	1.0	(\$127)
7	SDGE	0.4	(\$5,771)	0.4	(\$5,156)	0.4	(\$3,931)	>1	\$11,634	1.3	\$2,839
8	SCE/SCG	0.9	(\$421)	0.8	(\$741)	1.0	(\$43)	>1	\$6,204	0.9	(\$641)
9	SCE/SCG	0.9	(\$654)	0.8	(\$877)	1.0	(\$107)	>1	\$7,017	1.0	\$129
10	SCE/SCG	0.8	(\$1,219)	0.7	(\$1,263)	0.9	(\$394)	>1	\$7,507	1.1	\$1,078
10	SDGE	0.3	(\$10,212)	0.2	(\$9,305)	0.2	(\$7,973)	>1	\$11,920	1.4	\$3,928
11	PGE	0.6	(\$2,566)	0.8	(\$619)	1.7	\$797	>1	\$16,506	1.5	\$5,483
12	PGE	0.6	(\$2,711)	0.5	(\$1,842)	0.9	(\$298)	>1	\$16,431	1.5	\$5,009
12	SMUD/PGE	>1	\$9,050	>1	\$7,947	>1	\$8,379	>1	\$15,891	1.4	\$4,158
13	PGE	0.7	(\$1,586)	1.0	\$68	2.8	\$1,196	>1	\$12,617	1.2	\$1,801
14	SCE/SCG	0.7	(\$2,048)	0.9	(\$114)	>1	\$1,323	>1	\$13,034	1.6	\$7,205
14	SDGE	0.3	(\$12,617)	0.1	(\$8,789)	0.2	(\$5,555)	>1	\$23,366	2.0	\$11,238
15	SCE/SCG	0.9	(\$229)	2.2	\$1,106	6.0	\$1,562	>1	\$2,084	0.7	(\$2,872)
16	PGE	0.3	(\$4,901)	0.2	(\$3,440)	0.2	(\$2,103)	>1	\$26,914	2.3	\$15,312

Source: California Energy Codes & Stz6dards, Draft Residential Cost-Effectiveness Results

Mixed-	Fuel	Pac	kag	jes	Effic	iency	Effic &	<u>iency</u> <u>PV</u>	<u>Effici</u> PV, 8	<u>ency,</u> & Bat
	Climate	Electric/	Total	Efficiency	On	Bill	On	-Bill	On	-Bill
	Zone	Gas Utility	EDR1 Margin	EDR2 Margin	B/C Ratio	NPV	B/C Ratio	NPV	B/C Ratio	NPV
	1	PGE	17.2	22.1	3.1	\$3,651	2.2	\$8,299	0.9	(\$2,664)
	2	PGE	14.4	14.2	1.9	\$1,751	2.0	\$4,974	0.6	(\$6,425)
	3	PGE	12.9	10.8	1.4	\$713	1.9	\$3,698	0.5	(\$7,663)
	4	PGE	13.5	9.8	1.0	\$18	1.5	\$2,068	0.4	(\$9,413)
	4	CPAU	13.5	9.8	0.5	(\$949)	0.8	(\$935)	0.2	(\$11,917)
	5	PGE	14.5	10.6	1.5	\$607	2.0	\$4,119	0.5	(\$7,425)
	5	PGE/SCG	14.5	10.6	1.4	\$408	2.0	\$3,920	0.5	(\$7,624)
	6	SCE/SCG	18.2	9.7	0.7	(\$574)	1.5	\$1,770	0.5	(\$7,154)
	7	SDGE	18.6	8.1	1.5	\$503	2.8	\$5,787	0.6	(\$6,282)
	8	SCE/SCG	17.1	9.7	0.8	(\$321)	1.5	\$1,666	0.6	(\$6,243)
1	9	SCE/SCG	16.4	8.8	0.8	(\$240)	1.6	\$1,907	0.6	(\$6,058)
l	10	SCE/SCG	15.0	8.9	0.9	(\$107)	1.6	\$1,958	0.6	(\$5,420)
	10	SDGE	15.0	8.9	1.5	\$817	2.4	\$4,645	0.5	(\$7,039)
	11	PGE	13.2	11.3	1.9	\$2,016	2.1	\$4,627	0.6	(\$5,857)
	12	PGE	13.4	11.3	1.4	\$791	1.8	\$3,631	0.5	(\$7,601)
	12	SMUD/PGE	13.4	11.3	1.0	(\$23)	1.1	\$343	0.4	(\$10,363)
	13	PGE	12.8	9.9	1.7	\$1,663	2.2	\$4,948	0.7	(\$4,676)
	14	SCE/SCG	14.0	11.4	1.6	\$1,610	2.0	\$5,460	1.0	(\$819)
	14	SDGE	14.0	11.4	2.5	\$4,364	2.4	\$7,946	0.8	(\$3,494)
	15	SCE/SCG	14.0	8.7	1.6	\$1.351	1.6	\$1,481	0.8	(\$1.981)
	16	PGE	20.9	23.0	1.9	\$3,205	2.1	\$7,883	0.8	(\$3,301)

Source: California Energy Codes & Standards, Draft Residential Cost-Effectiveness Results

