CALIFORNIA ENERGY CODES & STANDARDS

A STATEWIDE UTILITY PROGRAM

Title 24, Part 11
Local Energy Efficiency Ordinances

2016 Energy Efficiency Ordinance Cost-Effectiveness Study: All Electric Non-Preempted

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Codes and Standards Program
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Table of Contents

List of Tables

List of Figures

1 Introduction

This addendum memo presents results from analysis evaluating the feasibility and cost-effectiveness of exceeding the 2016 Building Energy Efficiency Standards for all-electric single family and low-rise multifamily residential new construction located within Climate Zones 2, 3, and 13, specifically using non-preempted efficiency measures where natural gas is available at the site. This analysis builds upon the results of the CALGreen All-Electric Cost-Effectiveness Study, conducted for the California Statewide Codes and Standards Program and last modified October 11, 2017, which evaluated compliance package options across all sixteen California climate zones (DEG, 2017) (hereafter referred to as the Main All-Electric Report).

2 Methodology and Assumptions

The methodology used to develop the statewide compliance package options for all-electric buildings in the Main All-Electric Report was also used in this analysis. Refer to the Main All-Electric Report for details on the original analysis and the measures evaluated for identifying cost effective packages.

In the Main All-Electric Report, when natural gas is available, cost effective analysis assumed a heat pump water heater (HPWH) that exceeds federal minimum efficiency requirements. To avoid federal preemption issues, the following conditions were applied to all evaluated cases to ensure that any recommendations in this addendum apply to all projects, do not trigger federal preemption, and provide a basis for local jurisdictions to adopt an ordinance.

1. Natural gas was assumed to be available on-site. The CBECC-Res compliance software requires the user to specify whether natural gas is available, and adjusts the baseline assumptions, fuel selection, and Time Dependent Valuation (TDV) values according to the fuel selection. The baseline assumptions have a significant impact on the compliance margin, with more conservative results (lower compliance margins) where natural gas is available. For newly constructed buildings, natural gas is defined as being available on site in the 2016 Residential Alternative Calculation Method Reference Manual if a gas service line can be connected to the site without a gas main extension[1].
2. A split-system electric heat pump that meets the minimum federal requirements for efficiency; 14 SEER, 11.7 EER for cooling and 8.2 HSPF for heating.
3. A heat pump water heater (HPWH) that just meets the minimum federal requirement for efficiency with an Energy Factor (EF) of 2.0 was evaluated[2]. This eliminates any federal preemption issues.

Due to the effects of TDV, the all-electric designs generally result in lower overall compliance margins compared to the gas/electric designs. To compensate for the compliance penalty, efficiency measures were added as necessary to attain similar compliance margins as in the gas/electric study. As a starting point, the efficiency packages that were developed in the Main All-Electric Report were used. If the result wasn't compliant with the Title 24, Part 6 code then additional efficiency measures were added until the project met compliance. Measures used in the packages include:

- Quality Insulation Installation (QII) – HERS rater verified
- Reduced building enclosure leakage (3 ACH50)
- Improved window U-value / solar heat gain coefficient (SHGC)

[1] 2016 Residential Alternative Calculation Method Reference Manual. Section 2.2.10 (CEC, 2016).

[2] Calculated according to the latest federal efficiency standards, which define a minimum uniform energy factor (UEF). Conversion factor equations were applied to convert UEF to EF, which is the required input for the CBECC-Res simulation. A 65 gallon water heater was assumed.

- Insulated doors
- R-21 cavity wall insulation
- High performance attics (HPA)
- High efficacy air handler fans (AH Fan W/cfm)
- Duct insulation
- Low leakage ducts in conditioned space (LLDCS)
- HERS verified refrigerant charge
- HPWH location (garage or conditioned space)
- HERS verified hot water pipe insulation
- HERS verified compact hot water distribution
- PV compliance credit (PVCC)

Refer to the Main All-Electric Report for descriptions of the measures. A summary of measures and associated incremental costs is presented in Appendix A.

As in the Main All-Electric Report, photovoltaic (PV) was added to the efficiency packages and two sizing scenarios were evaluated. In both cases PV is evaluated in CBECC-Res according to the California Flexible Installation (CFI).

