

Title 24, Part 6  
Local Energy Efficiency Ordinances

## PV Plus Heat Pump Water Heating for Residential Single Family New Construction Cost-Effectiveness Study

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# 1 Introduction

The California Building Energy Efficiency Standards Title 24 (Title 24), Part 6 (CEC, 2016a) is maintained and updated every three years by two state agencies, the California Energy Commission (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, Part 6. 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.

In response to the Draft Model Local Solar Ordinance (CEC, 2016b) and the Local PV Ordinance Cost Effectiveness Study (DEG, 2016a) (hereafter jointly referred to as the Solar Ordinance), the Statewide Codes and Standards Team was asked to evaluate cost-effectiveness of a local ordinance that includes heat pump water heating in conjunction with a photovoltaic (PV) system. PV sizing is increased beyond what was recommended in the Solar Ordinance to offset electricity use of the heat pump water heater (HPWH). The following needs were identified for the proposed ordinance:

- a. Must be simple and easy to implement by the local jurisdiction
- b. Must not result in oversized PV systems that may cause adverse grid impacts

This study presents the results from analysis of the feasibility and cost-effectiveness of requiring new single family residential construction to install a rooftop PV system and HPWH in addition to meeting the requirements of 2016 Title 24, Part 6. The cost-effectiveness analysis for all 16 California climate zones in this report includes meeting minimum 2016 Title 24, Part 6 efficiency performance targets plus on-site renewable energy generation sized to comply with the specifications set forth in the Solar Ordinance plus 100 percent of the estimated additional electricity use from a HPWH. In all cases the PV system is sized to ensure the capacity doesn't exceed the estimated electrical energy use of the building.

This report represents one possible structure for an ordinance; additional scenarios including both PV and above-code energy efficiency measures are documented in reports posted on the LocalEnergyCodes.com web site. Multifamily buildings are not included in the scope of this evaluation.

## 2 Methodology and Assumptions

### 2.1 Building Prototypes

The CEC defines building prototypes which it uses to evaluate the cost-effectiveness of proposed changes to Title 24 requirements. There exist two single family prototypes and one multifamily prototype, all three of which are used in this analysis in development of the above-code efficiency packages. Table 1 describes the basic characteristics of each prototype. Additional details on the prototypes can be found in the ACM Approval Manual (CEC, 2016a).

**Table 1: Prototype Characteristics**

	Single Family One-Story	Single Family Two-Story
Conditioned Floor Area	2,100 ft <sup>2</sup>	2,700 ft <sup>2</sup>
Num. of Stories	1	2
Num. of Bedrooms	3	3
Window-to-Floor Area Ratio	20%	20%

Source: 2016 Alternative Calculation Method Approval Manual.

<http://www.energy.ca.gov/2015publications/CEC-400-2015-039/CEC-400-2015-039-CMF.pdf>

The standard Energy Commission protocol for single family prototypes is to weight the simulated energy impacts by a factor that represents the distribution of single-story and two-story homes being built statewide, assuming 45 percent single-story



and 55 percent two-story. Simulation results in this study are therefore characterized according to this ratio, which is approximately equivalent to a 2,430-square foot (ft<sup>2</sup>) house<sup>1</sup>.

## 2.2 Energy Simulations

The California Building Energy Code Compliance simulation tool, CBECC-RES 2016.3.0, was used to evaluate energy impacts using the 2016 Title 24, Part 6 prescriptive standards as the benchmark, and the 2016-time dependent valuation (TDV) values. TDV is the energy metric used by the Energy Commission since the 2005 energy code was developed, to evaluate compliance with the Title 24, Part 6 standards. TDV values energy use differently depending on the fuel source (gas, electricity, and propane), time of day, and season. TDV accounts for the forecasted average annual retail price over the 30-year building lifecycle. TDV was developed to reflect the “societal value or cost” of energy including long-term projected costs, such as the cost of providing energy during peak periods of demand, and other societal costs, such as projected costs for carbon emissions. Electricity used (or saved) during peak periods has a much higher value than electricity used (or saved) during off-peak periods (Horii et al., 2014).

The methodology used in the analyses for each of the prototypical building types begins with a design that precisely meets the minimum 2016 prescriptive requirements (0 percent over compliance margin). Standards Table 150.1-A, included in Appendix A, lists the prescriptive measures that determine the baseline design in each climate zone. Other features are defined consistent with the Standard Design in the Alternative Calculation Method Reference Manual (CEC, 2016d), and are designed to meet, but not exceed, the minimum requirements. Each prototype building has the following features:

- Slab-on-grade foundation.
- Vented attic. High performance attic in climate zones where prescriptively required (climate zones (CZ) 4, 8-16) with insulation installed below roof deck per Option B. Refer to Table 150.1-A in Appendix A.
- Ductwork located in the attic.
- Split-system gas furnace with air conditioner that meets the minimum federal guidelines for efficiency.
- Individual water heater.

## 2.3 Package Development

Using the 2016 Title 24, Part 6 baseline as the starting point, the following changes were made to the prototype buildings.

- Replace the gas tankless water heater with a HPWH that either meets or exceeds the minimum federal requirement for efficiency, where the latter has federal preemption issues. See the description of Case 1 & Case 2 below.
- Add a PV system that meets the requirements as defined in Section 2.4 and qualifies for the PV Compliance Credit (PVCC).

The federal standard for residential electric water heaters greater than 55 gallons requires an Energy Factor (EF) or Uniform Energy Factor (UEF) that precludes the use of electric resistance technology, but is lower than many of the HPWHs on the market today. Based on operational challenges experienced in the past, the Northwest Energy Efficiency Alliance (NEEA) established a rating system and criteria to ensure newly installed HPWHs perform adequately, especially in colder climates. The NEEA Tier 3 rating requires an EF equal to the ENERGY STAR® performance level, and includes requirements regarding noise and prioritizing heat pump use over supplemental electric resistance heating<sup>2</sup>. According to NEEA, virtually all HPWH sales in the Pacific Northwest territory are NEEA-certified units.

In all climate zones, specifying a minimum efficiency non-NEEA rated HPWH unit in place of the baseline gas tankless water heater, without any additional measures, results in a project that is non-compliant with 2016 Title 24, Part 6.

Two packages were developed as described below. The first case assumes a minimum efficiency HPWH avoiding federal preemption issues and provides a basis for local jurisdictions to adopt. The second case shows an alternative path for

<sup>1</sup> 2,430 ft<sup>2</sup> = (45% x 2,100 ft<sup>2</sup>) + (+ 55% x 2,700 ft<sup>2</sup>)

<sup>2</sup> <http://neea.org/advancedwaterheaterspec>



projects installing a HPWH with an efficiency above the minimum set by federal regulations. The HPWH was located in the garage for all scenarios.

1. Case 1: A HPWH which just meets the minimum federal efficiency requirements of 2.0 Energy Factor (EF)<sup>3</sup> coupled with a PVCC qualified PV system and a solar thermal system where necessary to meet energy code compliance. The HPWH is 65-gallon with an input rating of 5kW.
2. Case 2: A Tier 3 NEEA-rated HPWH that exceeds federal minimum efficiency requirements with a PVCC qualified PV System. The NEEA-rated HPWH selected is a 66-gallon unit with a Uniform Energy Factor (UEF) of 3.0 and an Energy Factor of 3.2.

Case 1 initially was evaluated without solar thermal. In the warmer climate zones, the PVCC was sufficient to offset the increased energy use of the HPWH relative to the baseline case. In other climates it was not, and a solar thermal backup system was added to comply with 2016 Title 24, Part 6. As a starting point, a system with a solar fraction of 0.20 was applied (solar fraction is the percent of the water heating load met by the solar thermal system). If the result still wasn't compliant, the solar fraction was increased until compliance was met. The fraction was increased at the following discrete intervals: 20 percent, 35 percent, 50 percent, and 60 percent. Once the solar fraction was determined based on modeling, the Solar Rating & Certification Corporation's (SRRC's) OG-300 Calculator<sup>4</sup> was used to estimate solar collector area required to meet the solar fraction in each climate zone and estimate incremental costs for the solar thermal systems. For Case 2, no other measures were included.

## 2.4 PV Sizing Criteria

The PV sizing methodology for this cost-effectiveness analysis used the following approach. The intent was to offset building electricity use while minimizing the risk of requiring PV systems that produce more electricity than the building consumes on an annual basis.

1. Initial PV system sizes are based on applying the prescriptive compliance criteria from the Solar Ordinance. Table 8 in Appendix B references this base prescriptive sizing, which was designed to offset 80 percent of total building estimated electricity use for a typical gas/electric home<sup>5</sup>, with gas water heating, built to the minimum 2016 Title 24, Part 6 requirements.
2. Increase PV system size to offset 100 percent of the increase in electricity use as calculated in the CBECC-Res software, as a result of the HPWH package.<sup>6</sup>
3. PV production estimates are climate specific and are based on PV modeling in CBECC-Res, which uses the PVWatts methodology. Assumptions consistent with the New Solar Homes Partnership (NSHP) California Flexible Installation (CFI) criteria (170-degree azimuth, 5:12 roof pitch), along with a 96 percent efficiency inverter, standard PV efficiency, and standard system losses are applied.

Proposed solar PV capacities are the minimum sizes required. A builder or homeowner may choose to install larger systems, provided the system complies with all utility net energy metering (NEM) rules and does not exceed the estimated electricity use.

<sup>3</sup> 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.

<sup>4</sup> <https://secure.solar-rating.org/Certification/Ratings/RatingsSummaryPage.aspx?type=2>

<sup>5</sup> Gas appliances include those that provide space heating, water heating, cooking, and clothes drying.

<sup>6</sup> The team considered aligning this PV size increment with the prescriptive compliance approach for HPWHs which is proposed under the 2019 Title 24, Part 6 45-Day Express Terms. The intent of the 2019 prescriptive code is to require additional PV to offset any TDV performance penalty for the HPWH case relative to the standard design with a natural gas tankless water heater. However, in this study the intent is to add PV to offset all the electricity use of the electric water heating package. These two approaches, as well as other changes to the 2019 base case assumptions, are different enough that it was decided aligning the two was not logical.