Mixed-Fuel: Efficiency, PV & Battery

Climate	Electric/	EDR1	EDR2	On-	Bill	2022	TDV
Zone	Gas Utility	Margin	Margin	B/C Ratio	NPV	B/C Ratio	NPV
1	PGE	24.3	7.3	0.9	(\$2,664)	1.0	\$27
2	PGE	12.8	5.6	0.6	(\$6,425)	1.3	\$4,243
3	PGE	7.8	4.3	0.5	(\$7,663)	1.1	\$883
4	PGE	8.1	3.7	0.4	(\$9,413)	1.1	\$1,099
4	CPAU	8.1	3.7	0.2	(\$11,917)	1.1	\$1,099
5	PGE	5.4	0.9	0.6	(\$6,553)	1.1	\$1,246
5	PGE/SCG	5.4	0.9	0.5	(\$6,752)	1.1	\$1,246
6	SCE/SCG	3.8	2.5	0.5	(\$7,154)	1.1	\$928
7	SDGE	2.4	2.1	0.6	(\$5,410)	1.0	\$547
8	SCE/SCG	1.8	0.6	0.6	(\$6,243)	1.1	\$1,865
9	SCE/SCG	3.0	1.1	0.6	(\$6,058)	1.3	\$3,779
10	SCE/SCG	4.2	1.2	0.6	(\$5,420)	1.0	\$557
10	SDGE	4.2	1.2	0.5	(\$7,039)	1.0	\$557
11	PGE	10.5	3.5	0.6	(\$5,857)	1.2	\$3,868
12	PGE	10.5	4.1	0.5	(\$7,601)	1.2	\$2,871
12	SMUD/PGE	10.5	4.1	0.4	(\$10,363)	1.2	\$2,871
13	PGE	7.5	2.1	0.7	(\$4,676)	1.3	\$4,440
14	SCE/SCG	7.7	1.7	1.0	(\$819)	1.2	\$3,639
14	SDGE	7.7	1.7	0.8	(\$3,494)	1.2	\$3,639
15	SCE/SCG	0.4	0.2	0.8	(\$1,981)	1.2	\$2,786
16	PGE	23.0	5.2	0.8	(\$3,301)	1.3	\$5,815

Source: California Energy Codes & Standards, Draft Residential Cost-Effectiveness Results

All-Electric Code Minimum Efficiency: Medium Office

cz	IOU territory	Elec Savings (kWh)	Gas Savings (therms)	GHG savings (tons)	Incremental Package Cost	Lifecycle Energy Cost Savings	Ś-TDV Savings	B/C Ratio (On- bill)	B/C Ratio (TDV)	NPV (On-bill)	NPV (TDV)
cz01	PG&E	(125,023)	6,225	4.1	(\$14,518)	(\$225,862)	(\$286,464)	0.1	0.1	(\$211,344)	(\$271,946)
cz02	PG&E	(73,889)	3,724	1.2	(\$28,311)	(\$125,954)	(\$109,287)	0.2	0.3	(\$97,643)	(\$80,976)
cz03	PG&E	(65,592)	3,289	0.8	(\$18,092)	(\$107,864)	(\$99,601)	0.2	0.2	(\$89,772)	(\$81,509)
cz04	PG&E	(47,193)	2,354	0.4	(\$18,590)	(\$73,671)	(\$73 <i>,</i> 475)	0.3	0.3	(\$55,081)	(\$54,885)
cz05	PG&E	(60,675)	3,057	1.0	(\$6,548)	(\$98,480)	(\$109,155)	0.1	0.1	(\$91,932)	(\$102,607)
cz06	SCE	(25,771)	1,242	(0.0)	(\$1,593)	(\$9,873)	(\$41,367)	0.2	0.0	(\$8,280)	(\$39,774)
cz07	SDG&E	(17,257)	856	0.2	\$1,040	(\$7,304)	(\$25,600)	-7.0	-24.6	(\$8,344)	(\$26,640)
cz08	SCE	(21,128)	1,079	0.2	(\$1,361)	(\$5,481)	(\$34,984)	0.2	0.0	(\$4,120)	(\$33,623)
cz09	SCE	(26,550)	1,260	(0.2)	(\$1,348)	(\$15,961)	(\$43,891)	0.1	0.0	(\$14,613)	(\$42,543)
cz10	SDG&E	(34,965)	1,632	(0.8)	\$403	(\$39,155)	(\$55,373)	-97.2	-137.4	(\$39,558)	(\$55,776)
cz10-2	SCE	(34,965)	1,632	(0.8)	\$403	(\$23,511)	(\$55,373)	-58.3	-137.4	(\$23,914)	(\$55,776)
cz11	PG&E	(82,229)	3,998	(0.2)	(\$4,385)	(\$143,476)	(\$126,735)	0.0	0.0	(\$139,091)	(\$122,350)
cz12	PG&E	(68,242)	3,36 3	0.1	(\$4,987)	(\$118,051)	(\$107,415)	0.0	0.0	(\$113,064)	(\$102,428)
cz13	PG&E	(56,530)	2,766	(0.6)	(\$4,480)	(\$90,487)	(\$94,308)	0.0	0.0	(\$86,007)	(\$89,828)
cz14	SDG&E	(77,899)	3,775	(0.4)	(\$3,968)	(\$157,889)	(\$120,576)	0.0	0.0	(\$153,921)	(\$116,608)
cz14-2	SCE	(77,899)	3,775	(0.4)	(\$3,968)	(\$87,979)	(\$120,576)	0.0	0.0	(\$84,011)	(\$116,608)
cz15	SCE	(15,832)	756	(0.4)	(\$1,399)	(\$6,476)	(\$27,902)	0.2	0.1	(\$5,077)	(\$26,503)
cz16	PG&E	(143,889)	7,039	4.9	(\$14,156)	(\$276,680)	(\$304,959)	0.1	0.0	(\$262,524)	(\$290,803)