- PV-Plus: This package is designed to yield a minimum PV system size consistent with the PV-Plus package in the Main All-Electric Report, also the same methodology used in the CEC proposed Solar PV Ordinance (CEC, 2017a). In the ordinance PV systems are sized to offset approximately 80 percent of estimated annual electricity consumption in a mixed-fuel home[3]. This results in PV systems sized to offset less than 80 percent (33 to 73 percent) of the total building electricity use in the all-electric design but relies on a PV system size that is the same, independent of fuel mix. If all-electric designs were also required to offset the total electricity use, they would be forced to purchase and install much larger PV systems, effectively penalizing all-electric designs. It is important to note that the system sizes in this report are examples only; all projects must independently evaluate the actual electricity use and appropriate PV system size to comply with code and meet the long-term, customer objectives.
- Zero-Electric: Exceed Title 24, Part 6 through building energy efficiency and install a PV system sized to offset 100 percent of estimated building site electricity use (total kWh), including appliances and plug loads. For the all-electric case, this system size is typically slightly larger than sizing the PV system to offset 100 percent of the TDV energy use, based on 2016 TDV.

In some instances, particularly in the hot Climate Zone 13 with the zero-electric package, there may not be sufficient unshaded roof space for the required PV capacity. For these cases exceptions will need to be developed similar to what the CEC is proposing for the 2019 Title 24, Part 6 Standards.

To evaluate cost-effectiveness, current PG&E rates were used for gas, electricity and net energy metering in all three climate zones. For an analogous analysis using rates projected over the 30-year building lifetime, see the CEC's and E3's Rooftop Solar PV System Report (CEC, 2017b) and CEC's ZNE presentation (CEC, 207c).

3 Results

3.1 Single Family Results

Table 1 summarizes the package of efficiency measures applied in each climate zone. The measures in red indicate additional efficiency measures required to meet minimum compliance with the Title 24, Part 6 code. This was only necessary for Climate Zone 3 where cooling loads are negligible and water heating loads comprise a substantial portion of the compliance budget. In

[3] Appliances that are typically gas in mixed fuel homes, including those that provide space heating, water heating, cooking, and clothes dryer, are not included.

this environment, the 2.0 EF HPWH results in enough of a compliance penalty that additional water heating and space heating measures were necessary to offset this.

Table 1: Single Family Efficiency Measure Package Results –Non-Preempted All Electric

Climate Zone	Compliance Margin	PVCC	QII	ACH50	Window U-value / SHGC	Door U-value	HPA[1]	AH Fan W/cfm	Duct Ins	HPWH Location[2]	HERS Verified HW Pipe Insul.
2	14.6%	Y	Y		.30/.50	0.20	R-13			CS	Y
3	1.6%	Y	Y	3	.30/.50	0.20		0.30	R-8	CS	Y
13	24.2%	Y	Y		.30/.23	0.20				Gar	

Red items indicate measures beyond what was included in the Main All-Electric Report packages.

[1]High Performance Attic: insulation R-value refers to insulation below the roof deck.

[2]CS = conditioned space; Gar = garage.

The cost-effectiveness of each package is presented in Figure 1. The non-preempted packages described in this memo are shown along with the "Natural Gas Available" scenario from the Main All-Electric Report. Both of these cases are evaluated with natural gas available on site, the former with a minimally efficient HPWH, and the latter with a NEEA-rated HPWH. While all the packages presented are cost-effective, in all three climate zones cost-effectiveness decreases for the non-preempted cases.

Table 2 provides the results in tabular form along with energy and greenhouse gas (GHG) savings. PV sizes shown in the table are based on calculated annual electricity from CBECC-Res, and according to the California Flexible Installation (CFI). The PV-Plus systems are based on methodology developed in CEC PV Ordinance (CEC, 2017a), and the zero-electric systems are sized to offset 100% of the calculated electricity use. The lifecycle benefit-to-cost (B/C) ratio threshold of one is roughly equivalent to a simple payback of 18 years. Economics will depend on the specific project design and efficiency measures implemented. Electricity savings include additional electricity use switching from gas to electric water heating and savings from PV. Tables in Appendix B include the breakdown of savings.

