DOCKETED

Docket Number:	17-BSTD-01
Project Title:	2019 Building Energy Efficiency Standards PreRulemaking
TN #:	217290
Document Title:	Model Solar Ordinance Cost Effectiveness Study
Description:	N/A
Filer:	Ingrid Neumann
Organization:	California Energy Commission
Submitter Role:	Commission Staff
Submission Date:	4/25/2017 11:05:21 AM
Docketed Date:	4/25/2017

CA Statewide Codes and Standards Program

Title 24, Part 11
Local Energy Efficiency Ordinances

Local PV Ordinance Cost Effectiveness Study

Prepared for:
Marshall Hunt
Codes and Standards Program
Pacific Gas and Electric Company

Prepared by:
Davis Energy Group, Inc.
Enercomp, Inc.
Misti Bruceri & Associates, LLC

Last Modified: September 23, 2016

LEGAL NOTICE

This report was prepared by Pacific Gas and Electric Company and funded by the California utility customers under the auspices of the California Public Utilities Commission.

Table of Contents

List of Tables

List of Figures

1 Introduction

The California Building Energy Efficiency Standards Title 24, Part 6 (Title 24) (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. 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.

The Energy Commission staff approached the statewide Codes and Standards team to provide inputs on a draft solar photovoltaic model ordinance. The Energy Commission staff asked the IOU team to review the ordinance language and to suggest recommended solar PV system sizing based on size of home.

Based on conversations between the Energy Commission, the IOUs and their consultant teams, the following needs were identified for the proposed PV ordinance:

a. Needs to be simple and easy to implement by the local jurisdiction
b. Must be aligned with the overall vision for energy efficiency and ZNE driving to a "glide path" to meet 2020 goals for residential new construction.
c. Must not result in oversized PV systems that may have grid impacts.

This report presents the results from analysis of the feasibility and cost-effectiveness of requiring new low-rise single family and multifamily residential construction to include rooftop PV systems in addition to meeting the 2016 Building Energy Efficiency Standards, which become effective January 1, 2017. The cost effectiveness analysis for all sixteen California climate zones in this report includes meeting minimum Title 24 efficiency performance targets plus on-site renewable energy generation sized to offset a portion of the total TDV loads of the building without risking sizing of the PV system larger than the estimated electrical energy use of the building. Additional scenarios including both PV and above-code energy efficiency measures are documented in a report delivered to Pacific Gas and Electric Company[1].

2 Methodology and Assumptions

2.1 Building Prototypes

The Energy Commission defines building prototypes which it uses to evaluate the cost-effectiveness of proposed changes to Title 24 requirements. Two single family prototypes and one multifamily prototype, are used in this analysis and 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 Alternative Calculation Method (ACM) Approval Manual (CEC, 2016b).

[1] Title 24, Part 11, Local Energy Efficiency Ordinances – CALGreen Cost Effectiveness Study, September 2, 2016

Table 1: Prototype Characteristics

	Single Family One-Story	Single Family Two-Story	Multifamily
Conditioned Floor Area	2,100 ft^2	2,700 ft^2	6,960 ft^2: (4) 780 ft^2 & (4) 960 ft^2 units
Num. of Stories	1	2	2
Num. of Bedrooms	3	3	(4) 1-bed & (4) 2-bed units
Window-to-Floor Area Ratio	20%	20%	15%

Additionally, each prototype building has the following features:

- Slab-on-grade foundation
- Vented attic. High performance attic in climates where prescriptively included (CZ 4, 8-16) with insulation installed below roof deck. Refer to Table 150.1-A in Appendix A.
- Ductwork located in the attic for single family homes and in conditioned space for multifamily.
- Split-system gas furnace with air conditioner that meets the minimum federal guidelines for efficiency
- Tankless gas water heater that meets the minimum federal guidelines for efficiency; individual water heaters in each multifamily apartment.

Other features are defined consistent with the Standard Design in the Alternative Calculation Method Reference Manual (CEC, 2016c), designed to meet, but not exceed, the minimum requirements.

The Energy Commission's standard protocol for the 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% single-story homes and 55% two-story homes. Simulation results in this study are therefore characterized according to this ratio, which is approximately equivalent to a 2,430 ft^2 house[2].