All-Electric + Efficiency Measures: Medium Office

CZ	IOU territory	Elec Savings (kWh)	Gas Savings (therms)	GHG savings (tons)	Incremental Package Cost	Lifecycle Energy Cost Savings	\$-TDV Savings	B/C Ratio (On- bill)	B/C Ratio (TDV)	NPV (On-bill)	NPV (TDV)
cz01	PG&E	(111,446)	6,474	7.2	(\$8,083)	(\$167,440)	(\$250,941)	0.0	0.0	(\$159,358)	(\$242,858)
cz02	PG&E	(58,992)	3,873	4.0	(\$9,580)	(\$60,522)	(\$60,658)	0.2	0.2	(\$50,943)	(\$51,078)
cz03	PG&E	(50,559)	3,421	3.5	(\$11,657)	(\$44,926)	(\$56,002)	0.3	0.2	(\$33,269)	(\$44,345)
cz04	PG&E	(32,540)	2,448	3.1	(\$11,440)	(\$9,337)	(\$30,368)	1.2	0.4	\$2,103	(\$18,929)
cz05	PG&E	(45,493)	3,180	3.7	(\$113)	(\$35,982)	(\$69,991)	0.0	0.0	(\$35,869)	(\$69,879)
cz06	SCE	(7,927)	1,292	2 .5	\$17,853	\$70,689	\$8,952	4.0	0.5	\$52,836	(\$8,902)
cz07	SDG&E	627	890	2.7	\$20,486	\$102,102	\$21,370	5.0	1.0	\$81,615	\$883
cz08	SCE	(597)	1,123	3.0	\$18,085	\$80,391	\$19,970	4.4	1.1	\$62,306	\$1,885
cz09	SCE	(10,491)	1,311	2.4	\$5,802	\$59,653	\$5,300	10.3	0.9	\$53,851	(\$503)
cz10	SDG&E	(18,177)	1,697	1.9	\$7,553	\$68,002	(\$5,218)	9.0	-0.7	\$60,448	(\$12,771)
cz10-2	SCE	(18,177)	1,697	1.9	\$7,553	\$53,826	(\$5,218)	7.1	-0.7	\$46,273	(\$12,771)
cz11	PG&E	(65,776)	4,157	3.0	\$2,765	(\$72,374)	(\$74,700)	-26.2	-27.0	(\$75,140)	(\$77,465)
cz12	PG&E	(53,227)	3,497	3.0	\$2,163	(\$52,921)	(\$60,643)	-24.5	-28.0	(\$55,085)	(\$62,806)
cz13	PG&E	(39,364)	2,876	2.5	\$2,670	(\$17,553)	(\$40,631)	-6.6	-15.2	(\$20,224)	(\$43,302)
cz14	SDG&E	(63,342)	3,926	2.7	\$3,182	(\$60,903)	(\$70,552)	-19.1	-22.2	(\$64,086)	(\$73,735)
cz14-2	SCE	(63,342)	3,926	2.7	\$3,182	(\$15,326)	(\$70,552)	-4.8	-22.2	(\$18,508)	(\$73,735)
cz15	SCE	3,183	787	2.8	\$5,751	\$85,937	\$29,149	14.9	5.1	\$80,186	\$23,398
cz16	PG&E	(129,253)	7,321	8.5	(\$7,721)	(\$211,186)	(\$264,261)	0.0	0.0	(\$203,466)	(\$256,540)

All-Electric + Efficiency + Load Flexibility: Medium Office

		Elec Savings	Gas Savings	GHG savings	Incremental	Lifecycle Energy		B/C Ratio (On-			
CZ	IOU territory	(kWh)	(therms)	(tons)	Package Cost	Cost Savings	\$-TDV Savings	bill)	B/C Ratio (TDV)	NPV (On-bill)	NPV (TDV)
cz01	PG&E	(92,904)	6,474	12.3	(\$8,083)	(\$115,790)	(\$172,314)	0.1	0.0	(\$107,707)	(\$164,232)
cz02	PG&E	(44,933)	3,873	7.9	(\$9,580)	(\$4,661)	(\$11,274)	2.1	0.8	\$4,918	(\$1,694)
cz03	PG&E	(36,566)	3,421	7.2	(\$11,657)	\$5,837	(\$13,011)	>1	0.9	\$17,494	(\$1,354)
cz04	PG&E	(21,376)	2,448	6.1	(\$11,440)	\$40,590	\$7,482	>1	>1	\$52,030	\$18,922
cz05	PG&E	(31,579)	3,180	7.3	(\$113)	\$16,871	(\$25,230)	>1	0.0	\$16,984	(\$25,117)
cz06	SCE	1,488	1,292	5.0	\$17,853	\$140,469	\$41,117	7.9	2.3	\$122,615	\$23,263
cz07	SDG&E	8,252	890	4.6	\$20,486	\$193,074	\$46,460	9.4	2.3	\$172,588	\$25,974
cz08	SCE	7,512	1,123	5.2	\$18,085	\$155,413	\$49,110	8.6	2.7	\$137,328	\$31,025
cz09	SCE	(1,970)	1,311	4.8	\$5,802	\$139,529	\$39,223	24.0	6.8	\$133,726	\$33,421
cz10	SDG&E	(8,596)	1,697	4.7	\$7,553	\$187,376	\$31,987	24.8	4.2	\$179,822	\$24,434
cz10-2	SCE	(8,596)	1,697	4.7	\$7,553	\$137,165	\$31,987	18.2	4.2	\$129,612	\$24,434
cz11	PG&E	(53,242)	4,157	6.8	\$2,765	(\$20,046)	(\$23,875)	-7.2	-8.6	(\$22,812)	(\$26,641)
cz12	PG&E	(41,281)	3,497	6.4	\$2,163	(\$1,459)	(\$15,560)	-0.7	-7.2	(\$3,622)	(\$17,723)
cz13	PG&E	(28,829)	2,876	5.7	\$2,670	\$34,369	\$3,897	12.9	1.5	\$31,699	\$1,227
cz14	SDG&E	(50,580)	3,926	6.3	\$3,182	\$44,365	(\$24,265)	13.9	-7.6	\$41,183	(\$27,448)
cz14-2	SCE	(50,580)	3,926	6.3	\$3,182	\$65,701	(\$24,265)	20.6	-7.6	\$62,518	(\$27,448)
cz15	SCE	11,541	787	5.3	\$5,751	\$170,854	\$67,999	29.7	11.8	\$165,102	\$62,248
cz16	PG&E	(116,801)	7,321	12.1	(\$7,721)	(\$168,192)	(\$224,838)	0.0	0.0	(\$160,471)	(\$217,117)