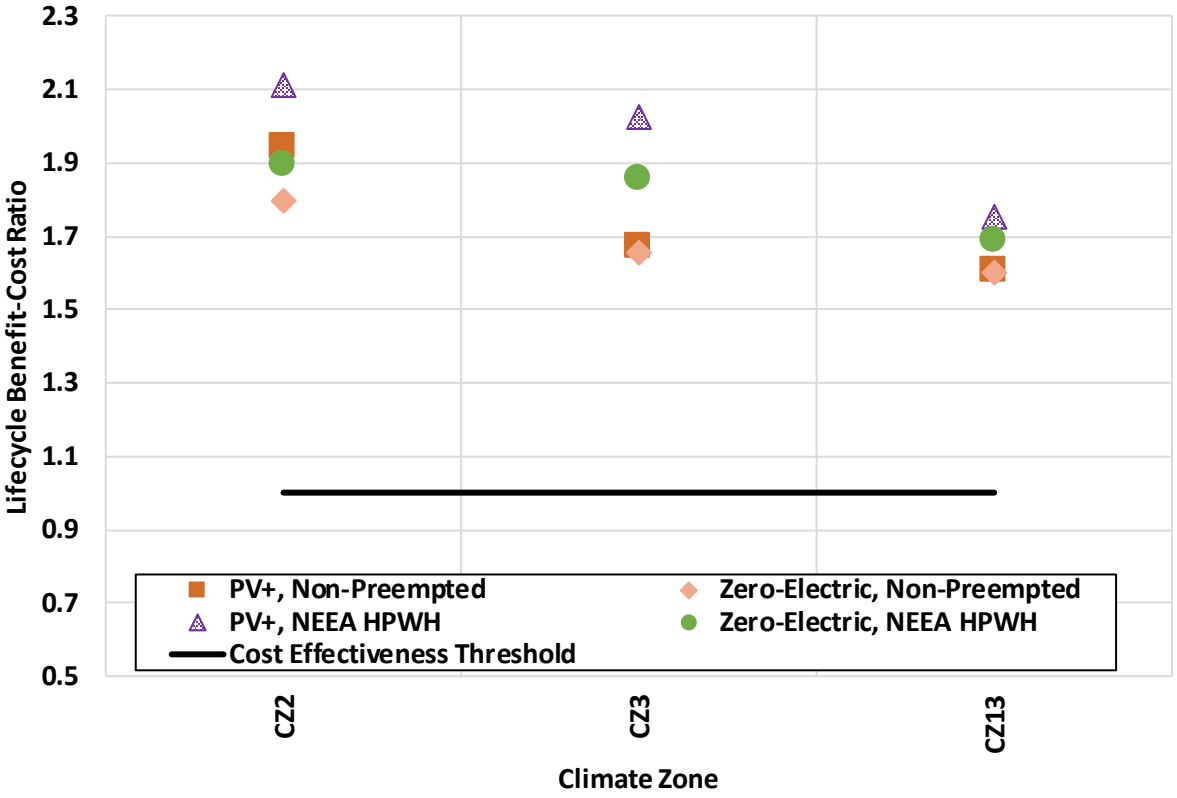


Figure 1: Single family cost effectiveness comparison

Table 2: Single Family Package Cost-Effectiveness Results

Climate Zone	T-24 Comp. Margin	PV Capacity (kW)	Elec Savings (kWh)	Gas Savings (therms)	% GHG Savings[1]	Package Cost[2]	Year 1 Utility Cost Savings	Simple Payback	Lifecycle B/C Ratio
Non-Preempted PV+ Package									
2	14.6%	2.5	3,405	122.9	54.1%	$9,598	$1,016	9.4	1.94
3	1.6%	2.6	2,972	123.5	56.6%	$9,719	$884	11.0	1.67
13	24.2%	3.7	4,725	106.6	59.5%	$12,459	$1,091	11.4	1.61
Non-Preempted Zero-Electric Package									
2	14.6%	5.4	7,972	122.9	100.0%	$19,237	$1,880	10.2	1.79
3	1.6%	5.0	6,789	123.5	100.0%	$17,696	$1,594	11.1	1.65
13	24.2%	6.5	9,122	106.6	100.0%	$21,765	$1,900	11.5	1.60

[1] Based on CA electricity production and equivalent CO_2 (CO_2e) emission rates of 0.724 lbCO_2e/kWh & 11.7 lb-CO_2e / therm.