## 2.5 Measure Costs

Table 2 below summarizes the incremental costs applied in this analysis. Incremental costs for the HPWH are relative to a gas tankless water heater (0.82 EF) which meets minimum prescriptive requirements, and includes equipment, labor and replacement costs.

**Table 2: Measure Cost Assumptions**

Measure	Incremental Cost
Federal Minimum Efficiency HPWH (2.0 EF)	\$1,115
NEEA Tier 3 Listed HPWH (3.2 EF)	\$1,403
Solar Thermal	\$140/ ft <sup>2</sup> collector area
PV System	\$2.80/W DC <sup>7</sup>
PV Inverter – Replacement	\$0.40/W DC

Table 3 below provides additional detail on the water heater incremental costs.

**Table 3: HPWH Cost Assumptions<sup>a, b</sup>**

Component	Gas Tankless	2.0 EF HPWH	NEEA HPWH	Source & Notes
First material cost	\$1,150	\$1,368	\$1,570	Internet search comparing products <sup>c</sup>
First labor cost	\$326	\$468	\$468	Iron cost study (Iron, 2014).
Present value of replacement	\$513	\$1,269	\$1,354	Assumes 13-year equipment life for HPWHs <sup>8</sup> , 20-year life for tankless water heaters (DOE, 2016), and the lifecycle terms described in Section 2.6.
<i>Total Cost</i>	<i>\$1,989</i>	<i>\$3,105</i>	<i>\$3,392</i>	
<i>Incremental Cost</i>	<i>-</i>	<i>\$1,115</i>	<i>\$1,403</i>	

<sup>a</sup> Maintenance costs are not included.

<sup>b</sup> These are costs to the builder. An additional ten percent markup for builder profit and overhead is added on top of the costs presented in this table.

<sup>c</sup> Websites referenced included [www.amazon.com](http://www.amazon.com) and [www.supplyhouse.com](http://www.supplyhouse.com)

Solar thermal costs are based on statistics for solar thermal system installations under the California Solar Initiative (CSI) Thermal program<sup>9</sup>. On average, systems installed through the program on single family buildings incurred a total project cost of about \$200/ ft<sup>2</sup> of solar collector area. Net costs reported in Table 2 include the 30 percent federal solar investment tax credit, but no CSI incentive. The CSI incentive for solar thermal systems with electricity as the backup fuel has been exhausted in PG&E and Southern California Edison (SCE) territories. The CSI incentive is excluded from this analysis statewide, including San Diego Gas and Electric (SDG&E) territory.

Installed costs for solar PV are estimated using statewide data from the Lawrence Berkeley National Laboratory Tracking the Sun IX report (LBNL, 2016) and based on 2015 residential new construction costs. The costs of \$4.00/watt (W) from the report represents the cost to the homeowner, and is based on new construction residential sized systems (1-4 kilowatt (kW)). Net costs reported in Table 2 include the 30 percent FSITC, but no NSHP incentive. Inverter replacement costs are included at 20

<sup>7</sup> W DC = Watts direct current

<sup>8</sup> HPWH life based on average lifetime for storage tank water heaters.

<sup>9</sup> <http://www.csithermalstats.org/download.html>



years, based on expected lifetimes of micro inverters. Inverter costs of \$0.29/W are based on an National Renewable Energy Laboratory report (NREL, 2015) with an added labor cost of \$275 for replacement.

## 2.6 Cost-Effectiveness

A customer-based approach to evaluating cost-effectiveness was used based on past experience with reach code adoption by local governments. Residential utility rates at the time of the analysis were applied to calculate utility costs for all cases and determine cost-effectiveness for the proposed packages. Annual utility costs were calculated using hourly electricity and gas output from CBECC-Res and applying the utility tariffs summarized in Table 4 and included in Appendix C. The standard residential rate (E1 in PG&E territory, D in SCE territory, & DR in SDG&E territory) was applied to the base case without any PV system. The applicable residential time-of-use (TOU) rate was applied to all cases with PV systems.<sup>10</sup> Any annual electricity production in excess of annual electricity consumption is credited to the utility account at the applicable wholesale rate based on the approved NEM2 tariffs, which is the second round of NEM tariffs now in effect, for that utility. Minimum daily use billing and mandatory non-by passable charges have been applied. The net surplus compensation rates for the different utilities are as follows<sup>11</sup>:

- PG&E: \$0.0272/kilowatt-hour (kWh)
- SCE: \$0.0256/kWh
- SDG&E: \$0.0275/kWh

There is considerable uncertainty about how the NEM tariffs will change over time. Future changes including devaluation of solar production have not been evaluated, because the proposed changes are still unknown and are not expected to change significantly in the current 2016 code cycle for which this analysis applies.

Climate zones have been applied according to the predominant investor owned utility (IOU) serving the population of each zone. Climate zones 10 and 14 have been evaluated with both SCE/SoCalGas and SDG&E tariffs since each utility has customers within these climate zones.

**Table 4: IOU Utility Tariffs Used Based on Climate Zone**

Climate Zones	Electric/Gas Utility	Electricity (Standard)	Electricity (Time-of-Use)	Natural Gas
1-5, 11-13, 16	PG&E	E1	E-TOU, Option A	G1
6, 8-10, 14, 15	SCE/SoCalGas®	D	TOU-D-T	GR
7, 10, 14	SDG&E	DR	DR-SES	GR

Source: Utility websites, See Appendix C for details on the tariffs applied.

Cost-effectiveness was evaluated for all 16 climate zones and is presented according to the lifecycle benefit-to-cost (B/C) ratio. This B/C ratio represents the cost-effectiveness of energy efficiency over a 30-year lifetime taking into account discounting of future savings and financing of incremental costs. 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. The ratio is calculated as follows:

$$\text{Lifecycle Benefit to Cost Ratio} = \frac{\text{Equation 1} \quad (\text{Annual utility cost savings} * \text{Lifecycle cost factor})}{(\text{First incremental cost} * \text{Financing factor})}$$

<sup>10</sup> Under NEM rulings by the CPUC (D-16-01-144, 1/28/16), all new PV customers shall be in an approved TOU rate structure. As of March 2016, all new PG&E net energy metering (NEM) customers are enrolled in a time-of-use rate.

(<http://www.pge.com/en/myhome/saveenergymoney/plans/tou/index.page?>)

<sup>11</sup> Net surplus compensation rates for each utility are based on a 1-year average over the period October 2016 – September 2017.



The lifecycle cost factor is 19.6 and was calculated using Equation 2 as follows. No utility rate escalation is assumed which if observed would increase the benefit-to-cost ratios found in this study. However, if peak TOU periods continue shifting into the evening and future NEM rates continue devaluing grid exports, both of which are likely, the benefit-to-cost ratios presented here would decrease.

$$\text{Lifecycle Cost Factor} = \frac{1 - (1 + \text{disc})^{-n}}{\text{disc}} \quad \text{Equation 2}$$

Where:

- $n$  = analysis and financing term of 30 years
- $\text{disc}$  = real discount rate of three percent

The financing factor is calculated as follows:

$$\text{Financing Factor} = \frac{PV_{\text{Mortgage Increase}} - PV_{\text{Tax Savings}}}{L} \quad \text{Equation 3}$$

Where:

- $L$  = first incremental cost (\$)
- $PV_{\text{Mortgage Increase}}$  = Present value of increased mortgage costs
- $PV_{\text{Tax Savings}}$  = Present value of tax savings from additional interest payments due to increased mortgage

$PV_{\text{Mortgage Increase}}$  is calculated using Equations 4 and 5.

$$P = L \frac{\left[ \frac{c}{12} * x \left( 1 + \frac{c}{12} \right)^{n * 12} \right]}{\left[ \left( 1 + \frac{c}{12} \right)^{n * 12} - 1 \right]} \quad \text{Equation 4}$$

$$PV_{\text{Mortgage Increase}} = P * x * 12 \frac{1 - (1 + \text{disc})^{-n}}{\text{disc}} \frac{1 - (1 + \text{disc})^{-n}}{\text{disc}} \quad \text{Equation 5}$$

Where:

- $P$  = incremental monthly mortgage payment (\$)
- $c$  = loan interest rate of 4.5 percent

$PV_{\text{Tax Savings}}$  is calculated using Equations 6 and 7.

$$\text{Annual Tax Savings} = \text{balance} * c * \text{taxrate} \quad \text{Equation 6}$$

$$PV_{\text{Tax Savings}} = \sum_{n=1}^{30} \text{Annual Tax Savings} * x \frac{1}{(1 + \text{disc})^n} \sum_{n=1}^{30} \text{Annual Tax Savings} * \frac{1}{(1 + \text{disc})^n} \quad \text{Equation 7}$$

Where:

- $\text{taxrate}$  = average tax rate of 20 percent (to account for tax savings due to loan interest deductions)



- *balance* = balance of incremental cost of mortgage at beginning of each year

The financing factor based on the above assumptions was 1.068 for this study.

Simple payback is also presented and is calculated using the equation below. Based on the terms described above the lifecycle B/C ratio threshold of one is roughly equivalent to a simple payback of 18 years.

$$\text{Simple payback} = \text{First incremental cost} / \text{Annual customer utility cost savings} \quad \text{Equation 8}$$

## 2.7 Greenhouse Gas Emissions

Equivalent CO<sub>2</sub> emission (CO<sub>2</sub>-e) savings were calculated using the following emission factors. Electricity factors are specific to California electricity production.