All-Electric Code Minimum Efficiency: Retail

cz	IOU territory	Elec Savings (kWh)	Gas Savings (therms)	GHG savings (tons)	Incremental Package Cost	Lifecycle Energy Cost Savings	Ś-TDV Savings	B/C Ratio (On- bill)	B/C Ratio (TDV)	NPV (On-bill)	NPV (TDV)
cz01	PG&E	(28,458)	3,502	13.6	(\$33,047)	(\$69,041)	(\$10,907)	0.5	3.0	(\$35,994)	\$22,140
cz02	PG&E	(12,517)	1,665	6.3	(\$10,420)	\$78,971	\$12,000	>1	>1	\$89,391	\$22,420
cz03	PG&E	(8,859)	1,287	5.0	(\$10,188)	(\$83,417)	\$10,142	0.1	>1	(\$73,229)	\$20,330
cz04	PG&E	(5,584)	1,011	4.0	(\$10,204)	(\$7,284)	\$12,733	1.4	>1	\$2,920	\$22,937
cz05	PG&E	(7,891)	1,076	3.9	(\$9,023)	\$2,261	(\$1,202)	>1	7.5	\$11,284	\$7,821
cz06	SCE	(1,304)	466	1.9	(\$9,010)	\$2,923	\$8,150	>1	>1	\$11,933	\$17,160
cz07	SDG&E	(2,953)	350	1.2	(\$6,077)	(\$6,050)	\$288	1.0	>1	\$27	\$6,365
cz08	SCE	(533)	439	1.9	(\$9,121)	\$15,748	\$11,299	>1	>1	\$24,869	\$20,420
cz09	SCE	(4,750)	526	1.8	(\$6,086)	\$1,219	(\$966)	>1	6.3	\$7,305	\$5,120
cz10	SDG&E	(7,280)	753	2.5	(\$6,117)	(\$29,654)	(\$1,557)	0.2	3.9	(\$23,537)	\$4,560
cz10-2	SCE	(7,280)	753	2.5	(\$6,117)	(\$17,377)	(\$1,557)	0.4	3.9	(\$11,260)	\$4,560
cz11	PG&E	(16,369)	1,866	6.6	(\$6,098)	(\$28,658)	\$2,804	0.2	>1	(\$22,560)	\$8,902
cz12	PG&E	(10,542)	1,585	6.0	(\$9,141)	(\$8,758)	\$14,871	1.0	>1	\$383	\$24,012
cz13	PG&E	(13,052)	1,404	4.8	(\$6,097)	(\$25,741)	(\$1,118)	0.2	5.5	(\$19,644)	\$4,979
cz14	SDG&E	(13,851)	1,543	5.0	(\$6,030)	(\$59,505)	(\$787)	0.1	7.7	(\$53,475)	\$5,243
cz14-2	SCE	(13,851)	1,543	5.0	(\$6,030)	(\$23,716)	(\$787)	0.3	7.7	(\$17,686)	\$5,243
cz15	SCE	(3,993)	324	1.0	(\$6,086)	(\$3,503)	(\$4,928)	1.7	1.2	\$2,583	\$1,158
cz16	PG&E	(43,724)	4,076	14.0	(\$67,914)	(\$143,365)	(\$51,688)	0.5	1.3	(\$75,451)	\$16,226

All-Electric Code + Efficiency: Retail

CZ	IOU territory	Elec Savings (kWh)	Gas Savings (therms)	GHG savings (tons)	Incremental Package Cost	Lifecycle Energy Cost Savings	\$-TDV Savings	B/C Ratio (On- bill)	B/C Ratio (TDV)	NPV (On-bill)	NPV (TDV)
cz01	PG&E	(12,566)	3,502	16.3	(\$29,001)	\$54,830	\$29,137	>1	>1	\$83,831	\$58,138
cz02	PG&E	6,802	1,665	9.5	(\$4,940)	\$156,033	\$63,219	>1	>1	\$160,973	\$68,159
cz03	PG&E	9,952	1,287	8.2	(\$6,142)	\$79,546	\$70,440	>1	>1	\$85 <i>,</i> 688	\$76,582
cz04	PG&E	14,256	1,011	7.4	(\$6,158)	\$174,328	\$74,020	>1	>1	\$180,486	\$80,178
cz05	PG&E	11,300	1,076	7.2	(\$4,977)	\$78,642	\$51,038	>1	>1	\$83 <i>,</i> 619	\$56,015
cz06	SCE	18,843	466	5.3	(\$3,530)	\$51,769	\$69 <i>,</i> 465	>1	>1	\$55,299	\$72,995
cz07	SDG&E	18,250	350	4.9	(\$597)	\$108,391	\$62,093	>1	>1	\$108,988	\$62,690
cz08	SCE	21,555	439	5.6	(\$3,641)	\$79,170	\$85 <i>,</i> 880	>1	>1	\$82,811	\$89,521
cz09	SCE	16,246	526	5.5	(\$2,040)	\$60,580	\$54,550	>1	>1	\$62,620	\$56,590
cz10	SDG&E	(1,326)	753	3.5	(\$6,117)	(\$17,774)	\$10,729	0.3	>1	(\$11,657)	\$16,846
cz10-2	SCE	(1,326)	753	3.5	(\$6,117)	(\$7,320)	\$10,729	0.8	>1	(\$1,203)	\$16,846
cz11	PG&E	(12,469)	1,866	7.3	(\$6,098)	(\$15,992)	\$7,538	0.4	>1	(\$9,894)	\$13,636
cz12	PG&E	7,439	1,585	8.9	(\$5,095)	\$44,245	\$70,424	>1	>1	\$49,340	\$75,519
cz13	PG&E	8,915	1,404	8.3	(\$2,051)	\$48,227	\$54,387	>1	>1	\$50,278	\$56 <i>,</i> 438
cz14	SDG&E	7,524	1,543	8.6	(\$1,984)	\$13,956	\$51,032	>1	>1	\$15,940	\$53,016
cz14-2	SCE	7,524	1,543	8.6	(\$1,984)	\$30,143	\$51,032	>1	>1	\$32,127	\$53,016
c715	SCE	713	37/	1 9	(\$6,086)	\$17,209	\$8,835	>1	>1	\$73,795	\$14 921
cz16	PG&E	(40,576)	4,076	14.6	(\$67,914)	(\$134,739)	(\$44,385)	0.5	1.5	(\$66,825)	\$23,529