[2] Includes 10 percent markup for builder profit and overhead.

3.2 Low-Rise Multifamily Results

Table 3 summarizes the package of efficiency measures identified in each climate. The measures in red indicate additional efficiency measures required to meet minimum compliance with the Title 24, Part 6 code. Three additional measures were necessary to meet compliance in Climate Zone 2. A compliant package could not be achieved for the multifamily prototype in Climate Zone 3.

Table 3: Multifamily Efficiency Measure Package Results – Non-Preempted All Electric

Climate Zone	Compliance Margin	PVCC	QII	Window U-value / SHGC	Door U-value	R-21 Walls	HPA[1]	AH Fan W/cfm	LLDCS[2]	Refrigerant Charge	HPWH Location[3]	HERS Compact Dist.
2	0.8%	Y	Y	0.30/0.23	0.20	Y	R-13	0.30	Y		CS	Y
3	*No Package*											
13	16.5%	Y	Y	0.30/0.23	0.20			0.30			CS	

Red items indicate measures beyond what was included in the Main All-Electric Report packages.

[1]High Performance Attic: insulation R-value refers to insulation below the roof deck.

[2]LLDCS = Low leakage duct in conditioned space HERS verification credit which requires < 25 cfm leakage to outside.

[3]CS = conditioned space.

Table 4 presents results for Climate Zone 3, showing that even after adding most commonly accepted efficiency measures which are not federally preempted, this case is still far from compliance. Envelope and water heating distribution measures can partially offset the water heating penalty; however, it cannot be fully offset. Including compliance credits from moving the HPWH into conditioned space and HERS verified compact distribution, the compliance penalty as a result of the 2.0 EF HPWH remains larger than the sum of the space heating and space cooling budgets combined. While this package does not comply with code, it is cost effective with lifecycle B/C ratios of 1.14 and 1.26 for the PV+ and the zero-electric packages, respectively.

Table 4: Climate Zone 3 Results – Non-Preempted All-Electric

Climate Zone	Compliance Margin	PVCC	QII	Window U-value / SHGC	Door U-value	R-21 Walls	HPA[1]	AH Fan W/cfm	LLDCS[2]	Refrigerant Charge	HPWH Location[3]	HERS Compact Dist.
3	-20.4%	Y	Y	0.30/0.50	0.20	Y	R-13	0.30	Y	Y	CS	Y

Red items indicate measures beyond what was included in the Main All-Electric Report packages.

[1]High Performance Attic: insulation R-value refers to insulation below the roof deck.