**Table 5: Equivalent CO<sub>2</sub> Emissions Factors**

Fuel	Value	Source
<i>Electricity</i>	0.724 lb. CO <sub>2</sub> -e/kWh	U.S. Environmental Protection Agency's 2007 eGRID data. <sup>12</sup>
<i>Natural Gas</i>	11.7 lb. CO <sub>2</sub> -e/therm	Emission rates for natural gas combustion as reported by the U.S. Environmental Protection Agency's GHG Equivalencies Calculator. <sup>13</sup>

# 3 Results

## 3.1 Packages

Table 6 presents results from the efficiency measure package development for both Case 1 and Case 2. In addition to the federal minimum HPWH and the PVCC, Case 1 applied a solar thermal hot water system in Climate Zones 1 through 7, and 16. In Climate Zones 8 through 15, the PVCC was sufficient to offset the increased energy use of the HPWH and still meet 2016 Title 24, Part 6 compliance requirements. The approximate collector area required to meet the specified solar thermal fraction is reported for each climate zone. Case 2 includes a NEEA rated Tier 3 HPWH with an EF of 3.2. No additional measures were necessary to meet compliance for Case 2.

<sup>12</sup> <https://www.epa.gov/energy/ghg-equivalencies-calculator-calculations-and-references>

<sup>13</sup> <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>



**Table 6: Single Family Efficiency Measure Package Results**

Climate Zone	PVCC	Case 1					Case 2		
		HPWH EF	Solar Thermal Fraction	Approximate Solar Thermal Collector Area (ft <sup>2</sup> )	PV Capacity (kW DC)	T24 Comp. Margin	HPWH EF	PV Capacity (kW DC)	T24 Comp. Margin
CZ1	Y	2.0	50%	40	4.0	1.7%	3.2	3.9	1.9%
CZ2	Y	2.0	50%	30	3.1	5.0%	3.2	3.1	5.8%
CZ3	Y	2.0	50%	30	3.2	6.6%	3.2	3.2	8.3%
CZ4	Y	2.0	20%	20	3.1	1.3%	3.2	2.8	16.0%
CZ5	Y	2.0	50%	30	2.9	2.0%	3.2	2.9	3.1%
CZ6	n/a	2.0	50%	30	3.0	0.8%	3.2	3.0	2.8%
CZ7	n/a	2.0	60%	30	2.6	6.0%	3.2	2.7	2.4%
CZ8	Y	2.0	n/a	n/a	3.5	4.4%	3.2	3.1	31.8%
CZ9	Y	2.0	n/a	n/a	3.4	11.2%	3.2	2.9	28.1%
CZ10	Y	2.0	n/a	n/a	3.4	9.1%	3.2	3.0	25.5%
CZ11	Y	2.0	n/a	n/a	4.5	8.1%	3.2	4.0	17.2%
CZ12	Y	2.0	n/a	n/a	4.0	5.9%	3.2	3.5	20.7%
CZ13	Y	2.0	n/a	n/a	4.6	11.2%	3.2	4.2	19.9%
CZ14	Y	2.0	n/a	n/a	3.4	6.9%	3.2	3.0	16.2%
CZ15	Y	2.0	n/a	n/a	5.2	13.0%	3.2	4.9	17.9%
CZ16	Y	2.0	35%	30	3.5	5.1%	3.2	3.4	7.6%

### 3.2 Cost-Effectiveness

A comparison of cost-effectiveness across climate zones is presented in Figure 1. Table 7 provides the results in tabular form, along with energy and greenhouse gas (GHG) savings. The lifecycle B/C ratio threshold of one is roughly equivalent to a simple payback of 18 years.

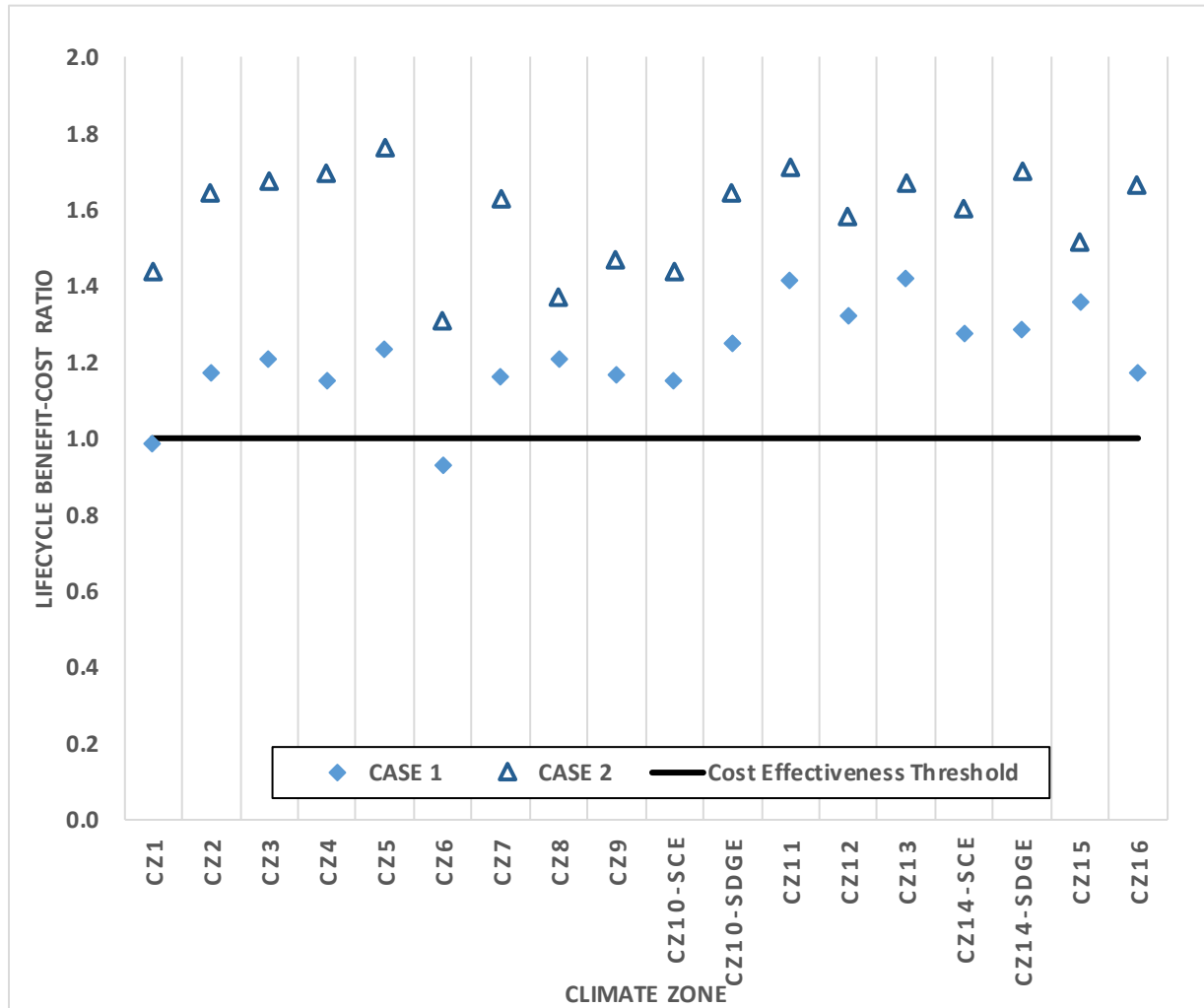
The PV system capacity is sized to meet the prescriptive PV capacities recommended in the Solar Ordinance in addition to offsetting 100 percent of the incremental electricity use for the HPWH package relative to the 2016 Title 24, Part 6 baseline case. Capacities range from 2.6 kW DC in mild Climate Zone 7 to 5.2 kW DC in hot Climate Zone 15. The impact of sizing the PV to offset the HPWH electricity use is an increase in PV system size by 0.3 to 1.1 kW DC relative to just offsetting 80 percent of electricity use, depending on climate zone and the case. Greenhouse gas (GHG) savings range from 39 percent to 76 percent.

Case 1 is cost-effective in all climate zones with the exception of Climate Zones 1 and 6. In these zones, the analysis does not result in a viable non-preempted option. Solar thermal costs would need to come down substantially (approximately 40 percent) from the estimated \$200/ft<sup>2</sup> of collector area in order for the packages to be cost-effective in these climate zones. Case 2 demonstrates cost-effectiveness in all climate zones with a B/C ratio ranging from 1.2 to 1.7.

The PV capacities for Case 1 are larger than for Case 2 for the climate zones without solar thermal systems (Climate Zones 8 through 15). The lower efficiency HPWH in Case 1 results in additional water heating electricity use and subsequently requires a larger PV capacity to offset the increase in energy use. In the other climates the solar thermal system reduces the water heating electricity use and the resultant PV capacity is similar across Case 1 and Case 2.



Energy savings details for each case and climate zone with a breakdown between efficiency savings and savings from PV electricity generation are presented in Appendix D.