All-Electric Code Minimum Efficiency: Quick Service Restaurant

	IOU	Elec Savings	Gas Savings	GHG savings	Incremental Package	Lifecycle Energy Cost		B/C Ratio (On-	B/C Ratio		
CZ	territory	(kWh)	(therms)	(tons)	Cost	Savings	\$-TDV Savings	bill)	(TDV)	NPV (On-bill)	NPV (TDV)
cz01	PG&E	(147,052)	12,279	38.9	\$27,757	(\$240,794)	(\$167,123)	-8.7	-6.0	(\$268,551)	(\$194,879)
cz02	PG&E	(135,327)	11,191	34.6	\$31,996	(\$197,692)	(\$125,795)	-6.2	-3.9	(\$229,688)	(\$157,791)
cz03	PG&E	(127,058)	10,631	33.4	\$33,291	(\$206,633)	(\$128 <i>,</i> 833)	-6.2	-3.9	(\$239,924)	(\$162,124)
cz04	PG&E	(122,826)	10,290	32.5	\$33,192	(\$174,983)	(\$97,892)	-5.3	-2.9	(\$208,174)	(\$131,083)
cz05	PG&E	(128,786)	10,674	33.1	\$34,128	(\$212,799)	(\$144,921)	-6.2	-4.2	(\$246,926)	(\$179,049)
cz06	SCE	(114,516)	9,608	30.4	\$33,482	(\$262,550)	(\$106,415)	-7.8	-3.2	(\$296,032)	(\$139,897)
cz07	SDG&E	(111,728)	9,430	30.1	\$35,021	(\$473,103)	(\$118,442)	-13.5	-3.4	(\$508,124)	(\$153,463)
cz08	SCE	(113,020)	9,559	30.4	\$34,848	(\$262,420)	(\$81,009)	-7.5	-2.3	(\$297,268)	(\$115,856)
cz09	SCE	(114,892)	9,696	30.7	\$34,021	(\$267,221)	(\$78,506)	-7.9	-2.3	(\$301,241)	(\$112,527)
cz10	SDG&E	(118,903)	9,919	31.0	\$34,848	(\$478,850)	(\$99,922)	-13.7	-2.9	(\$513,698)	(\$134,770)
cz10-2	SCE	(118,903)	9,919	31.0	\$34,848	(\$273,334)	(\$99,922)	-7.8	-2.9	(\$308,182)	(\$134,770)
cz11	PG&E	(127,984)	10,783	33.8	\$34,970	(\$176,126)	(\$107,315)	-5.0	-3.1	(\$211,096)	(\$142,285)
cz12	PG&E	(128,835)	10,749	33.5	\$34,882	(\$190,209)	(\$116,904)	-5.5	-3.4	(\$225,091)	(\$151,785)
cz13	PG&E	(123,199)	10,460	33.1	\$34,921	(\$167,426)	(\$106,814)	-4.8	-3.1	(\$202,347)	(\$141,735)
cz14	SDG&E	(127,265)	10,689	32.9	\$34,085	(\$491,126)	(\$94,608)	-14.4	-2.8	(\$525,211)	(\$128,692)
cz14-2	SCE	(127,265)	10,689	32.9	\$34,085	(\$272,756)	(\$94,608)	-8.0	-2.8	(\$306,841)	(\$128,692)
cz15	SCE	(103,082)	9,199	30.3	\$35,462	(\$246,043)	(\$82,638)	-6.9	-2.3	(\$281,505)	(\$118,099)
cz16	PG&E	(154,604)	12,298	37.2	\$28,769	(\$231,548)	(\$210,098)	-8.0	-7.3	(\$260,316)	(\$238,867)

All-Electric Code Minimum Efficiency + Mixed-Fuel Cooking: Quick Service Restaurant