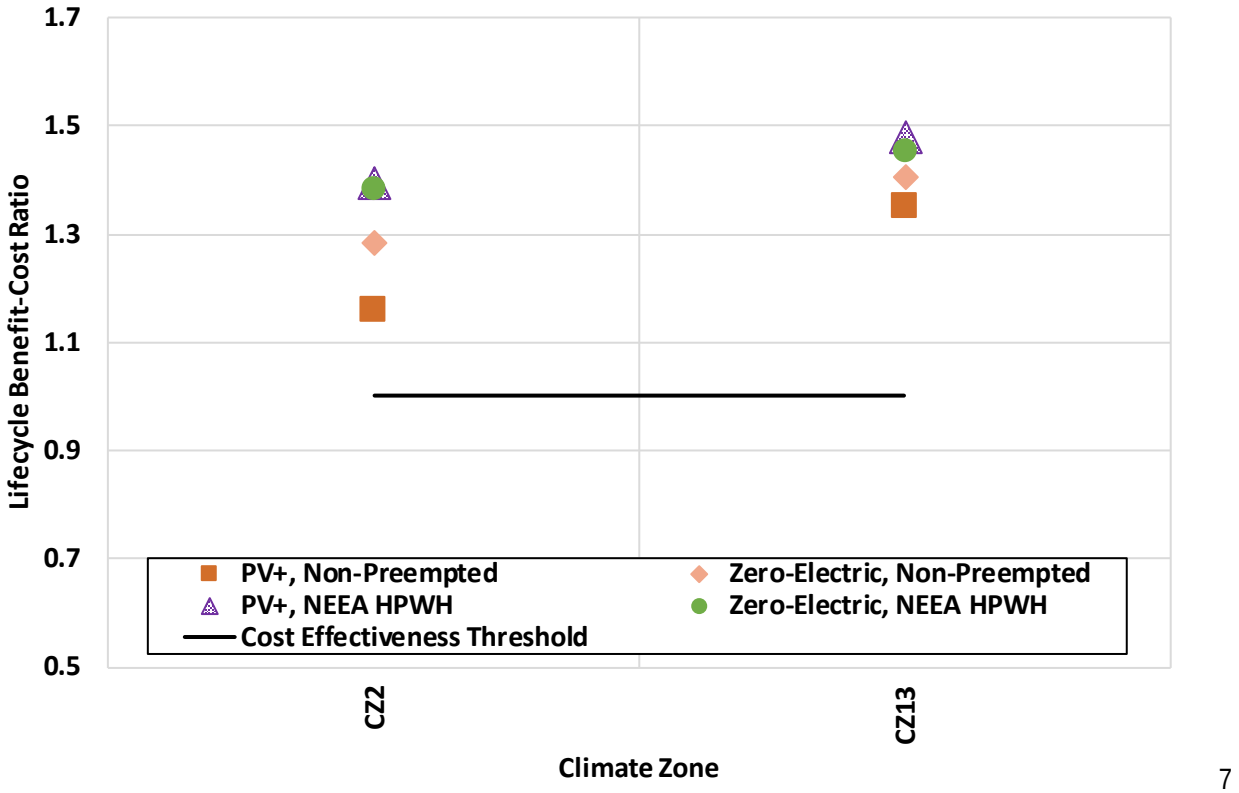
[2]LLDCS = Low leakage duct in conditioned space HERS verification credit which requires < 25 cfm leakage to outside.

[3]CS = conditioned space.

A comparison of cost effectiveness for the multifamily prototype in Climate Zones 2 and 13 is presented in Figure 2. The non-preempted packages described in this memo are shown along with the "Natural Gas Available" scenario from the Main All-Electric Report. Both of these cases are evaluated with natural gas available on site, the former with a minimally efficient HPWH and the latter with a NEEA rated HPWH. Similar to the single family results all the packages presented are cost effective with cost effectiveness decreasing for the non-preempted cases.

Table 5 provides the results in tabular form along with energy and greenhouse gas (GHG) savings. PV sizes shown in the

table are based on calculated annual electricity from CBECC-Res, and according to the California Flexible Installation (CFI). The PV-Plus systems are based on methodology developed in CEC PV Ordinance (CEC, 2017a), and the zero-electric systems are sized to offset 100% of the calculated electricity use. The lifecycle B/C ratio threshold of one is roughly equivalent to a simple payback of 18 years. Economics will depend on the specific project design and efficiency measures implemented. Electricity savings include additional electricity use switching from gas to electric water heating and savings from PV. Tables in Appendix B include the breakdown of savings.



7

Figure 2: Multifamily all-electric cost effectiveness comparison

Table 5: Multifamily Efficiency Package Cost-Effectiveness Results

Climate Zone	T-24 Comp. Margin	PV Capacity (kW)	Elec Savings (kWh)	Gas Savings (therms)	% GHG Savings[1]	Package Cost[2]	Year 1 Utility Cost Savings	Simple Payback	Lifecycle B/C Ratio
Non-Preempted PV+ Package									
2	0.8%	1.4	1,256	86.5	43%	$6,085	$384	15.8	1.16
3	*No Package*								
13	16.5%	1.8	2,109	75.1	50%	$6,644	$489	13.6	1.35
Non-Preempted Zero-Electric Package									
2	0.8%	3.3	4,198	86.5	100%	$12,006	$839	14.3	1.28
3	*No Package*								
13	16.5%	3.6	4,878	75.1	100%	$12,253	$938	13.1	1.41

Climate Zone	T-24 Comp. Margin	PV Capacity (kW)	Elec Savings (kWh)	Gas Savings (therms)	% GHG Savings[1]	Package Cost[2]	Year 1 Utility Cost Savings	Simple Payback	Lifecycle B/C Ratio

[1] Based on CA electricity production and equivalent CO_2 (CO_2e) emission rates of 0.724 lbCO_2e / kWh & 11.7 lb-CO_2e / therm.