2.2 Energy Simulations

The CBECC-RES 2016.2.0 Alpha2[3] compliance simulation tool was used to evaluate energy impacts using the 2016 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 Title 24 energy code to evaluate compliance with the Title 24 standards. TDV values energy use differently depending on the fuel source (gas, electricity, and propane), time of day, and season. TDV was developed to reflect the "societal value or cost" of energy including long-term projected costs of energy such as the cost of providing energy during peak periods of demand and other societal costs such as projected costs for carbon emissions. Electricity used (or saved) during peak periods of the summer 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% compliance margin). Standards

[2] 2,430 ft^2 = 45% * 2,100 ft^2 + 55% * 2,700 ft^2

[3] On June 14, 2016 the Energy Commission approved CBECC-Res 2016.2.0 Version of the software. The version used for this study is nearly identical to the approved version with the exception of minor changes that do not affect the cost effective analysis of the measures evaluated.

Table 150.1-A, included in Appendix A lists the prescriptive measures that determine the base design in each climate zone.

2.3 PV Sizing Criteria

The minimum PV system size required by the proposed ordinance is determined using a performance-based (simulation) approach. There is a prescriptive sizing option that yields minimum system capacities equivalent to the performance option. The intent of the PV sizing assumptions is to size PV to offset building electricity use while minimizing the risk of requiring PV system sizes that produce significantly more than the building total electricity use on an annual basis. The following considerations were used for sizing the PV systems:

1. Solar PV capacities proposed in the ordinance are the minimum sizes required. A builder or homeowner may install larger systems.
2. Solar PV sizing is based on percent of total building TDV energy use. Initial calculations were conducted such that PV system size is equivalent to offsetting 80% of total building estimated electricity use for a typical gas/electric home built to the minimum 2016 Title 24 requirements.
3. The performance option is based on offsetting a certain percentage of total TDV energy use. System sizes calculated in Step 3 above were adjusted to reference a percentage of TDV energy use, and grouped into three bins depending on system size and climate zone (see Table 2). The sizing is fuel agnostic since it based on TDV and designed such that builders designing homes more efficient than 2016 code are not forced to install PV systems larger than the building's projected annual electricity use. The performance section of the ordinance uses TDV which needs to be incorporated into CBECC-Res software making the review process for building departments similar to that for regular Title 24 compliance review.
4. Based on these calculations, prescriptive PV capacity tables were developed for each climate zone (see Table 3) for single family buildings with conditioned floor areas less than 4,500 square feet. Larger homes must use the performance approach. Homes smaller than 4,500 square feet may comply either with the prescriptive or the performance path.
5. PV system values shown in Table 2 and Table 3 were calculated using the following methodology:
    - PV size was estimated based on percent of total building TDV for each climate zone and reflects a value that does not exceed 80% of total building electricity use.
    - Calculations are based on specs for a 2016 code compliant building and both TDV and electricity use were calculated using CBECC-Res software.
    - HVAC energy use (cooling, heating, IAQ fans) are based on per square foot energy using a weighted average of the 2,100 single-story and 2,700 2-story single family prototype buildings and assuming gas appliances. Values specific to each climate zone.
    - Water heating energy use assumes a standard gas tankless water heater and is adjusted based on number of bedrooms consistent with the rules in the Alternative Calculation Method (ACM) Reference Manual (CEC. 2016c). Hot water usage capped at 5 bedrooms per ACM.
    - Plug load, lighting, and appliance energy use based on algorithms developed from 2016 CASE report and used in CBECC-Res. Values are adjusted based on # of bedrooms and floor area. Values capped at 4,150 square feet and 7 bedrooms per ACM.
    - PV production based on specific PV production for each climate zone, using PV modeling in CBECC-Res (PVWatts methodology). Assumes standard PV efficiency and assumptions consistent with the NSHP California Flexible Installation (CFI) criteria (170

degree azimuth, 5:12 roof pitch), along with a 96% efficiency inverter and standard system losses.