cz	IOU territory	Elec Savings (kWh)	Gas Savings (therms)	GHG savings (tons)	Incremental Package Cost	Lifecycle Energy Cost Savings	Ś-TDV Savings	B/C Ratio (On- bill)	B/C Ratio (TDV)	NPV (On-bill)	NPV (TDV)
cz01	PG&E	(42,174)	4,825	17.4	(\$19,363)	(\$32,674)	(\$14,025)	0.6	1.4	(\$13,312)	\$5,338
cz02	PG&E	(32,296)	3,737	12.9	(\$15,124)	(\$22,421)	(\$421)	0.7	35.9	(\$7,297)	\$14,703
cz03	PG&E	(25,714)	3,177	11.5	(\$14,659)	(\$12,796)	\$1,237	1.1	>1	\$1,863	\$15,896
cz04	PG&E	(22,613)	2,836	10.2	(\$14,693)	(\$9,577)	\$8,936	1.5	>1	\$5,116	\$23,628
cz05	PG&E	(26,729)	3,220	11.2	(\$13,013)	(\$15,991)	(\$5,724)	0.8	2.3	(\$2,978)	\$7,289
cz06	SCE	(17,064)	2,154	7.7	(\$13,572)	(\$2,310)	\$1,040	5.9	>1	\$11,262	\$14,612
cz07	SDG&E	(15,357)	1,976	7.1	(\$12,886)	(\$22,920)	(\$586)	0.6	22.0	(\$10,034)	\$12,300
cz08	SCE	(16,623)	2,105	7.5	(\$13,037)	(\$3,403)	\$2,728	3.8	>1	\$9,634	\$15,765
cz09	SCE	(17,888)	2,242	8.0	(\$13,120)	(\$8,924)	\$5,725	1.5	>1	\$4,197	\$18,845
cz10	SDG&E	(19,883)	2,465	8.5	(\$13,037)	(\$27,745)	(\$2,502)	0.5	5.2	(\$14,708)	\$10,535
cz10-2	SCE	(19,883)	2,465	8.5	(\$13,037)	(\$11,066)	(\$2,502)	1.2	5.2	\$1,971	\$10,535
cz11	PG&E	(28,111)	3,329	11.5	(\$13,002)	(\$15,796)	\$3,743	0.8	>1	(\$2,794)	\$16,746
cz12	PG&E	(27,606)	3,295	11.4	(\$13,047)	(\$15,491)	\$4,456	0.8	>1	(\$2,444)	\$17,503
cz13	PG&E	(24,240)	3,006	10.7	(\$13,007)	(\$9,929)	\$4,344	1.3	>1	\$3 <i>,</i> 078	\$17,351
cz14	SDG&E	(28,119)	3,235	10.6	(\$13,056)	(\$58,936)	(\$525)	0.2	24.9	(\$45,880)	\$12,531
cz14-2	SCE	(28,119)	3,235	10.6	(\$13,056)	(\$24,166)	(\$525)	0.5	24.9	(\$11,109)	\$12,531
cz15	SCE	(11,170)	1,745	6.5	(\$11,657)	(\$3,491)	\$7,070	3.3	>1	\$8,166	\$18,727
cz16	PG&E	(51,910)	4,844	15.4	(\$18,438)	(\$66,251)	(\$64,564)	0.3	0.3	(\$47,814)	(\$46,127)

All-Electric + Efficiency + Mixed-Fuel Cooking: Quick Service Restaurant

cz	IOU territory	Elec Savings (kWh)	Gas Savings (therms)	GHG savings (tons)	Incremental Package Cost	Lifecycle Energy Cost Savings	\$-TDV Savings	B/C Ratio (On- bill)	B/C Ratio (TDV)	NPV (On-bill)	NPV (TDV)
cz01	PG&E	(21,588)	4,825	21.3	\$1,254	\$48,804	\$38,671	38.9	30.8	\$47,550	\$37,416
cz02	PG&E	(22,483)	3,737	15.0	\$3,960	\$16,134	\$25,857	4.1	6.5	\$12,174	\$21,897
cz03	PG&E	(8,419)	3,177	14.8	\$5,958	\$55,410	\$43,415	9.3	7.3	\$49,452	\$37,457
cz04	PG&E	(6,606)	2,836	13.3	\$5,924	\$53,482	\$52,399	9.0	8.8	\$47,557	\$46,474
cz05	PG&E	(9,413)	3,220	14.7	\$7,604	\$52,307	\$37,814	6.9	5.0	\$44,703	\$30,210
cz06	SCE	(2,281)	2,154	10.6	\$7,535	\$31,978	\$38,266	4.2	5.1	\$24,442	\$30,731
cz07	SDG&E	(1,122)	1,976	9.9	\$8,221	\$20,632	\$34,774	2.5	4.2	\$12,410	\$26,553
cz08	SCE	(9,967)	2,105	8.8	\$6,047	\$17,813	\$22,445	2.9	3.7	\$11,766	\$16,397
cz09	SCE	(10,253)	2,242	9.5	\$5,474	\$14,183	\$25,472	2.6	4.7	\$8,709	\$19,998
cz10	SDG&E	(12,471)	2,465	10.1	\$5,557	\$4,993	\$22,512	0.9	4.1	(\$564)	\$16,955
cz10-2	SCE	(12,471)	2,465	10.1	\$5,557	\$11,586	\$22,512	2.1	4.1	\$6,028	\$16,955
cz11	PG&E	(17,763)	3,329	13.6	\$5,592	\$25,009	\$33,326	4.5	6.0	\$19,418	\$27,734
cz12	PG&E	(18,541)	3,295	13.4	\$5,547	\$20,099	\$29,450	3.6	5.3	\$14,551	\$23,903
cz13	PG&E	(14,805)	3,006	12.6	\$5,587	\$27,280	\$32,082	4.9	5.7	\$21,693	\$26,496
cz14	SDG&E	(18,253)	3,235	12.7	\$5,538	(\$16,114)	\$26,379	-2.9	4.8	(\$21,651)	\$20,841
cz14-2	SCE	(18,253)	3,235	12.7	\$5,538	\$6,808	\$26,379	1.2	4.8	\$1,270	\$20,841
cz15	SCE	(4,523)	1,745	7.9	\$6,937	\$22,580	\$27,222	3.3	3.9	\$15,643	\$20,285
cz16	PG&E	(31,187)	4,844	19.4	\$2,180	\$15,165	(\$6,819)	7.0	-3.1	\$12,985	(\$8,998)