[2] Includes 10 percent markup for builder profit and overhead.

4 Conclusions & Summary

This analysis evaluated the feasibility and cost effectiveness of exceeding the 2016 Building Energy Efficiency Standards for all-electric single family and low-rise multifamily residential new construction located within Climate Zones 2, 3, and 13, specifically using non-preempted efficiency measures where natural gas is available at the site. The results of this evaluation can provide local jurisdictions in these climate zones flexibility when adopting an energy efficiency ordinance ensuring that appropriate requirements are established, which can be met either with a mixed-fuel design or an all-electric design without federal preemption concerns. Federal preemption is not triggered in any of the cases.

Table 6 summarizes recommended cost-effective ordinance criteria for single family and multifamily buildings. Recommended Title 24 compliance margin targets were set based on results of the cost-effectiveness analysis, and are lower than those recommended in the Main All-Electric Report. Consistent with CALGreen voluntary tiers, the analysis assumes a pre-requisite for all packages includes HERS verification of Quality Insulation Installation (QII).

Table 6: All-Electric Reach Code Package Recommendations

Building Type	Climate Zone	T-24 Compliance Target	QII	PVCC Allowed	PV
SF	2	10%	Yes	Yes	Yes
	3	0%	Yes	Yes	Yes
	13	20%	Yes	Yes	Yes
MF	2	0%	Yes	Yes	Yes
	3	*No package*			
	13	10%	Yes	Yes	Yes

Compliance is much more challenging when non-preemptive heat pump water heaters are assumed. As a result, it is recommended that the PVCC be allowed to meet minimum code requirements in all cases. For single family buildings the compliance target fell from 30 percent to 10 percent for Climate Zone 2 and to 20 percent for Climate Zone 13. While it is possible to add efficiency measures and achieve higher compliance margins, this could be challenging for projects particularly in Climate Zone 2 where the package already includes several above code measures. In Climate Zone 3, additional measures had to be included simply to comply with code.

For low rise multifamily buildings in Climate Zone 2, additional measures had to be included simply to comply with code, and the compliance target dropped from 15 percent to 0 percent. In Climate Zone 13, the target dropped from 25 percent to 10 percent. In Climate Zone 3 no package of measures for multifamily buildings that was both cost effective and complied with the 2016 Title 24, Part 6 code was identified.

In most cases the package locates the HPWH within conditioned space. This is a feasible upgrade for many buildings, and can provide many benefits including reduced water heating storage losses and reduced space cooling loads for non-ducted systems. However, for some projects this can present challenges, such as increasing space heating energy use for non-

ducted systems, locating the unit and routing ducting, and may not be practical for all homes. Any jurisdiction adopting an all-electric reach code should consider allowing a trade-off for this measure.

This analysis evaluated multifamily buildings with individual water heaters only. When central water heating is specified, it is recommended that local jurisdictions work individually with these projects to ensure that the requirements can be reasonably met. There are few HPWH product options for central configurations, and those that are available may not be appropriate for all climates or project conditions. In addition, there is currently no ability to model central HPWHs in CBECC-Res, and although the CEC has a work-around, it does not allow any credit for the efficiency rating of the HPWH, resulting in a compliance margin penalty.

As noted above, achieving compliance is much more challenging using an all-electric design and minimum efficiency HPWH when natural gas is available at the site. It is important to note that the analysis does not result in packages that exceed the minimum compliance budget in Climate Zone 3 (single family) and Zones 2 and 3 (multifamily). Although there is no TDV savings, the packages do require installation of additional PV system capacity (beyond compliance credit) and result in site electricity and natural gas savings, and reduced GHG emissions.