Table 2: Minimum Percent Reduction of Total Annual TDV Energy Use by Climate Zone (Performance Approach)

Climate Zone	% Total TDV
CZs 14, 16	35%
CZs 1, 2, 4, 9-13, 15	45%
CZs 3, 5-8	55%

Table 3: Minimum PV System Size (kW_{DC}) required to meet Solar PV Ordinance by Climate Zone

Conditioned Space (ft2)	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

2.4 Cost Effectiveness

A customer based approach to evaluating cost effectiveness was used based on past experience with reach code adoption by local governments. The current residential utility rates at the time of the analysis were used 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) was applied to the base case and all cases without PV systems. The applicable residential time-of-use (TOU) rate was applied to all cases with PV systems. [4] 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 NEM tariffs for that utility. The net surplus compensation rates for the different utilities are as follows:

- PG&E: $0.043 / kWh
- SCE: $0.0298 / kWh[5]
- SDG&E: $0.0321 / kWh[6]

[4] 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?).

[5] SCE net surplus compensation rate based on 1-year average September 2015 – August 2016.

[6] SDG&E net surplus compensation rate based on 1-year average August 2015 – July 2016.

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 / SoCal Gas	D	TOU-D-T	GR
7	SDG&E	DR	DR-SES	GR

Table 5 below summarizes the incremental costs applied in this analysis. A range of PV pricing was evaluated. Case 1 assumes that the installed cost is reduced by the current NSHP incentive. Case 2 assumes no NSHP incentive in the cost. The 30% federal solar investment tax credit is applied in both cases.

Table 5: Measure Descriptions & Cost Assumptions

Case	Incremental Cost		Source & Notes
	Single Family	MF – Per Unit	
1) Includes current NSHP incentive	$3.35 / W DC	$3.03 / W DC	Average installed system costs in California from Go Solar California (http://www.gosolarcalifornia.ca.gov/) reduced by $0.50/Watt to reflect NSHP incentives & 30% for the solar investment tax credit.[7]
2) No NSHP Incentive	$3.70 / W DC	$3.38 / W DC	Same assumptions as above but without the $0.50/Watt NSHP incentive

Cost effectiveness is presented according to lifecycle customer benefit-to-cost ratio. The benefit-to-cost ratio is a metric which 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:

Lifecycle Customer Benefit-Cost Ratio =
*(Annual utility cost savings * Lifecycle cost factor) / (First incremental cost * Financing factor)*

The lifecycle cost factor is 19.6 and includes the following assumptions:

- 30-year measure life & utility cost savings
- 3% real discount rate
- No utility rate escalation (conservative assumption)

The financing factor is 1.068 and includes the following assumptions:

- 30-year financing term
- 4.5% loan interest rate
- 3% real discount rate
- 20% average tax rate (to account for tax savings due to loan interest deductions)

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

[7] Avg. system cost for systems < 10kW (for the last 12 months) of $5.29/Watt for single family (http://www.gosolarcalifornia.ca.gov/). For multi-family systems, an average of the < 10 kW and > 10kW system cost ($4.37/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.

Simple payback = First incremental cost / Annual customer utility cost savings

2.5 Greenhouse Gas Emissions

Equivalent CO_2 emission savings were calculated using the following emission factors. Electricity factors are specific to California electricity production.

Table 6: Equivalent CO_2 Emissions Factors

		Source
Electricity	0.724 lb. CO_2-e / kWh	U.S. Environmental Protection agency's 2007 eGRID data.[8]
Natural Gas	11.7 lb. CO_2-e / Therm	Emission rates for natural gas combustion as reported by the U.S. Environmental Protection agency's GHG Equivalencies Calculator.[9]

3 Results

3.1 Single Family Results

A comparison of cost effectiveness for each climate zone, with and without the NSHP incentive, is presented in Figure 1. Table 7 provides the results in tabular form for the case without the NSHP incentive, along with energy and greenhouse gas (GHG) savings. The lifecycle benefit-to-cost ratio threshold of one is roughly equivalent to a simple payback of 18 years.

The PV system capacity is sized based upon the values in Table 3 to provide approximately 80% of estimated annual kWh consumption with capacities ranging from 2.2 kW DC in mild climate zone 7 to 4.6 kW DC in hot climate zone 15. The solar package demonstrates cost effectiveness in all climate zones with a benefit-to-cost ratio ranging from 1.18 to 1.59 with the NSHP incentive and 1.07 to 1.44 without the NSHP incentive. Greenhouse gas (GHG) savings range from 25.7% to 63.8%.

