

Multifamily New Construction Cost-effectiveness Study

Building Energy Efficiency Standards: January 1, 2023

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This new Cost-Effectiveness Study on Multifamily New Construction documents cost-effective combinations of measures that exceed the minimum state requirements. The analysis considers low-rise and mid-rise multifamily building types and evaluates mixed fuel and all-electric package options in all sixteen California climate zones (CZs). Two different metrics were used to assess cost-effectiveness: On-Bill and Time Dependent Valuation (TDV). The full report contains detailed definitions of these metrics as well as the new compliance metrics introduced in the 2022 Code.

Prototypes:

For this analysis, two multifamily building prototypes were used: a 3-story loaded corridor structure where access to the apartments is from an interior hallway, and a 5-story mixed use structure with retail space on the first floor. Together, these prototypes are estimated to represent 91% of new multifamily construction in California.

Climate Zones: All 16

Measure Packages

1. All-Electric Prescriptive Code: This package meets all the prescriptive requirements of 2022 Title 24, Part 6.
2. All-Electric Prescriptive Code + Photovoltaic (PV): Using the code minimum package as a starting point, PV capacity was added to offset all the estimated electricity use.
3. Mixed Fuel Efficiency Only: This package uses only efficiency measures that don't 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 all the estimated electricity use. A battery system was also added. This package only applies to the 3-story prototype (the 5-story prototype includes a battery system in the baseline per the 2022 prescriptive requirements).
5. Mixed Fuel Efficiency + PV: Using the Efficiency Package as a starting point, PV capacity was added to offset all the estimated electricity use. This package only applies to the 5-story prototype.

Study Results

Table 1 summarizes results for each prototype and depicts the efficiency TDV compliance margins achieved for each CZ and measure 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 team highlighted cells meeting both these 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.

Table 1. Summary of Efficiency TDV Compliance Margins and Cost-Effectiveness

Climate Zone	Electric /Gas Utility	3-Story				5-Story			
		All-Electric Prescriptive Code	All-Electric + PV	Mixed Fuel Efficiency	Mixed Fuel Efficiency + PV + Battery	All-Electric Prescriptive Code	All-Electric + PV	Mixed Fuel Efficiency	Mixed Fuel Efficiency + PV
CZ01	PGE	26%	26%	1%	1%	14%	14%	0%	0%
CZ02	PGE	20%	20%	1%	1%	9%	9%	1%	1%
CZ03	PGE	21%	21%	1%	1%	11%	11%	0%	0%
CZ04	PGE	18%	18%	1%	1%	9%	9%	1%	1%
CZ04	CPAU	18%	18%	1%	1%	9%	9%	1%	1%
CZ05	PGE	23%	23%	1%	1%	12%	12%	0%	0%
CZ05	PGE/SCG	23%	23%	1%	1%	12%	12%	0%	0%
CZ06	SCE/SCG	18%	18%	1%	1%	9%	9%	0%	0%
CZ07	SDGE	20%	20%	0%	0%	11%	11%	0%	0%
CZ08	SCE/SCG	13%	13%	1%	1%	8%	8%	1%	1%
CZ09	SCE	13%	13%	1%	1%	7%	7%	1%	1%
CZ10	SCE/SCG	14%	14%	3%	3%	7%	7%	2%	2%
CZ10	SDGE	14%	14%	3%	3%	7%	7%	2%	2%
CZ11	PGE	14%	14%	3%	3%	8%	8%	2%	2%
CZ12	PGE	17%	17%	2%	2%	9%	9%	2%	2%
CZ12	SMUD/PGE	17%	17%	2%	2%	9%	9%	2%	2%
CZ13	PGE	13%	13%	4%	4%	7%	7%	2%	2%
CZ14	SCE/SCG	13%	13%	3%	3%	6%	6%	2%	2%
CZ14	SDGE	13%	13%	3%	3%	6%	6%	2%	2%
CZ15	SCE/SCG	5%	5%	5%	5%	3%	3%	3%	3%
CZ16	PG&E	24%	24%	5%	5%	9%	9%	2%	2%

Key takeaways and recommendations from the analysis include:

- The Reach Codes Team found all-electric new construction to be feasible and cost-effective based on TDV in all cases. In many cases all-electric prescriptive code construction results in an increase in utility costs and is not cost-effective On-Bill. Some exceptions include the Sacramento Municipal Utility District (SMUD) and City of Palo Alto Utilities (CPAU) territories where lower electricity rates relative to gas rates result in lower overall utility bills.
- All-electric packages have lower GHG emissions than mixed-fuel packages in all cases, due to the clean power sources currently available from California's electricity generation sources.
- The 2022 Title 24 Code's new source energy metric combined with the heat pump space heating baseline in most climate zones encourages all-electric construction. While the code does not include an electric baseline for water heating, the penalty for central electric water heating observed in the performance approach in past code cycles has been removed and a credit is provided for well-designed central heat pump water heaters in most cases.
- Electrification combined with increased PV capacity results in utility cost savings and was found to be On-Bill cost-effective in all cases.
- The results in this study were based on today's net energy metering (NEM 2.0) rules and do not account for recently approved changes to the NEM tariff (referred to as the net billing tariff). The net billing tariff decreases the value of PV to the consumer as compared to NEM 2.0. As a result, the cost-effectiveness of the packages that include above-code PV capacity is expected to be less under the net billing tariff. Conversely, the net billing tariff is expected to increase On-Bill cost-effectiveness of the all-electric prescriptive code scenario. An all-electric home has better on-site utilization of generated electricity from PV than a mixed fuel home with a similar sized PV system, and as a result exports less electricity to the grid. Since the net-billing tariff values exports less than under NEM 2.0, the relative impact on annual utility costs to the mixed fuel baseline is greater.
- This analysis supports a modest reach based on either efficiency TDV or source energy for all-electric buildings. However, this may be challenging for some projects given the recent changes to which the industry must adapt, including the efficiency updates and multifamily restructuring in the 2022 Title 24, Part 6 code.

While project compliance margins using a CO₂ refrigerant heat pump water heating system are high, the Reach Code Team found lower compliance margins using other heat pump water heater system designs. Focusing on supporting projects to electrify water heating is expected to support the market shift towards central heat pump water heaters.

- For jurisdictions interested in a reach code that allows for mixed fuel buildings, the mixed fuel efficiency and PV package (and battery for the 3-story prototype) were found to be cost-effective based on TDV in all cases and cost-effective On-Bill in most climate zones. This path referred to as “Electric-Preferred” allows for mixed-fuel buildings but requires a higher building performance than for all-electric buildings. The efficiency measures evaluated in this study did not provide significant compliance benefit. As a result, the Reach Codes Team recommends establishing a compliance target based on source energy or total TDV. This would allow for PV and battery to be used to meet the target.
- Jurisdictions interested in increasing affordable multifamily housing should know that applying the CARE rates has the overall impact of increasing utility cost savings for an all-electric building in most climate zones compared to a code compliant mixed fuel building, improving On-Bill cost-effectiveness.

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. Reach codes that amend Part 6 of the CA Building Code and require energy performance beyond state code minimums must demonstrate the proposed changes are cost-effective and must obtain approval from the Energy Commission.

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.

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