When weighing adoption of an all-electric code, local jurisdictions should consider impacts of switching natural gas end uses to electricity, for both homeowners and the electrical grid. For example, an all-electric code may have potential grid impacts as a result of adding electrical load from electric appliances when the PV system is not generating electricity, and pushing more electricity back to the grid during peak PV generating hours. These issues can be mitigated through implementation of demand response, battery or thermal storage strategies.

5 References

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Appendix A – Measure Cost Details

Table 7: Measure Descriptions & Cost Assumptions

Measure	Performance Level	Incremental Cost		Source & Notes
		Single Family	MF–Per Unit	
HPWH	EF 2.0	$1,115	$1,115	See details in Table 8 below
QII	Yes	$519	$133	City of Palo Alto 2016 Reach Code Ordinance: http://www.cityofpaloalto.org/civicax/filebank/documents/52054
ACH50	3.0	$379	$200	NREL measure cost database ($0.115/ft² for sealing) + HERS Rater verification ($100).
Wall Insulation	R-21	$381	$94	Relative to R-19. 2016 CASE Report: Residential High Performance Walls and QII, 2016-RES-ENV2-F.
Cool Roof	Aged Reflect = 0.20	$523	$131	$0-$0.50/ft² of roof area per local industry expert at LBNL. Used average of $0.25/ft².
Window U-Factor/SHGC	0.30/0.23	$73	$20	EnerComp ($0.15/ft² of window area).
Doors	0.20 U-factor	$40	$20	EnerComp ($1.00/ft² for exterior doors).
High Performance Attics (HPA)	R-13 under roof deck	$878	$219	For Climate Zones 1-3, & 5-7 only where HPA is not prescriptive. 2016 CASE Report: Residential Ducts in Conditioned Space/High Performance Attics, 2016-RES-ENV1-F.
Fan Efficacy	0.3 watts/cfm	$143	$104	HVAC contractor costs, MF reduction for smaller capacity.
Refrigerant Charge	HERS verified	N/A	$75	Local HERS Rater.
Duct Insulation	R-8	$164	N/A	For Climate Zones 3, 6, & 7 where not prescriptive. Cost is relative to R-6. 2016 CASE Report: Residential Ducts in Conditioned Space/High Performance Attics, 2016-RES-ENV1-F.
Low Leakage Ducts in Conditioned Space	25cfm leakage to outside	N/A	$200	Only includes the cost for blower door testing (see ACH50 costs for SF above) since the basecase assume ductwork located in conditioned space and duct testing.
HERS Verification of Hot Water Pipe Insulation	HERS verified	$146	N/A	Roughly equivalent to code requirements effective Jan. 2017. ten percent of $3.87 per ft (2013 SF DHW CASE Report) for additional labor to pass HERS inspection. $100 for HERS verification per local HERS Raters.
Hot Water Compact Distribution	HERS verified	N/A	$112	Assume compact design already or easily achieved in MF units – no added cost. $100 HERS verification fee per local HERS Rater. Pipe insulation cost per the pipe insulation measure assumptions. N/A
PV System	System size varies	$2.80/W DC	$2.63/W DC	Source: Tracking the Sun IX. (https://emp.lbl.gov/sites/default/files/tracking_the_sun_ix_report.pdf). Single Family: Avg. system cost of $4.00/watt in 2015 for residential new construction. Multifamily systems: an average residential and small commercial system costs @ $3.25/watt was used. Systems are expected to be typically greater than 10 kW, although not as large as some commercial systems reported on in the database. In both cases, costs assume 30 percent for the solar investment tax credit. No NSHP incentive was used.

PV Inverter–Replacement	Micro inverter	$0.40/W DC	$0.40/W DC	Assumes inverter replacement at 20 years based on life of micro inverters. NREL cost study: $0.29/W based on new construction. (http://www.nrel.gov/docs/fy15osti/64746.pdf). Add labor cost of $275.