**Figure 1: Single family cost effectiveness comparison**



**Table 7: Single Family Efficiency Package Cost Effectiveness Results**

Climate Zone	PV Capacity (kW)	Elec Savings (kWh)	Gas Savings (Therms) <sup>a</sup>	% Carbon Savings <sup>b</sup>	Package Cost <sup>c</sup>	Utility Cost Savings	Simple Payback	Lifecycle Benefit-Cost Ratio
<b>Case 1</b>								
CZ1	4.0	4,100	126	47.5%	\$19,473	\$1,046	18.6	0.99
CZ2	3.1	3,793	115	50.9%	\$15,213	\$970	15.7	1.2
CZ3	3.2	3,998	128	65.8%	\$15,516	\$1,021	15.2	1.2
CZ4	3.1	3,620	111	55.1%	\$13,673	\$856	16.0	1.1
CZ5	2.9	3,797	122	65.6%	\$14,609	\$983	14.9	1.2
CZ6	3.0	3,826	109	69.5%	\$14,911	\$756	19.7	0.9
CZ7	2.6	3,474	109	74.1%	\$13,703	\$866	15.8	1.2
CZ8	3.5	4,091	105	76.1%	\$11,802	\$775	15.2	1.2
CZ9	3.4	4,104	104	69.6%	\$11,500	\$729	15.8	1.2
CZ10-SCE/SoCalGas	3.4	4,099	103	66.5%	\$11,500	\$720	16.0	1.1
CZ10-SDG&E	3.4	4,099	103	66.5%	\$11,500	\$781	14.7	1.2
CZ11	4.5	5,609	101	60.2%	\$14,823	\$1,141	13.0	1.4
CZ12	4.0	4,627	106	57.5%	\$13,313	\$956	13.9	1.3
CZ13	4.6	5,616	100	61.5%	\$15,126	\$1,167	13.0	1.4
CZ14-SCE/SoCalGas	3.4	4,499	103	51.8%	\$11,500	\$797	14.4	1.3
CZ14-SDG&E	3.4	4,499	103	51.8%	\$11,500	\$804	14.3	1.3
CZ15	5.2	7,653	79	75.3%	\$16,939	\$1,253	13.5	1.4
CZ16	3.5	4,167	122	38.8%	\$16,422	\$1,046	15.7	1.2
<b>Case 2</b>								
CZ1	3.9	4,005	121	46.1%	\$13,327	\$1,042	12.8	1.4
CZ2	3.1	3,861	112	51.0%	\$10,910	\$976	11.2	1.6
CZ3	3.2	4,068	126	66.1%	\$11,212	\$1,021	11.0	1.7
CZ4	2.8	3,585	109	54.4%	\$10,004	\$923	10.8	1.7
CZ5	2.9	3,861	119	65.9%	\$10,306	\$988	10.4	1.8
CZ6	3.0	3,904	107	70.0%	\$10,608	\$754	14.1	1.3
CZ7	2.7	3,616	108	75.7%	\$9,702	\$859	11.3	1.6
CZ8	3.1	4,122	104	76.3%	\$10,910	\$813	13.4	1.4
CZ9	2.9	3,949	103	67.5%	\$10,306	\$823	12.5	1.5
CZ10-SCE/SoCalGas	3.0	4,110	102	66.4%	\$10,608	\$831	12.8	1.4
CZ10-SDG&E	3.0	4,110	102	66.4%	\$10,608	\$948	11.2	1.6
CZ11	4.0	5,507	99	59.0%	\$13,629	\$1,269	10.7	1.7
CZ12	3.5	4,581	104	56.8%	\$12,119	\$1,043	11.6	1.6
CZ13	4.2	5,672	98	61.7%	\$14,234	\$1,295	11.0	1.7
CZ14-SCE/SoCalGas	3.0	4,505	101	51.6%	\$10,608	\$926	11.5	1.6
CZ14-SDG&E	3.0	4,505	101	51.6%	\$10,608	\$983	10.8	1.7
CZ15	4.9	7,662	78	75.3%	\$16,349	\$1,346	12.1	1.5
CZ16	3.4	4,198	119	38.6%	\$11,817	\$1,072	11.0	1.7

<sup>a</sup> Gas savings resulting from replacing gas tankless water heater with electric HPWH.<sup>b</sup> Based on California electricity production and equivalent CO<sub>2</sub> emission rates of 0.724 lbCO<sub>2</sub>e/kWh & 11.7 lb-CO<sub>2</sub>e/therm.<sup>c</sup> Includes ten percent markup for builder profit and overhead on HPWH. NSHP incentive not applied to PV costs.

## 4 Conclusions & Summary

This report evaluated the feasibility of a proposed local ordinance promoting PV plus heat pump water heating for single family homes. In Case 1, a federal minimum efficiency HPWH was coupled with a PV system in addition to a solar thermal system where it was necessary to achieve compliance with 2016 Title 24, Part 6. In Case 2 a NEEA rated Tier 3 HPWH was coupled with a PV system only. In both cases the PV system was sized to meet the prescriptive PV capacities recommended in the Solar Ordinance, in addition to offsetting 100 percent of the incremental electricity use for the HPWH relative to the 2016 Title 24, Part 6 base case.

The Case 1 package includes the following items:

- A HPWH with a 2.0 EF, the minimum allowed by federal efficiency standards.
- PV systems sized to meet the prescriptive PV capacities recommended in the Solar Ordinance in addition to offsetting 100 percent of the incremental electricity use for the HPWH relative to the 2016 Title 24, Part 6 baseline case.
  - PVCC used for compliance in all applicable climate zones
- Solar thermal system sized as required to meet 2016 Title 24, Part 6 compliance. In warmer climates, Climate Zones 8-15, no solar thermal system was necessary.

The Case 2 package offers an alternative design to Case 1 by removing the solar thermal measure and upgrading the water heater to a Tier 3 NEEA rated HPWH. The Case 2 packages includes the following items:

- A Tier 3 NEEA rated HPWH.
- PV systems sized to meet the prescriptive PV capacities recommended in the Solar Ordinance in addition to offsetting 100 percent of the incremental electricity use for the HPWH package relative to the 2016 Title 24, Part 6 baseline case.
  - PVCC used for compliance in all applicable climate zones

The Case 2 alternative is shown to be more cost-effective than Case 1 and is cost-effective in all climate zones for single family new construction analysis.

One of the analysis objectives was to evaluate and identify a cost-effective measure package that did not include high efficiency equipment measures since state and local governments are prohibited from adopting minimum efficiency standards for equipment that is federally regulated under the National Appliance Energy Conservation Act (NAECA), including heating, cooling, and water heating equipment. The Case 1 package demonstrates that the requirements for a local ordinance can be met without the use of equipment that exceeds federal minimum efficiency requirements in all climate zones except Climate Zones 1 and 6. While cost-effective in most climate zones, the Case 1 package is not the only design choice. More often, builders use a combination of improvements that include high efficiency equipment to meet the performance requirements, as shown in Case 2, which usually results in a higher B/C ratio. All measure packages are examples only, using a prototypical building, demonstrating that there are multiple options to cost-effectively meet the performance requirements.

The results indicate that achieving compliance with 2016 Title 24, Part 6 using a HPWH, PV systems, and other measures as described below is feasible for single family homes everywhere except in Climate Zones 1 and 6. There are certainly other combinations of efficiency measures that would result in a cost-effective package. However, these were not within the scope of this analysis. Future analysis may evaluate these as well as additional high efficiency water heating strategies. It is important to note that the packages contained in this report are examples only; any project meeting requirements of a local ordinance must independently evaluate and identify the most cost-effective approach based on project-specific factors.



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## Appendix A – Prescriptive Package

The following presents the residential prescriptive package as printed in the 2016 Building Energy Efficiency Standards (CEC, 2016a).

TABLE 150.1-A COMPONENT PACKAGE-A STANDARD BUILDING DESIGN

						C															
						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Building Envelope Insulation	Roofs/ Ceilings	Option A (meets §150.1(c)(9A))	Continuous Insulation Above Roof Rafter	Roofing Type	No Air Space <sup>1</sup>	NR	NR	NR	R 8	NR	NR	NR	R 8	R 8	R 8	R 8	R 8	R 8	R 8	R 8	
				With Air Space <sup>2</sup>	NR	NR	NR	R 6	NR	NR	NR	R 6	R 6	R 6	R 6	R 6	R 6	R 6	R 6	R 6	
			Ceiling Insulation		R 38	R 38	R 30	R 38	R 30	R 30	R 30	R 38	R 38	R 38	R 38	R 38	R 38	R 38	R 38	R 38	
			Radiant Barrier		NR	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	NR	
		Option B (meets §150.1(c)(9A))	Below Roof Deck Insulation	Roofing Type	No Air Space	NR	NR	NR	R 18	NR	NR	NR	R 18	R 18	R 18	R 18	R 18	R 18	R 18	R 18	
				With Air	NR	NR	NR	R 13	NR	NR	NR	R 13	R 13	R 13	R 13	R 13	R 13	R 13	R 13	R 13	
			Ceiling Insulation		R 38	R 38	R 30	R 38	R 30	R 30	R 30	R 38	R 38	R 38	R 38	R 38	R 38	R 38	R 38	R 38	
			Radiant Barrier		NR	REQ	REQ	NR	REQ	REQ	REQ	NR	NR	NR	NR	NR	NR	NR	NR	NR	
		Option C (meets	Ceiling Insulation		R 38	R 30	R 30	R 30	R 30	R 30	R 30	R 30	R 30	R 30	R 30	R 38	R 38	R 38	R 38	R 38	
			Radiant		NR	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	NR	



TABLE 150.1-A COMPONENT PACKAGE-A STANDARD BUILDING DESIGN (CONTINUED)

				Climate Zone															
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Building Envelope Insulation	Walls	Above Grade	Framed <sup>4</sup>	U 0.051	U 0.051	U 0.051	U 0.051	U 0.051	U 0.065	U 0.065	U 0.051	U 0.051	U 0.051	U 0.051	U 0.051	U 0.051	U 0.051	U 0.051	U 0.051
			Mass Wall Interior <sup>5</sup>	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.059 R 17
			Mass Wall Exterior <sup>6</sup>	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.1025 R 8.0	U 0.125 R 8.0	U 0.070 R 13
		Below Grade	Below Grade Interior <sup>7</sup>	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.066 R 15
			Below Grade Exterior	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.100 R 10	U 0.100 R 10	U 0.053 R 19
	Floors	Slab Perimeter		NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	U 0.58 R 7.0
		Raised		U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19
		Concrete Raised		U 0.092 R 8.0	U 0.092 R 8.0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.092 R 8.0	U 0.138 R 4.0	U 0.092 R 8.0	U 0.092 R 8.0	U 0.138 R 4.0	U 0.092 R 8.0
Building Envelope	Roofing Products	Low-sloped	Aged Solar Reflectance	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.63	NR	0.63	NR
			Thermal Emittance	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.75	NR	0.75	NR
		Steep Sloped	Aged Solar Reflectance	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.20	0.20	0.20	0.20	0.20	0.20	NR
			Thermal Emittance	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.75	0.75	0.75	0.75	0.75	0.75	NR
Building Envelope	Fenestration	Maximum U-factor		0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32
		Maximum SHGC		NR	0.25	NR	0.25	NR	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
		Maximum Total Area		20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
		Maximum West Facing Area		NR	5%	NR	5%	NR	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%



TABLE 150.1-A COMPONENT PACKAGE-A STANDARD BUILDING DESIGN (CONTINUED)