[8] https://www.epa.gov/energy/ghg-equivalencies-calculator-calculations-and-references

[9] https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

Figure 1: Single family cost effectiveness comparison

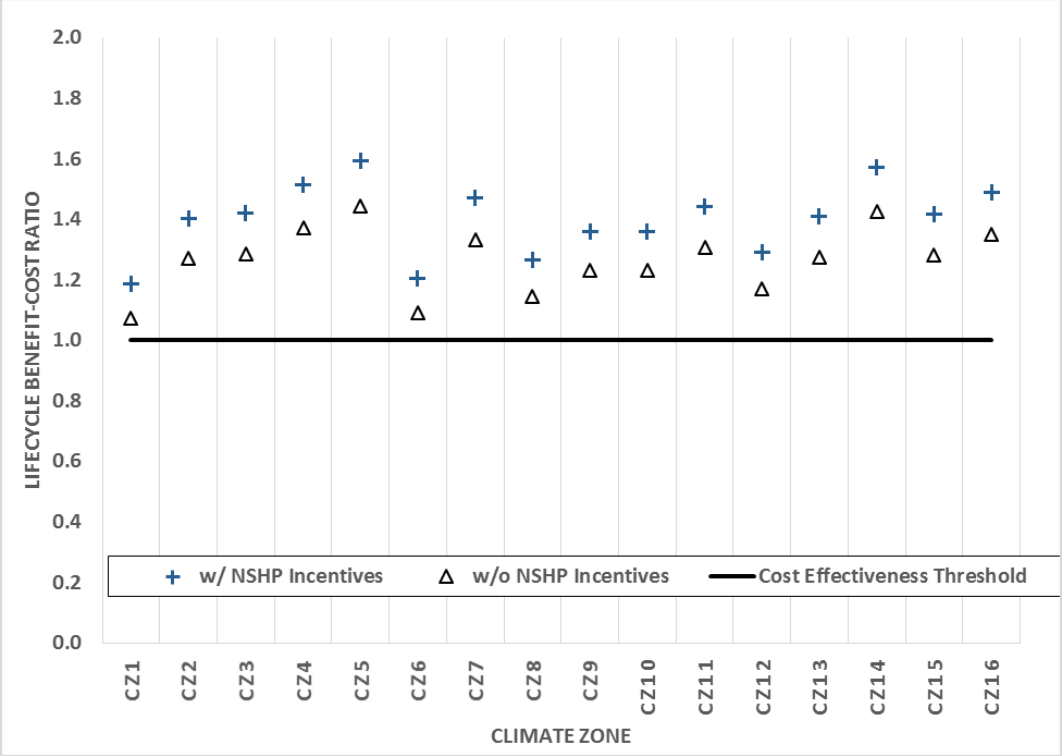


Table 7: Single Family PV Package Cost Effectiveness Results

Climate Zone	PV Capacity (kW)	Elec Savings (kWh)	% Carbon Savings[1]	Package Cost[2]	Utility Cost Savings	Simple Payback	Lifecycle Benefit-Cost Ratio
CZ1	3.0	4,041	30.4%	$12,301	$719	17.1	1.07
CZ2	2.5	3,857	33.7%	$10,041	$694	14.5	1.27
CZ3	2.6	4,049	42.5%	$10,448	$732	14.3	1.29
CZ4	2.3	3,647	36.0%	$9,226	$688	13.4	1.37
CZ5	2.3	3,810	41.9%	$9,226	$725	12.7	1.44
CZ6	2.5	3,892	46.8%	$10,041	$596	16.8	1.09
CZ7	2.2	3,546	48.4%	$8,819	$639	13.8	1.33
CZ8	2.6	4,058	51.7%	$10,448	$652	16.0	1.15
CZ9	2.5	4,026	47.1%	$10,041	$674	14.9	1.23
CZ10	2.5	4,108	46.1%	$10,265	$688	14.9	1.23
CZ11	3.5	5,533	44.9%	$14,155	$1,007	14.1	1.31
CZ12	2.9	4,582	40.4%	$11,894	$757	15.7	1.17
CZ13	3.7	5,680	47.2%	$14,969	$1,040	14.4	1.27
CZ14	2.5	4,528	37.2%	$10,265	$796	12.9	1.42
CZ15	4.6	7,670	63.8%	$18,676	$1,303	14.3	1.28
CZ16	2.5	4,187	25.7%	$10,041	$738	13.6	1.35