All-Electric + Efficiency + Load Flexibility + Mixed-Fuel Cooking: Quick Service Restaurant

cz	IOU territory	Elec Savings (kWh)	Gas Savings (therms)	GHG savings (tons)	Incremental Package Cost	Lifecycle Energy Cost Savings	\$-TDV Savings	B/C Ratio (On- bill)	B/C Ratio (TDV)	NPV (On-bill)	NPV (TDV)
cz01	PG&E	(21,549)	4,825	22.5	(\$4,258)	\$49,316	\$52,873	>1	>1	\$53,574	\$57,131
cz02	PG&E	(22,319)	3,737	16.0	(\$1,552)	\$17,107	\$32,829	>1	>1	\$18,659	\$34,380
cz03	PG&E	(8,372)	3,177	15.8	\$446	\$55,916	\$51,661	125.4	115.9	\$55,470	\$51,215
cz04	PG&E	(6,554)	2,836	14.3	\$412	\$53,984	\$57,924	131.0	140.6	\$53,572	\$57,512
cz05	PG&E	(9,125)	3,220	15.8	\$2,092	\$53,758	\$48,741	25.7	23.3	\$51,667	\$46,649
cz06	SCE	(2,183)	2,154	11.5	\$2,023	\$39,498	\$44,206	19.5	21.9	\$37,475	\$42,184
cz07	SDG&E	(1,158)	1,976	10.7	\$2,709	\$33,585	\$42,301	12.4	15.6	\$30,876	\$39,592
cz08	SCE	(9,875)	2,105	9.7	\$535	\$23,371	\$25,954	43.7	48.5	\$22,837	\$25,419
cz09	SCE	(10,195)	2,242	10,3	(\$38)	\$22,198	\$29,074	>1	>1	\$22,237	\$29,112
cz10	SDG&E	(12,298)	2,465	10.9	\$45	\$18,335	\$27,566	408.5	614.2	\$18,290	\$27,521
cz10-2	SCE	(12,298)	2,465	10.9	\$45	\$20,020	\$27,566	446.0	614.2	\$19,975	\$27,521
cz11	PG&E	(17,722)	3,329	14.5	\$79	\$25,462	\$39,428	320.9	497.0	\$25,382	\$39,349
cz12	PG&E	(18,487)	3,295	14.3	\$35	\$20,617	\$35,977	589.0	1,027.8	\$20,582	\$35,942
cz13	PG&E	(14,856)	3,006	13.5	\$74	\$27,357	\$37,732	367.8	507.3	\$27,283	\$37,657
cz14	SDG&E	(17,938)	3,235	13.7	\$26	\$5,575	\$31,459	218.3	1,232.0	\$5,549	\$31,433
cz14-2	SCE	(17,938)	3,235	13.7	\$26	\$19,153	\$31,459	750.1	1,232.0	\$19,127	\$31,433
cz15	SCE	(4,402)	1,745	8.5	\$1,425	\$27,644	\$31,358	19.4	22.0	\$26,220	\$29,933
cz16	PG&E	(31,023)	4,844	20.9	(\$3,333)	\$16,306	\$17,427	>1	>1	\$19,639	\$20,760

All-Electric Code Minimum Efficiency: Hotel

	IOU	Elec Savings	Gas Savings	GHG savings	Incremental Package	Lifecycle Energy Cost	\$-TDV	B/C Ratio (On-	B/C Ratio	NPV (On-	NPV
CZ	territory	(kWh)	(therms)	(tons)	Cost	Savings	Savings	bill)	(TDV)	bill)	(TDV)
cz01	PG&E	(285,231)	19,776	81.1	(\$282,107)	(\$433,380)	(\$43,973)	0.7	6.4	(\$151,273)	\$238,134
cz02	PG&E	(226,043)	15,033	60.1	(\$332,685)	(\$347,841)	(\$31,858)	1.0	10.4	(\$15,156)	\$300,827
cz03	PG&E	(220,102)	14,920	60.7	(\$322,120)	(\$343,738)	(\$18,491)	0.9	17.4	(\$21,618)	\$303,629
cz04	PG&E	(197,612)	13,279	54.6	(\$322,727)	(\$281,110)	(\$28,436)	1.1	11.3	\$41,617	\$294,291
cz05	PG&E	(213,953)	14,274	57.9	(\$282,568)	(\$327,761)	(\$32,587)	0.9	8.7	(\$45,193)	\$249,981
cz06	SCE	(173,435)	11,602	48.9	(\$282,242)	(\$422,004)	(\$4,882)	0.7	57.8	(\$139,762)	\$277,360
cz07	SDG&E	(168,706)	11,261	48.0	(\$283,893)	(\$703,970)	\$770	0.4	>1	(\$420,077)	\$284,663
cz08	SCE	(166,201)	11,070	47.0	(\$285,232)	(\$387,131)	(\$13,984)	0.7	20.4	(\$101,899)	\$271,248
cz09	SCE	(173,520)	11,609	48.8	(\$282,472)	(\$377,174)	(\$14,719)	0.7	19.2	(\$94,702)	\$267,753
cz10	SDG&E	(180,333)	12,095	50.0	(\$285,232)	(\$662,556)	(\$9,201)	0.4	31.0	(\$377,324)	\$276,031
cz10-2	SCE	(180,333)	12,095	50.0	(\$285,232)	(\$387,446)	(\$9,201)	0.7	31.0	(\$102,214)	\$276,031
cz11	PG&E	(221,597)	15,350	61.3	(\$286,568)	(\$432,116)	(\$9,644)	0.7	29.7	(\$145,548)	\$276,924
cz12	PG&E	(215,898)	14,627	58.6	(\$287,634)	(\$423,070)	(\$23,255)	0.7	12.4	(\$135,436)	\$264,379
cz13	PG&E	(200,686)	13,631	55.1	(\$286,403)	(\$395,159)	(\$17,913)	0.7	16.0	(\$108,756)	\$268,490
cz14	SDG&E	(218,338)	15,034	59.6	(\$282,204)	(\$776,032)	\$4,050	0.4	>1	(\$493,828)	\$286,254
cz14-2	SCE	(218,338)	15,034	59.6	(\$282,204)	(\$437,442)	\$4,050	0.6	>1	(\$155,238)	\$286,254
cz15	SCE	(144.814)	9.528	40.9	(\$282.391)	(\$338.379)	(\$16.297)	0.8	17.3	(\$55.988)	\$266.094
cz16	PG&E	(322,165)	21,139	81.7	(\$283,683)	(\$535,999)	(\$156,336)	0.5	1.8	(\$252,316)	\$127,347