				Climate Zone																
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
HVAC SYSTEM	Space Heating <sup>11</sup>	Electric-Resistance Allowed		No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	
		If gas, AFUE		MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	
		If Heat Pump, HSPF <sup>9</sup>		MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	
	Space cooling	SEER		MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	
		Refrigerant Charge Verification or Fault Indicator Display		NR	REQ	NR	NR	NR	NR	NR	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	NR	
		Whole House Fan <sup>10</sup>		NR	NR	NR	NR	NR	NR	NR	REQ	REQ	REQ	REQ	REQ	REQ	REQ	NR	NR	
	Central System Air Handlers	Central Fan Integrated Ventilation System Fan Efficacy		REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	
	Ducts <sup>12</sup>	Roof/Ceiling Options A & B	Duct Insulation	R-8	R-8	R-6	R-8	R-6	R-6	R-6	R-8	R-8	R-8	R-8	R-8	R-8	R-8	R-8	R-8	
			\$150.1(c)9A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
		Roof/Ceiling	Duct Insulation	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6
			\$150.1(c)9B	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ
Water Heating	All Buildings			System Shall meet Section 150.1(c)8																



**Footnote requirements to TABLE 150.1-A:<sup>14</sup>**

1. Install the specified R-value with no air space present between the roofing and the roof deck.
2. Install the specified R-value with an air space present between the roofing and the roof deck. Such as standard installation of concrete or clay tile.
3. R-values shown for below roof deck insulation are for wood-frame construction with insulation installed between the framing members.
4. Assembly U-factors can be met with cavity insulation alone or with continuous insulation alone, or with both cavity and continuous insulation that results in an assembly U-factor equal to or less than the U-factor shown. Use Reference Joint Appendices JA4 Table 4.3.1, 4.3.1(a), or Table 4.3.4 to determine alternative insulation products to meet the required maximum U-factor.
5. Mass wall has a thermal heat capacity greater than or equal to 7.0 Btu/h-ft<sup>2</sup>. "Interior" denotes insulation installed on the inside surface of the wall.
6. Mass wall has a thermal heat capacity greater than or equal to 7.0 Btu/h-ft<sup>2</sup>. "Exterior" denotes insulation installed on the exterior surface of the wall.
7. Below grade "interior" denotes insulation installed on the inside surface of the wall.
8. Below grade "exterior" denotes insulation installed on the outside surface of the wall.
9. HSPF means "heating seasonal performance factor."
10. When whole house fans are required (REQ), only those whole house fans that are listed in the Appliance Efficiency Directory may be installed. Compliance requires installation of one or more WHFs whose total airflow CFM is capable of meeting or exceeding a minimum 1.5 cfm/square foot of conditioned floor area as specified by Section 150.1(c)12.
11. A supplemental heating unit may be installed in a space served directly or indirectly by a primary heating system, provided that the unit thermal capacity does not exceed 2 kilowatts or 7,000 Btu/hr and is controlled by a time limiting device not exceeding 30 minutes.
12. For duct and air handler location: REQ denotes location in conditioned space. When the table indicates ducts and air handlers are in conditioned space, a HERS verification is required as specified by Reference Residential Appendix RA3.1.4.3.8.

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<sup>14</sup> Single family buildings are modeled with Option B.



## Appendix B – Prescriptive Minimum PV Sizing by Climate Zone from Solar PV Ordinance

Table 8 presents the prescriptive PV sizing requirements from Table 3 in the Local PV Ordinance Cost Effectiveness Study (DEG, 2016a).

**Table 8: Minimum PV System Size (kWDC) Required to Meet Solar Ordinance by Climate Zone**

Conditioned Space (ft <sup>2</sup> )	CZ1	CZ2	CZ3	CZ4	CZ5	CZ6	CZ7	CZ8	CZ9	CZ10	CZ11	CZ12	CZ13	CZ14	CZ15	CZ16
Less than 1000	1.6	1.4	1.5	1.3	1.4	1.5	1.3	1.5	1.4	1.4	1.7	1.5	1.8	1.3	2.1	1.3
1000 - 1499	2.0	1.7	1.7	1.5	1.6	1.7	1.5	1.8	1.7	1.7	2.2	1.9	2.3	1.6	2.8	1.6
1500 - 1999	2.4	2.0	2.1	1.8	1.9	2.0	1.8	2.1	2.0	2.0	2.7	2.3	2.8	2.0	3.5	1.9
2000 - 2499	2.8	2.3	2.4	2.1	2.1	2.3	2.0	2.4	2.3	2.3	3.2	2.7	3.4	2.3	4.2	2.3
2500 - 2999	3.2	2.6	2.7	2.4	2.4	2.6	2.3	2.7	2.6	2.7	3.7	3.1	3.9	2.7	4.9	2.6
3000 - 3499	3.6	2.9	3.0	2.6	2.7	2.9	2.5	3.0	2.9	3.0	4.2	3.4	4.4	3.0	5.6	3.0
3500 - 3999	3.9	3.2	3.2	2.9	2.9	3.2	2.7	3.3	3.2	3.3	4.7	3.8	4.9	3.4	6.3	3.3
4000 - 4499	4.3	3.5	3.5	3.2	3.1	3.4	2.9	3.6	3.5	3.6	5.1	4.2	5.4	3.7	7.0	3.6



## Appendix C – Utility Rate Tariffs

The following are the PG&E electricity (both standard and time-of-use) and natural gas tariffs applied in this study. The PG&E monthly gas rate in \$/therm was applied on a monthly basis for the 12-month period ending September 2017.



**Pacific Gas and  
Electric Company®**  
U 39 San Francisco, California

Cancelling Revised Cal. P.U.C. Sheet No. 41845-E  
Revised Cal. P.U.C. Sheet No. 41626-E

### ELECTRIC SCHEDULE E-1 RESIDENTIAL SERVICES

Sheet 1

**APPLICABILITY:** This schedule is applicable to single-phase and polyphase residential service in single-family dwellings and in flats and apartments separately metered by PG&E; to single-phase and polyphase service in common areas in a multifamily complex (see Special Condition 8); and to all single-phase and polyphase farm service on the premises operated by the person whose residence is supplied through the same meter.

The provisions of Schedule S—Standby Service Special Conditions 1 through 6 shall also apply to customers whose premises are regularly supplied in part (but not in whole) by electric energy from a nonutility source of supply. These customers will pay monthly reservation charges as specified under Section 1 of Schedule S, in addition to all applicable Schedule E-1 charges. See Special Conditions 11 and 12 of this rate schedule for exemptions to standby charges.

**TERRITORY:** This rate schedule applies everywhere PG&E provides electric service.

**RATES:** Total bundled service charges are calculated using the total rates below. Customers on this schedule are subject to the delivery minimum bill amount shown below applied to the delivery portion of the bill (i.e. to all rate components other than the generation rate). In addition, total bundled charges will include applicable generation charges per kWh for all kWh usage.

Customers receiving a medical baseline allowance shall pay for all usage in excess of 200 percent of baseline at a rate \$0.04000 per kWh less than the applicable rate for usage in excess of 200 percent of baseline. No portion of the rates paid by customers that receive a Medical Baseline allowance shall be used to pay the DWR Bond charge. For these customers, the Conservation Incentive Adjustment is calculated residually based on the total rate less the sum of: Transmission, Transmission Rate Adjustments, Reliability Services, Distribution, Generation, Public Purpose Programs, Nuclear Decommissioning, Competition Transition Charges (CTC), New System Generation Charges, and Energy Cost Recovery Amount. Customers receiving a medical baseline allowance shall also receive a 50 percent discount on the delivery minimum bill amount shown below.

Direct Access (DA) and Community Choice Aggregation (CCA) charges shall be calculated in accordance with the paragraph in this rate schedule titled Billing.

#### TOTAL RATES

Total Energy Rates (\$ per kWh)	
Baseline Usage	\$0.21169 (I)
101% - 400% of Baseline	\$0.27993 (I)
High Usage Over 400% of Baseline	\$0.43343 (I)
Delivery Minimum Bill Amount (\$ per meter per day)	\$0.32854
California Climate Credit (per household, per semi-annual payment occurring in the April and October bill cycles)	(\$39.42) (R)

(Continued)

Advice	5231-E	Issued by	Date Filed	February 16, 2018
Decision		<b>Robert S. Kenney</b>	Effective	March 1, 2018
		Vice President, Regulatory Affairs	Resolution	





**Pacific Gas and  
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U 39

San Francisco, California

Cancelling

Revised  
Revised

Cal. P.U.C. Sheet No.  
Cal. P.U.C. Sheet No.

41875-E  
41647-E

**ELECTRIC SCHEDULE E-TOU  
RESIDENTIAL TIME-OF-USE SERVICE**

Sheet 2

RATES  
(Cont'd.):

**OPTION A TOTAL RATES**

Total Energy Rates (\$ per kWh)	PEAK		OFF-PEAK	
<i>Summer</i>				
Total Usage	\$0.39980	(I)	\$0.32423	(I)
Baseline Credit (Applied to Baseline Usage Only)	(\$0.08581)	(I)	(\$0.08581)	(I)
<i>Winter</i>				
Total Usage	\$0.28183	(I)	\$0.26754	(I)
Baseline Credit (Applied to Baseline Usage Only)	(\$0.08581)	(I)	(\$0.08581)	(I)
Delivery Minimum Bill Amount (\$ per meter per day)	\$0.32854			
California Climate Credit (per household, per semi-annual payment occurring in the April and October bill cycles)	(\$39.42)	(R)		

Total bundled service charges shown on customer's bills are unbundled according to the component rates shown below. Where the delivery minimum bill amount applies, the customer's bill will equal the sum of (1) the delivery minimum bill amount plus (2) for bundled service, the generation rate times the number of kWh used. For revenue accounting purposes, the revenues from the delivery minimum bill amount will be assigned to the Transmission, Transmission Rate Adjustments, Reliability Services, Public Purpose Programs, Nuclear Decommissioning, Competition Transition Charges, Energy Cost Recovery Amount, DWR Bond, and New System Generation Charges based on kWh usage times the corresponding unbundled rate component per kWh, with any residual revenue assigned to Distribution.\*

\* This same assignment of revenues applies to direct access and community choice aggregation customers.