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

[2] Includes 10% markup for builder profit and overhead. $0.50 / W NSHP incentive not applied to package costs

3.2 Multifamily Results

A comparison of cost effectiveness for the multi-family prototype is presented in Figure 2. Table 8 provides the results in tabular form for the case without the NSHP incentive, along with energy and greenhouse gas savings. *All multifamily results are presented on a per dwelling unit basis*. The lifecycle benefit-to-cost ratio threshold of one is roughly equivalent to a simple payback of 18 years.

The solar package demonstrates cost effectiveness in all climate zones with a benefit-to-cost ratio ranging from 1.16 to 1.59 with the NSHP incentive and 1.04 to 1.43 without the NSHP incentive. Greenhouse gas (GHG) savings range from 30.8% to 54.9%. The required PV capacity per apartment ranges from 1.3 kW DC in the mild climates to 2.1 kW DC in hot climates (CZ15). For the multifamily prototype 8-unit apartment building, this is equivalent to 10.4 to 16.8 kW for the building.

Figure 2: Multifamily cost effectiveness comparison

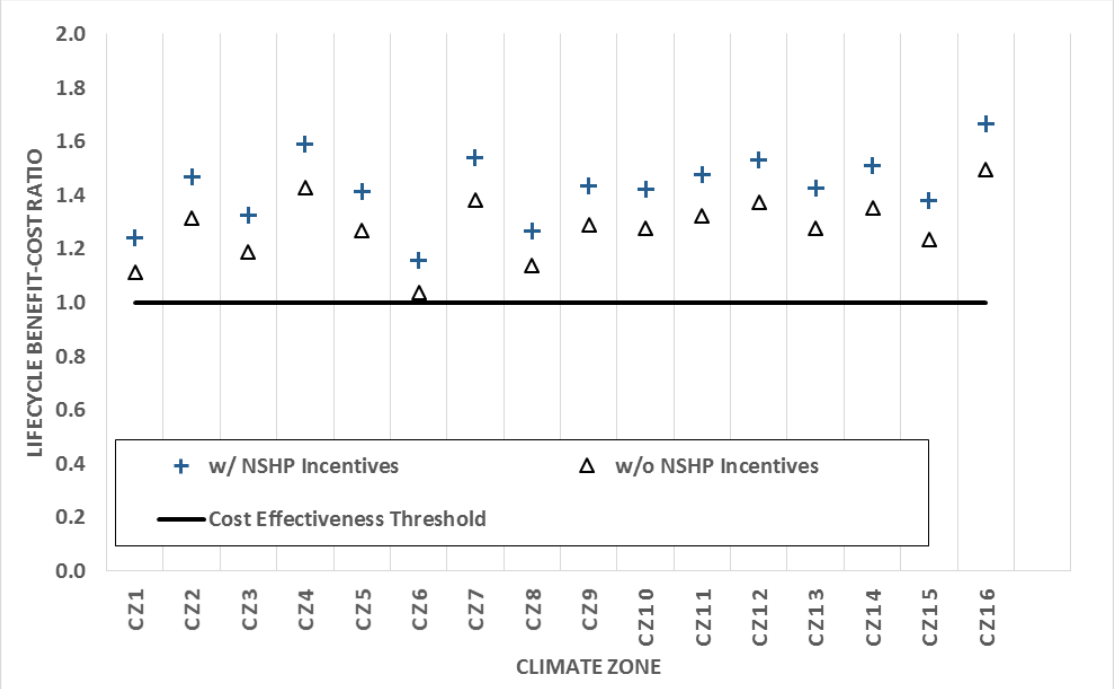


Table 8: Multifamily PV Package Cost Effectiveness Results

Climate Zone	PV Capacity (kW)	Elec Savings (kWh)	% Carbon Savings[1]	Package Costs[2]	Utility Cost Savings	Simple Payback	Lifecycle Benefit-Cost Ratio
CZ1	1.6	2,141	35.5%	$5,951	$361	16.5	1.11
CZ2	1.4	2,191	39.2%	$5,207	$373	14.0	1.32
CZ3	1.5	2,368	46.6%	$5,579	$361	15.5	1.19
CZ4	1.3	2,093	39.8%	$4,835	$376	12.9	1.43
CZ5	1.4	2,355	46.9%	$5,207	$360	14.5	1.27
CZ6	1.5	2,368	49.5%	$5,579	$315	17.7	1.04
CZ7	1.3	2,129	46.2%	$4,835	$364	13.3	1.38
CZ8	1.5	2,373	48.9%	$5,579	$345	16.2	1.14
CZ9	1.4	2,287	45.4%	$5,207	$365	14.3	1.29
CZ10	1.4	2,282	44.3%	$5,207	$362	14.4	1.28
CZ11	1.7	2,707	44.2%	$6,322	$456	13.9	1.32
CZ12	1.5	2,354	41.1%	$5,579	$417	13.4	1.37
CZ13	1.8	2,782	45.9%	$6,694	$466	14.4	1.28
CZ14	1.3	2,336	38.5%	$4,835	$356	13.6	1.35
CZ15	2.1	3,513	54.9%	$7,810	$526	14.8	1.24
CZ16	1.3	2,208	30.8%	$4,835	$394	12.3	1.49

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

[2] Includes 10% markup for builder profit and overhead. $0.50 / W NSHP incentive not applied to package costs

4 Conclusions & Summary

This report finds the evaluated solar PV ordinance to be both feasible and cost effective, and reduces energy demand in all 16 California climates zones.

The following describes the recommended PV sizing and requirements for all climate zones. The PV ordinance requires that all buildings meet code compliance for the 2016 Title 24, Part 6 without the use of the PV compliance credit (PVCC). Projects are also required to install a PV system based on the capacities shown in Table 2 and Table 3.