Table 8: HPWH Cost Assumptions

Component	Gas Tankless	2.0 EF HPWH	NEEA HPWH	Source & Notes
First material cost	$1,150	$1,368	$1,570	Internet search comparing products
First labor cost	$326	$468	$468	Itron cost study (Itron, 2014)
Present value of replacement	$513	$1,269	$1,354	Assumes 13 year equipment life for HPWHs[1], 20-year life for tankless water heaters (DOE, 2016).
Total Cost	*$1,989*	*$3,105*	*$3,392*	
Incremental Cost	-	*$1,115*	*$1,403*	

1. HPWH life based on average lifetime for storage tank water heaters.

Table 9: All-Electric Cost Assumptions – Natural Gas Available

Measure	Incremental Cost: Single Family	Incremental Cost: MF – Per Unit	Source & Notes
Site Gas Infrastructure	($1,500)	($500)	See description below.
In-house Gas Infrastructure	($200)	($150)	
Electric Service Upgrade	$200	$200	
Heat Pump Water Heater	$1,403	$1,403	See description below.
Electric Dryer	($100)	$0	Internet search comparing product pricing. Installation labor assumed the same as base.

The all-electric infrastructure and water heater costs are based on the following assumptions:

- Site Gas Infrastructure (to Building Meter). Natural gas infrastructure costs for installing a service gas line from the utility main to the point of service and providing a gas meter are $1,500 for single family and $500 per dwelling unit for multifamily. Estimates are based on multiple sources including a PG&E online calculator[4], an EPRI study (EPRI, 2016), and costs provided by both single and multifamily builders and developers. Site infrastructure costs for multifamily are on a per apartment unit basis assuming a single gas

[4] https://www.pge.com/en/myhome/customerservice/other/newconstruction/projectcosts/results.page?serviceType=gas&gasType=gas_new&electricOverType=&electricUnderType=&pevType=&proj=gas_new

main run to the building, and all gas meters in a single location at the building. These costs are expected to be conservative for a new residential development, and don't include the full savings from eliminating natural gas infrastructure to serve entire subdivisions, particularly in locations with difficult or long gas piping and trenching requirements.

- In-House Gas Infrastructure (from Meter to Appliances). Installation costs to run a gas line from the meter to the appliance location is $200 per appliance for single family and $150 for multifamily. The cost estimates include providing gas to the water heater only. This estimate was based on the EPRI study and costs provided by builders.
- Electric Service Upgrade. The EPRI study estimated $600 for additional electric service including panel upgrades and running 220V service to the water heater, air handler, dryer, and stove. For this analysis, the incremental cost only represents additional service for the water heater, for both single family and multifamily, and the dryer for single family. It is assumed that typical practice in a mixed fuel home is to run both gas and 220V service for the dryer, therefore there is no assumed incremental cost for the electric dryer. The assumed incremental cost is $200 for both single family and multifamily.
- Water Heater (HPWH). Incremental costs for the heat pump water heater are relative to a gas tankless 0.82 EF water heater which meets minimum prescriptive requirements, and include equipment, labor and replacement costs. Details are provided in Table 8 above. The costs for this study are based on the 2.0 Energy Factor HPWH to avoid federal preemption concerns.

Appendix B – Energy Savings Details

Table 10: Single Family Package Energy Savings Results

Climate Zone	T-24 Comp. Margin	PV Capacity (kW)	Elec Savings (kWh)			Gas Savings (therms)
			w/o PV	PV Only	Net Savings	
Non-Preempted PV+ Package						
2	14.6%	2.5	-452	3,857	3,405	122.9
3	1.6%	2.6	-1,076	4,049	2,972	123.5
13	24.2%	3.7	-954	5,680	4,725	106.6
Non-Preempted Zero-Electric Package						
2	14.6%	5.4	-452	8,424	7,972	122.9
3	1.6%	5.0	-1,076	7,865	6,789	123.5
13	24.2%	6.5	-954	10,076	9,122	106.6

Table 11: Multifamily Efficiency Package Energy Savings Results

Climate Zone	T-24 Comp. Margin	PV Capacity (kW)	Elec Savings (kWh)			Gas Savings (therms)
			w/o PV	PV Only	Net Savings	
Non-Preempted PV+ Package						
2	0.8%	1.4	-935	2,191	1,256	86.5
3	*No Package*					
13	16.5%	1.8	-673	2,782	2,109	75.1
Non-Preempted Zero-Electric Package						
2	0.8%	3.3	-935	5,133	4,198	86.5
3	*No Package*					
13	16.5%	3.6	-673	5,551	4,878	75.1