(Continued)

Advice 5231-E  
Decision

Issued by  
**Robert S. Kenney**  
Vice President, Regulatory Affairs

Date Filed February 16, 2018  
Effective March 1, 2018  
Resolution





**Pacific Gas and  
Electric Company**

U 39

San Francisco, California

Cancelling

Revised  
Revised

Cal. P.U.C. Sheet No. 33319-G  
Cal. P.U.C. Sheet No. 33280-G

**GAS SCHEDULE G-1  
RESIDENTIAL SERVICE**

Sheet 1

**APPLICABILITY:** This rate schedule\* applies to natural gas service to Core End-Use Customers on PG&E's Transmission and/or Distribution Systems. To qualify, service must be to individually-metered single family premises for residential use, including those in a multifamily complex, and to separately-metered common areas in a multifamily complex where Schedules GM, GS, or GT are not applicable. Common area accounts that are separately metered by PG&E have an option of switching to a core commercial rate schedule. Common area accounts are those accounts that provide gas service to common use areas as defined in Rule 1.

**TERRITORY:** Schedule G-1 applies everywhere within PG&E's natural gas Service Territory.

**RATES:** Customers on this schedule pay a Procurement Charge and a Transportation Charge, per meter, as shown below. The Transportation Charge will be no less than the Minimum Transportation Charge, as follows:

	Minimum Transportation Charge:**	
	Per Day	
	\$0.09863	
	Per Therm	
	Baseline	Excess
Procurement:	\$0.39848 (R)	\$0.39848 (R)
Transportation Charge:	\$0.88798	\$1.42077
Total:	\$1.28646 (R)	\$1.81925 (R)

Public Purpose Program Surcharge:



Customers served under this schedule are subject to a gas Public Purpose Program (PPP) Surcharge under Schedule G-PPPS.

See Preliminary Statement, Part B for the Default Tariff Rate Components.

The Procurement Charge on this schedule is equivalent to the rate shown on informational Schedule G-CP—Gas Procurement Service to Core End-Use Customers.

**BASELINE QUANTITIES:** The delivered quantities of gas shown below are billed at the rates for baseline use.

BASELINE QUANTITIES (Therms Per Day Per Dwelling Unit)		
Baseline Territories***	Summer Effective Apr. 1, 2016	Winter Effective Nov. 1, 2015
P	0.46	2.15
Q	0.69	1.98
R	0.46	1.79
S	0.46	1.92
T	0.69	1.79
V	0.69	1.79
W	0.46	1.69
X	0.59	1.98
Y	0.85	2.55

\* PG&E's gas tariffs are available online at [www.pge.com](http://www.pge.com).

\*\* The Minimum Transportation charge does not apply to submetered tenants of master-metered customers served under gas rate Schedules GS and GT.

\*\*\* The applicable baseline territory is described in Preliminary Statement, Part A.

(Continued)

Advice	3836-G	Issued by	Date Filed	April 24, 2017
Decision	97-10-065 & 98-07-025	Robert S. Kenney	Effective	May 1, 2017
		Vice President, Regulatory Affairs	Resolution	



## Pacific Gas and Electric Company

## Residential Non-CARE and CARE Gas Tariff Rates

January 1, 2016, to Present

(\$/therm)<sup>1/</sup>

Effective Date	Advice Letter Number	Minimum Transportation Charge <sup>2/</sup> (per day)	Procurement Charge	Transportation Charge <sup>2/</sup>	TOTAL Residential Non-CARE Schedules Charge <sup>3/</sup>
04/01/17	3827-G	\$0.09863	\$0.42225	\$0.88798 \$1.42077	\$1.31023 \$1.84302
05/01/17	3836-G	\$0.09863	\$0.39848	\$0.88798 \$1.42077	\$1.28646 \$1.81925
06/01/17	3844-G	\$0.09863	\$0.39102	\$0.88798 \$1.42077	\$1.27900 \$1.81179
07/01/17	3859-G	\$0.09863	\$0.31906	\$0.88566 \$1.41705	\$1.20472 \$1.73611
08/01/17	3870-G	\$0.09863	\$0.32821	\$0.88566 \$1.41705	\$1.21387 \$1.74526
09/01/17	3879-G	\$0.09863	\$0.27240 <sup>7/</sup>	\$0.88566 \$1.41705	\$1.15806 \$1.68945
10/01/17	3886-G	\$0.09863	\$0.31496	\$0.88566 \$1.41705	\$1.20062 \$1.73201
11/01/17	3899-G	\$0.09863	\$0.34180	\$0.88566 \$1.41705	\$1.22746 \$1.75885
12/01/17	3913-G	\$0.09863	\$0.37595 <sup>7/</sup>	\$0.88566 \$1.41705	\$1.26161 \$1.79300
01/01/18	3918-G	\$0.09863	\$0.37310	\$0.91828 \$1.46925	\$1.29138 \$1.84235
02/01/18	3931-G	\$0.09863	\$0.40635	\$0.91828 \$1.46925	\$1.32463 \$1.87560
03/01/18	3941-G	\$0.09863	\$0.32103 <sup>7/</sup>	\$0.91828 \$1.46925	\$1.23931 \$1.79028

<sup>1/</sup> Unless otherwise noted<sup>2/</sup> Effective July 1, 2005, the Transportation Charge will be no less than the Minimum Transportation Charge of \$0.09863 (per day). Applicable to Rate Schedule G-1 only and does not apply to submetered tenants of master-metered customers served under gas Rate Schedule GS and GT.<sup>3/</sup> Schedule G-PPPS (Public Purpose Program Surcharge) needs to be added to the TOTAL Non-CARE Charge and TOTAL CARE Charge for bill calculation. See Schedule G-PPPS for details and exempt customers.<sup>4/</sup> CARE Schedules include California Solar Initiative (CSI) Exemption in accordance with Advice Letter 3257-G-A.<sup>5/</sup> Per dwelling unit per day (Multifamily Service)<sup>6/</sup> Per installed space per day (Mobilehome Park Service)<sup>7/</sup> This procurement rate includes a charge of \$0.02431 per therm to reflect account balance amortizations in accordance with Advice Letter 3157-G.

Seasons: Winter = Nov-Mar Summer = April-Oct



The following are the SCE electricity tariffs, (both standard and time-of-use) and SoCalGas natural gas tariff applied in this study.



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

Cancelling Revised Cal. PUC Sheet No. 62848-E  
Revised Cal. PUC Sheet No. 62244-E

Schedule D

DOMESTIC SERVICE

Sheet 2

(Continued)

RATES

		Delivery Service	Generation <sup>2</sup>	
			UG***	DWREC <sup>3</sup>
		Total <sup>1</sup>		
Energy Charge- \$/kWh/Meter/Day				
Baseline Service				
	Summer	0.06675 (I)	0.05569 (I)	0.00000
	Winter	0.06675 (I)	0.05569 (I)	0.00000
Nonbaseline Service*				
	101% - 400% of Baseline - Summer	0.16034 (R)	0.05569 (I)	0.00000
	Winter	0.16034 (R)	0.05569 (I)	0.00000
High Usage Charge				
	(Over 400% of Baseline) - Summer	0.26072 (I)	0.05569 (I)	0.00000
	- Winter	0.26072 (I)	0.05569 (I)	0.00000
Basic Charge - \$/Meter/Day				
	Single-Family Accommodation	0.031		
	Multi-Family Accommodation	0.024		
Minimum Charge** - \$/Meter/Day				
	Single-Family Accommodation	0.335 (I)		
	Multi-Family Accommodation	0.335 (I)		
Minimum Charge (Medical Baseline)** - \$/Meter/Day				
	Single-Family Accommodation	0.169 (I)		
	Multi-Family Accommodation	0.169 (I)		
California Climate Credit <sup>4</sup>		(36.00) (R)		
Peak Time Rebate - \$/kWh			(0.75)	
Peak Time Rebate				
w/enabling technology - \$/kWh			(1.25)	

\* Nonbaseline Service includes all kWh in excess of applicable Baseline allocations as described in Preliminary Statement, Part H, Baseline Service.

\*\* The Minimum Charge is applicable when the Delivery Service Energy Charge, plus the applicable Basic Charge is less than the Minimum Charge.

\*\*\* The ongoing Competition Transition Charge (CTC) of \$(0.00075) per kWh is recovered in the UG component of Generation. (I)

1 Total = Total Delivery Service rates are applicable to Bundled Service, Direct Access (DA) and Community Choice Aggregation Service (CCA Service) Customers, except DA and CCA Service Customers are not subject to the DWRBC rate component of this Schedule but instead pay the DWRBC as provided by Schedule DA-CRS or Schedule CCA-CRS.

2 Generation = The Generation rates are applicable only to Bundled Service Customers.

3 DWREC = Department of Water Resources (DWR) Energy Credit - For more information on the DWR Energy Credit, see the Billing Calculation Special Condition of this Schedule.

4 Applied on an equal basis, per household, semi-annually. See the Special Conditions of this Schedule for more information.

(Continued)

\* Nonbaseline Service includes all kWh in excess of applicable Baseline allocations as described in Preliminary Statement, Part H, Baseline Service.

\*\* The Minimum Charge is applicable when the Delivery Service Energy Charge, plus the applicable Basic Charge is less than the Minimum Charge.

\*\*\* The ongoing Competition Transition Charge (CTC) of \$(0.00075) per kWh is recovered in the UG component of Generation. (I)

1 Total = Total Delivery Service rates are applicable to Bundled Service, Direct Access (DA) and Community Choice Aggregation Service (CCA Service) Customers, except DA and CCA Service Customers are not subject to the DWRBC rate component of this Schedule but instead pay the DWRBC as provided by Schedule DA-CRS or Schedule CCA-CRS.

2 Generation = The Generation rates are applicable only to Bundled Service Customers.

3 DWREC = Department of Water Resources (DWR) Energy Credit - For more information on the DWR Energy Credit, see the Billing Calculation Special Condition of this Schedule.

4. Applied on an equal basis, per household, semi-annually. See the Special Conditions of this Schedule for more information.