All-Electric + Efficiency Measures: Hotel

C7		Elec Savings	Gas Savings	GHG savings	Incremental Package Cost	Lifecycle Energy	\$-TDV Savings	B/C Ratio (On-	B/C Ratio (TDV)	NPV (On-bill)	
cz01	PG&F	(249 121)	19 776	83.8	(\$264,363)	(\$285.821)	\$24 117	0.9	>1	(\$21.458)	\$288,480
cz02	PG&F	(198 724)	15,033	62.4	(\$299.491)	(\$227,860)	\$33,799	1.3	>1	\$71,630	\$333,290
cz03	PG&F	(193,297)	14,920	63.2	(\$288,926)	(\$229,686)	\$40,073	1.3	>1	\$59,240	\$328,999
cz04	PG&E	(170,598)	13.279	57.0	(\$289,533)	(\$169,413)	\$41,662	1.7	>1	\$120,120	\$331,195
cz05	PG&E	(188.870)	14.274	60.2	(\$249.374)	(\$228.207)	\$18,598	1.1	>1	\$21,167	\$267.971
cz06	SCE	(151,533)	11,602	50.6	(\$249,048)	(\$334,833)	\$44,954	0.7	>1	(\$85,786)	\$294,001
cz07	SDG&E	(147,707)	11,261	49.7	(\$250,699)	(\$577,691)	\$44,290	0.4	>1	(\$326,992)	\$294,989
cz08	SCE	(142,059)	11,070	48.8	(\$252,038)	(\$287,892)	\$45,863	0.9	>1	(\$35,854)	\$297,901
cz09	SCE	(147,511)	11,609	50.9	(\$249,278)	(\$266,826)	\$52,697	0.9	>1	(\$17,548)	\$301,975
cz10	SDG&E	(152,110)	12,095	52.3	(\$252,038)	(\$490,230)	\$58,959	0.5	>1	(\$238,192)	\$310,997
cz10-2	SCE	(152,110)	12,095	52.3	(\$252,038)	(\$261,796)	\$58,959	1.0	>1	(\$9,759)	\$310,997
cz11	PG&E	(184,798)	15,350	64.8	(\$253,374)	(\$270,608)	\$81,435	0.9	>1	(\$17,234)	\$334,809
cz12	PG&E	(186,193)	14,627	61.3	(\$254,440)	(\$296,164)	\$48,009	0.9	>1	(\$41,724)	\$302,448
cz13	PG&E	(167,537)	13,631	58.1	(\$253,209)	(\$252,952)	\$70,990	1.0	>1	\$256	\$324,198
cz14	SDG&E	(180,982)	15,034	63.0	(\$249,010)	(\$547,215)	\$100,254	0.5	>1	(\$298,206)	\$349,264
cz14-2	SCE	(180,982)	15,034	63.0	(\$249,010)	(\$269,728)	\$100,254	0.9	>1	(\$20,718)	\$349,264
0715	SCE	(108,865)	0,528	127	(\$2/0 107)	(\$187,074)	\$76,133	13	>1	¢61,222	\$325,630
cz16	PG&E	(273.725)	21.139	86.3	(\$250.489)	(\$315.167)	(\$58.362)	0.8	4.3	(\$64.678)	\$192.126

2022 California Green Building Code: Highlights

Energy Efficiency

- Compliance margin assumes both heat pump space heating and water heating
- Mixed-fuel compliance pathway is allowed (e.g., with battery storage)
- Electric cooking/laundry is not mandated

EV Infrastructure

- MF, Hotels/Motels
 - New Construction: 10% EV capable, 25% EV Ready w/ low power Level 2 Receptables, 5% of parking spaces 20+ units require Level 2 EVSE
 - Existing Buildings: 10% new parking spaces
 EV Capable, 10% altered spaces EV
 Capable
- Nonresidential
 - New Construction: 15% EV Capable, 5%
 EVSE Level 2 + Load Management

EV Charging Technology



COMMUNITY ENERGY



Code Approach	Pros	Cons
Zoning Code amendment Posted on BayAreaReachCodes.Org	 Flexible (i.e., time-certain policy can be included) Developer is aware at time of land-use permit Alignment with other land use regulations 	 Should comprehensively replicate or exceed all CALGreen mandatory req's
CALGreen amendments	 May be adopted simultaneously with CALGreen All-electric building amendments 	Complex strikethrough/underlinesRequires triennial adoption

COMMUNITY ENERGY



	2019 CALGreen	2022 CALGreen	Model Code				
	Mandatory	Mandatory					
Single Family Homes and Two-Family Townhomes	(1) Level 2 EV Capab space per dw	le for one parking relling unit	2 EV spaces total: • 1 Level 2 EV Ready circuit • 1 Level 1 EV Ready circuit				





EAST BAY





Automatic Load Management



EV Charging Demand

- Increase in light-duty EV ownership
 - 250,000 EVs sold in 2021, 12.5% of all vehicles
- Sale of gas vehicles phased out by 2035
- Pervasive issues
 - Costs of electrical upgrades
 - Underserved multi-family housing occupants



Cost-Benefit - Building

- Retrofit costs shown are "best case"
- Retrofit can be much higher
 - PG&E retrofit 'cost-per-port' ave. is \$18,000
- Costs include wiring, switch gear, conduit, trenching, and secondary transformer



Sources: 1) <u>Electric Vehicle Infrastructure Cost Analysis</u> for PCE and SVCE 2) Pacific Gas and Electric Company EV Charge Network Quarterly Report, Q2 2020