(Continued)

(To be inserted by utility)

Advice 3695-E-A  
Decision \_\_\_\_\_

2017

Issued by

Caroline Choi  
Senior Vice President

(To be inserted by Cal. PUC)

Date Filed Dec 22, 2017  
Effective Jan 1, 2018  
Resolution \_\_\_\_\_





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

Cancelling Revised Cal. PUC Sheet No. 62878-E  
Revised Cal. PUC Sheet No. 62259-E

Schedule TOU-D-T  
TIME-OF-USE TIERED DOMESTIC

Sheet 2

(Continued)

RATES

	Delivery Service Total <sup>1</sup>	Generation <sup>2</sup>	
		UG***	DWREC <sup>3</sup>
Energy Charge - \$/kWh/Meter/Day			
Summer Season - On-Peak			
Level I (up to 130% of Baseline)	0.11923 (R)	0.25554 (I)	0.00000
Level II (More than 130% of Baseline)	0.16123 (I)	0.25554 (I)	0.00000
Summer Season - Off-Peak			
Level I (up to 130% of Baseline)	0.11923 (R)	0.06604 (I)	0.00000
Level II (More than 130% of Baseline)	0.16123 (I)	0.06604 (I)	0.00000
Winter Season - On-Peak			
Level I (up to 130% of Baseline)	0.11923 (R)	0.13554 (I)	0.00000
Level II (More than 130% of Baseline)	0.16123 (I)	0.13554 (I)	0.00000
Winter Season - Off-Peak			
Level I (up to 130% of Baseline)	0.11923 (R)	0.05854 (I)	0.00000
Level II (More than 130% of Baseline)	0.16123 (I)	0.05854 (I)	0.00000
Basic Charge - \$/Meter/Day			
Single-Family Accommodation	0.031		
Multi-Family Accommodation	0.024		
Minimum Charge* - \$/Meter/Day			
Single-Family Accommodation	0.335 (I)		
Multi-Family Accommodation	0.335 (I)		
Minimum Charge (Medical Baseline)** - \$/Meter/Day			
Single-Family Accommodation	0.169 (I)		
Multi-Family Accommodation	0.169 (I)		
California Climate Credit <sup>4</sup>	(36.00) (R)		
California Alternate Rates for Energy Discount - %	100.00*		
Peak Time Rebate - \$/kWh		(0.75)	
Peak Time Rebate w/enabling technology - \$/kWh		(1.25)	

\* The Minimum Charge is applicable when the Delivery Service Energy Charge, plus the applicable Basic Charge is less than the Minimum Charge.

\*\* Represents 100% of the discount percentage as shown in the applicable Special Condition of this Schedule.

\*\*\* The ongoing Competition Transition Charge (CTC) of \$(0.00075) per kWh is recovered in the UG component of Generation. (I)

1 Total = Total Delivery Service rates are applicable to Bundled Service, Direct Access (DA) and Community Choice Aggregation Service (CCA Service) Customers, except DA and CCA Service Customers are not subject to the DWRBC rate component of this Schedule but instead pay the DWRBC as provided by Schedule DA-CRS or Schedule CCA-CRS

2 Generation = The Gen rates are applicable only to Bundled Service Customers.

3 DWREC = Department of Water Resources (DWR) Energy Credit – For more information on the DWR Energy Credit, see the Billing Calculation Special Condition of this Schedule.

4 Applied on an equal basis, per household, semi-annually. See the Special Conditions of this Schedule for more information.

(Continued)

(To be inserted by utility)

Advice 3695-E-A  
Decision \_\_\_\_\_

2018

Issued by  
Caroline Choi  
Senior Vice President

(To be inserted by Cal. PUC)

Date Filed Dec 22, 2017  
Effective Jan 1, 2018  
Resolution \_\_\_\_\_



**SOUTHERN CALIFORNIA GAS COMPANY** Revised CAL. P.U.C. SHEET NO. 54800-G  
 LOS ANGELES, CALIFORNIA CANCELING Revised CAL. P.U.C. SHEET NO. 54771-G

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

Sheet 1

**APPLICABILITY**

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

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

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

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

**TERRITORY**

Applicable throughout the service territory.

**RATES**

	<u>GR</u>	<u>GR-C</u>	<u>GT-R</u>
<u>Customer Charge</u> , per meter per day:.....	16.438¢	16.438¢	16.438¢

For "Space Heating Only" customers, a daily Customer Charge applies during the winter period from November 1 through April 30 <sup>1/</sup> : .....	33.149¢	33.149¢	33.149¢
---	---------	---------	---------

Baseline Rate, per therm (baseline usage defined in Special Conditions 3 and 4):

Procurement Charge: <sup>2/</sup> .....	29.482¢	29.482¢	N/A
<u>Transmission Charge</u> : <sup>3/</sup> .....	<u>53.427¢</u>	<u>53.427¢</u>	<u>53.577¢</u>
Total Baseline Charge: .....	82.909¢	82.909¢	53.577¢

Non-Baseline Rate, per therm (usage in excess of baseline usage):

Procurement Charge: <sup>2/</sup> .....	29.482¢	29.482¢	N/A
<u>Transmission Charge</u> : <sup>3/</sup> .....	<u>86.226¢</u>	<u>86.226¢</u>	<u>86.376¢</u>
Total Non-Baseline Charge: .....	115.708¢	115.708¢	86.376¢

<sup>1/</sup> For the summer period beginning May 1 through October 31, with some exceptions, usage will be accumulated to at least 20 Ccf (100 cubic feet) before billing.

(Footnotes continue next page.)

(Continued)

(TO BE INSERTED BY UTILITY)  
 ADVICE LETTER NO. 5266  
 DECISION NO.  
 RCS

ISSUED BY  
**Dan Skopec**  
 Vice President  
 Regulatory Affairs

(TO BE INSERTED BY CAL. PUC)  
 DATE FILED Mar 8, 2018  
 EFFECTIVE Mar 10, 2018  
 RESOLUTION NO. G-3351



The following are the SDG&E electricity (both standard and time-of-use) and natural gas tariffs applied in this study.



San Diego Gas & Electric Company  
San Diego, California

Revised Cal. P.U.C. Sheet No. 29903-E

Canceling Revised Cal. P.U.C. Sheet No. 29682-E

### SCHEDULE DR

Sheet 1

#### RESIDENTIAL SERVICE (Includes Rates for DR-LI)

#### APPLICABILITY

Applicable to domestic service for lighting, heating, cooking, water heating, and power, or combination thereof, in single family dwellings, flats, and apartments, separately metered by the utility; to service used in common for residential purposes by tenants in multi-family dwellings under Special Condition 8; to any approved combination of residential and nonresidential service on the same meter; and to incidental farm service under Special Condition 7.

This schedule is also applicable to customers qualifying for the California Alternate Rates for Energy (CARE) Program and/or Medical Baseline, residing in single-family accommodations, separately metered by the Utility, and may include Non-profit Group Living Facilities and Qualified Agricultural Employee Housing Facilities, if such facilities qualify to receive service under the terms and conditions of Schedule E-CARE. The rates for CARE and Medical Baseline customers are identified in the rates tables below as DR-LI and DR-MB rates, respectively.

Customers on this schedule may also qualify for a semi-annual California Climate Credit \$(33.50) per Schedule GHG-ARR.

#### TERRITORY

Within the entire territory served by the Utility.

#### RATES

##### Total Rates:

Description - DR Rates	UDC Total Rate	DWR-BC Rate	EECC Rate + DWR Credit	Total Rate
<b>Summer:</b>				
Up to 130% of Baseline Energy (\$/kWh)	0.09311 I	0.00549	0.17244 R	0.27104 I
131% - 400% of Baseline (\$/kWh)	0.29722 I	0.00549	0.17244 R	0.47515 I
Above 400% of Baseline (\$/kWh)	0.37568 I	0.00549	0.17244 R	0.55361 I
<b>Winter:</b>				
Up to 130% of Baseline Energy (\$/kWh)	0.15406 I	0.00549	0.07075 R	0.23030 I
131% - 400% of Baseline (\$/kWh)	0.32748 I	0.00549	0.07075 R	0.40372 I
Above 400% of Baseline (\$/kWh)	0.39415 I	0.00549	0.07075 R	0.47039 I
Minimum Bill (\$/day)	0.329			0.329

Description - DR-LI Rates	UDC Total Rate	DWR-BC Rate	EECC Rate + DWR Credit	Total Rate	Total Effective CARE Rate
<b>Summer - CARE Rates:</b>					
Up to 130% of Baseline Energy (\$/kWh)	0.09246 I	0.00000	0.17244 R	0.26490 I	0.16772 I
131% - 400% of Baseline (\$/kWh)	0.29657 I	0.00000	0.17244 R	0.46901 I	0.29912 I
Above 400% of Baseline (\$/kWh)	0.37503 I	0.00000	0.17244 R	0.54747 I	0.34963 I
<b>Winter - CARE Rates:</b>					
Up to 130% of Baseline Energy (\$/kWh)	0.15341 I	0.00000	0.07075 R	0.22416 I	0.14150 I
131% - 400% of Baseline (\$/kWh)	0.32683 I	0.00000	0.07075 R	0.39758 I	0.25314 I
Above 400% of Baseline (\$/kWh)	0.39350 I	0.00000	0.07075 R	0.46425 I	0.29606 I
Minimum Bill (\$/day)	0.164			0.164	0.164

(Continued)

1C7

Advice Ltr. No. 3167-E

Decision No. \_\_\_\_\_

Issued by  
**Dan Skopec**  
Vice President  
Regulatory Affairs

Date Filed Dec 29, 2017

Effective Jan 1, 2018

Resolution No. \_\_\_\_\_





San Diego Gas & Electric Company  
San Diego, California

Revised Cal. P.U.C. Sheet No. 29920-E  
Canceling Revised Cal. P.U.C. Sheet No. 29698-E

### SCHEDULE DR-SES

Sheet 1

#### DOMESTIC TIME-OF-USE FOR HOUSEHOLDS WITH A SOLAR ENERGY SYSTEM

##### APPLICABILITY

Service under this schedule is available on a voluntary basis for individually metered residential customers with Solar Energy Systems. Service is limited to individually metered residential customers with a Solar Energy System with domestic service for lighting, heating, cooking, water heating, and power, or combination thereof, in single family dwellings and flats. Qualifying California Alternative Rates for Energy (CARE) customers are eligible for service on this schedule, as further described under Special Condition 8 of this schedule.

Customers on this schedule may also qualify for a semi-annual California Climate Credit \$(33.50) per Schedule GHG-ARR.

CPUC Decision (D.)17-01-006 and D.17-10-018 permit certain eligible behind-the-meter solar customers to continue billing under grandfathered time-of-use (TOU) period definitions for a specific period of time. Customer eligibility and applicable TOU periods, rates and conditions for TOU Period Grandfathering are defined in Special Condition 14. All terms and conditions in this Schedule apply to TOU grandfathering customers unless otherwise specified.

##### TERRITORY

Within the entire territory served by the Utility.

##### RATES\*

Description - DR-SES Rates	UDC Total Rate	DWR-BC Rate	EECC Rate + DWR Credit	Total Rate
Energy Charges (\$/kWh)				
On-Peak - Summer	0.16196 I	0.00549	0.37036 R	0.53781 R
Off-Peak - Summer	0.16196 I	0.00549	0.11866 R	0.28611 I
Super Off-Peak - Summer	0.16196 I	0.00549	0.06055 R	0.22803 I
On-Peak - Winter	0.16196 I	0.00549	0.08054 R	0.24799 I
Off-Peak - Winter	0.16196 I	0.00549	0.07149 R	0.23894 I
Super Off-Peak - Winter	0.16196 I	0.00549	0.06144 R	0.22689 I
Minimum Bill (\$/day)	0.329			0.329

- (1) Total Rates consist of UDC, Schedule DWR-BC (Department of Water Resources Bond Charge), and Schedule EECC (Electric Energy Commodity Cost) rates, with the EECC rates reflecting a DWR Credit of \$0.00000 that customers receive on their monthly bills.
- (2) Total Rates presented are for customers that receive commodity supply and delivery service from Utility. Differences in total rates paid by Direct Access (DA) and Community Choice Aggregation (CCA) customers are identified in Schedule DA-CRS and CCA-CRS, respectively.
- (3) DWR-BC charges do not apply to CARE or Medical Baseline customers.

##### UDC Rates

Description-DR-SES	Transm	Distr	PPP	ND	CTC	LGC	RS	TRAC	UDC Total
Energy Charges (\$/kWh)									
On-Peak - Summer	0.03622 R	0.10032 I	0.01347 I	(0.00005) I	0.00165 R	0.01031 I	0.00004 R	0.00000	0.16196 I
Off-Peak - Summer	0.03622 R	0.10032 I	0.01347 I	(0.00005) I	0.00165 R	0.01031 I	0.00004 R	0.00000	0.16196 I
Super Off-Peak - Summer	0.03622 R	0.10032 I	0.01347 I	(0.00005) I	0.00165 R	0.01031 I	0.00004 R	0.00000	0.16196 I
On-Peak - Winter	0.03622 R	0.10032 I	0.01347 I	(0.00005) I	0.00165 R	0.01031 I	0.00004 R	0.00000	0.16196 I
Off-Peak - Winter	0.03622 R	0.10032 I	0.01347 I	(0.00005) I	0.00165 R	0.01031 I	0.00004 R	0.00000	0.16196 I
Super Off-Peak - Winter	0.03622 R	0.10032 I	0.01347 I	(0.00005) I	0.00165 R	0.01031 I	0.00004 R	0.00000	0.16196 I
Minimum Bill (\$/day)		0.329							0.329

(Continued)

1C7

Advice Ltr. No. 3167-E

Decision No.

Issued by  
**Dan Skopec**  
Vice President  
Regulatory Affairs

Date Filed Dec 29, 2017

Effective Jan 1, 2018

Resolution No.





San Diego Gas & Electric Company  
San Diego, California

Revised Cal. P.U.C. Sheet No. 23019-G  
Canceling Revised Cal. P.U.C. Sheet No. 23006-G

### SCHEDULE GR

Sheet 1

#### RESIDENTIAL NATURAL GAS SERVICE (Includes Rates for GR, GR-C, GTC/GTCA)

#### APPLICABILITY

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

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

The GTC/GTCA rate is applicable to intrastate gas transportation-only services to individually metered residential customers, as set forth in Special Condition 11.

Customers taking service under this schedule may be eligible for a 20% California Alternate Rate for Energy (CARE) program discount, reflected as a separate line item on the bill, if they qualify to receive service under the terms and conditions of Schedule G-CARE.

#### TERRITORY

Within the entire territory served natural gas by the utility.

#### RATES

	<u>GR</u>	<u>GR-C</u>	<u>GTC/GTCA<sup>1/</sup></u>
<u>Baseline Rate</u> , per therm (baseline usage defined in Special Conditions 3 and 4):			
Procurement Charge: <sup>2/</sup>	\$0.34839	\$0.34839 I	N/A
Transmission Charge:	<u>\$0.86581</u>	<u>\$0.86581</u>	<u>\$0.86581</u>
Total Baseline Charge:	\$1.21420	\$1.21420 I	\$0.86581
<u>Non-Baseline Rate</u> , per therm (usage in excess of baseline usage):			
Procurement Charge: <sup>2/</sup>	\$0.34839	\$0.34839 I	N/A
Transmission Charge:	<u>\$1.04206</u>	<u>\$1.04206</u>	<u>\$1.04206</u>
Total Non-Baseline Charge:	\$1.39045	\$1.39045 I	\$1.04206
<u>Minimum Bill</u> , per day: <sup>3/</sup>			
Non-CARE customers:	\$0.09863	\$0.09863	\$0.09863
CARE customers:	\$0.07890	\$0.07890	\$0.07890

<sup>1/</sup> The rates for core transportation-only customers, with the exception of customers taking service under Schedule GT-NGV, include any FERC Settlement Proceeds Memorandum Account (FSPMA) credit adjustments.

<sup>2/</sup> This charge is applicable to Utility Procurement Customers and includes the GPC and GPC-A Procurement Charges shown in Schedule GPC which are subject to change monthly as set forth in Special Condition 7.

<sup>3/</sup> Effective starting May 1, 2017, the minimum bill is calculated as the minimum bill charge of \$0.09863 per day times the number of days in the billing cycle (approximately \$3 per month) with a 20% discount applied for CARE customer resulting in a minimum bill charge of \$0.07890 per day (approximately \$2.40 per month).

(Continued)

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Advice Ltr. No. 2649-G

Decision No. \_\_\_\_\_

Issued by  
**Dan Skopek**  
Vice President  
Regulatory Affairs

Date Filed Feb 6, 2018

Effective Feb 10, 2018

Resolution No. \_\_\_\_\_



## Appendix D – Energy Savings Details

**Table 9: Single Family Package Energy Savings Details for Case 1**

Climate Zone	T-24 Comp. Margin	PV Capacity (kW)	Elec Savings (kWh)			Gas Savings (therms)
			w/o PV	PV Only	Net Savings	
Case 1						
CZ1	1.7%	4.0	-1,252	5,353	4,100	126
CZ2	5.0%	3.1	-1,059	4,851	3,793	115
CZ3	6.6%	3.2	-1,053	5,051	3,998	128
CZ4	1.3%	3.1	-1,372	4,992	3,620	111
CZ5	2.0%	2.9	-1,081	4,878	3,797	122
CZ6	0.8%	3.0	-911	4,737	3,826	109
CZ7	6.0%	2.6	-785	4,259	3,474	109
CZ8	4.4%	3.5	-1,447	5,538	4,091	105
CZ9	11.2%	3.4	-1,450	5,554	4,104	104
CZ10-SCE/SoCalGas	9.1%	3.4	-1,443	5,543	4,099	103
CZ10-SDGE	9.1%	3.4	-1,443	5,543	4,099	103
CZ11	8.1%	4.5	-1,556	7,166	5,609	101
CZ12	5.9%	4.0	-1,650	6,277	4,627	106
CZ13	11.2%	4.6	-1,493	7,109	5,616	100
CZ14-SCE/SoCalGas	6.9%	3.4	-1,609	6,109	4,499	103
CZ14-SDGE	6.9%	3.4	-1,609	6,109	4,499	103
CZ15	13.0%	5.2	-1,047	8,699	7,653	79
CZ16	5.1%	3.5	-1,778	5,945	4,167	122



**Table 10: Single Family Package Energy Savings Details for Case 2**

Climate Zone	T-24 Comp. Margin	PV Capacity (kW)	Elec Savings (kWh)			Gas Savings (therms)
			w/o PV	PV Only	Net Savings	
Case 2						
CZ1	1.9%	3.9	-1,214	5,219	4,005	121
CZ2	5.8%	3.1	-990	4,851	3,861	112
CZ3	8.3%	3.2	-983	5,051	4,068	126
CZ4	16.0%	2.8	-924	4,509	3,585	109
CZ5	3.1%	2.9	-1,017	4,878	3,861	119
CZ6	2.8%	3.0	-833	4,737	3,904	107
CZ7	2.4%	2.7	-807	4,423	3,616	108
CZ8	31.8%	3.1	-783	4,905	4,122	104
CZ9	28.1%	2.9	-788	4,737	3,949	103
CZ10-SCE/SoCalGas	25.5%	3.0	-781	4,890	4,110	102
CZ10-SDGE	25.5%	3.0	-781	4,890	4,110	102
CZ11	17.2%	4.0	-862	6,369	5,507	99
CZ12	20.7%	3.5	-912	5,493	4,581	104
CZ13	19.9%	4.2	-819	6,491	5,672	98
CZ14-SCE/SoCalGas	16.2%	3.0	-885	5,390	4,505	101
CZ14-SDGE	16.2%	3.0	-885	5,390	4,505	101
CZ15	17.9%	4.9	-535	8,197	7,662	78
CZ16	7.6%	3.4	-1,577	5,775	4,198	119