Lifecycle benefit-to-cost ratios for adding PV to a 2016 code compliant building are above one, demonstrating cost effectiveness for both the single family and multifamily prototypes in all climate zones.

This report has identified that an ordinance that requires compliance with the 2016 building code, without taking the PV credit, combined with PV systems sized to the values shown in Table 2 and Table 3 is cost effective for both single family and low-rise multifamily dwellings and can be adopted by cities and counties within investor-owned utility territories across California consistent to the requirements of the Public Resources Code (25402.1(h)) and to the benefit of the jurisdiction, its residents, and the state.

5 References

CEC. 2016a. 2016 Building Energy Efficiency Standards for Residential and Nonresidential Buildings. CEC-400-2015-037-CMF. June 2015. California Energy Commission. http://www.energy.ca.gov/2015publications/CEC-400-2015-037/CEC-400-2015-037-CMF.pdf

CEC. 2016b. 2016 Alternative Calculation Method Approval Manual. CEC-400-2015-039-CMF. June 2015. California Energy Commission. http://www.energy.ca.gov/2015publications/CEC-400-2015-039/CEC-400-2015-039-CMF.pdf

CEC. 2016c. 2016 Residential Alternative Calculation Method Reference Manual. CEC-400-2015-024-CMF-REV. June 2017. California Energy Commission. http://www.energy.ca.gov/2015publications/CEC-400-2015-024/CEC-400-2015-024-CMF-REV.pdf

Horii, B., E. Cutter, N. Kapur, J. Arent, and D. Conotyannis. 2014. "Time Dependent Valuation of Energy for Developing Building Energy Efficiency Standards." http://www.energy.ca.gov/title24/2016standards/prerulemaking/documents/2014-07-09_workshop/2017_TDV_Documents/

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[1]	NR	NR	NR	R 8	NR	NR	NR	R 8	R 8	R 8	R 8	R 8	R 8	R 8	R 8	R 8
					With Air Space[2]	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	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 38	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[4]		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[5]		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[6]		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[7]		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	U0.269 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[11]**	**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[9]		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[10]		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[12]	**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
			§150.1(c)9B	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															

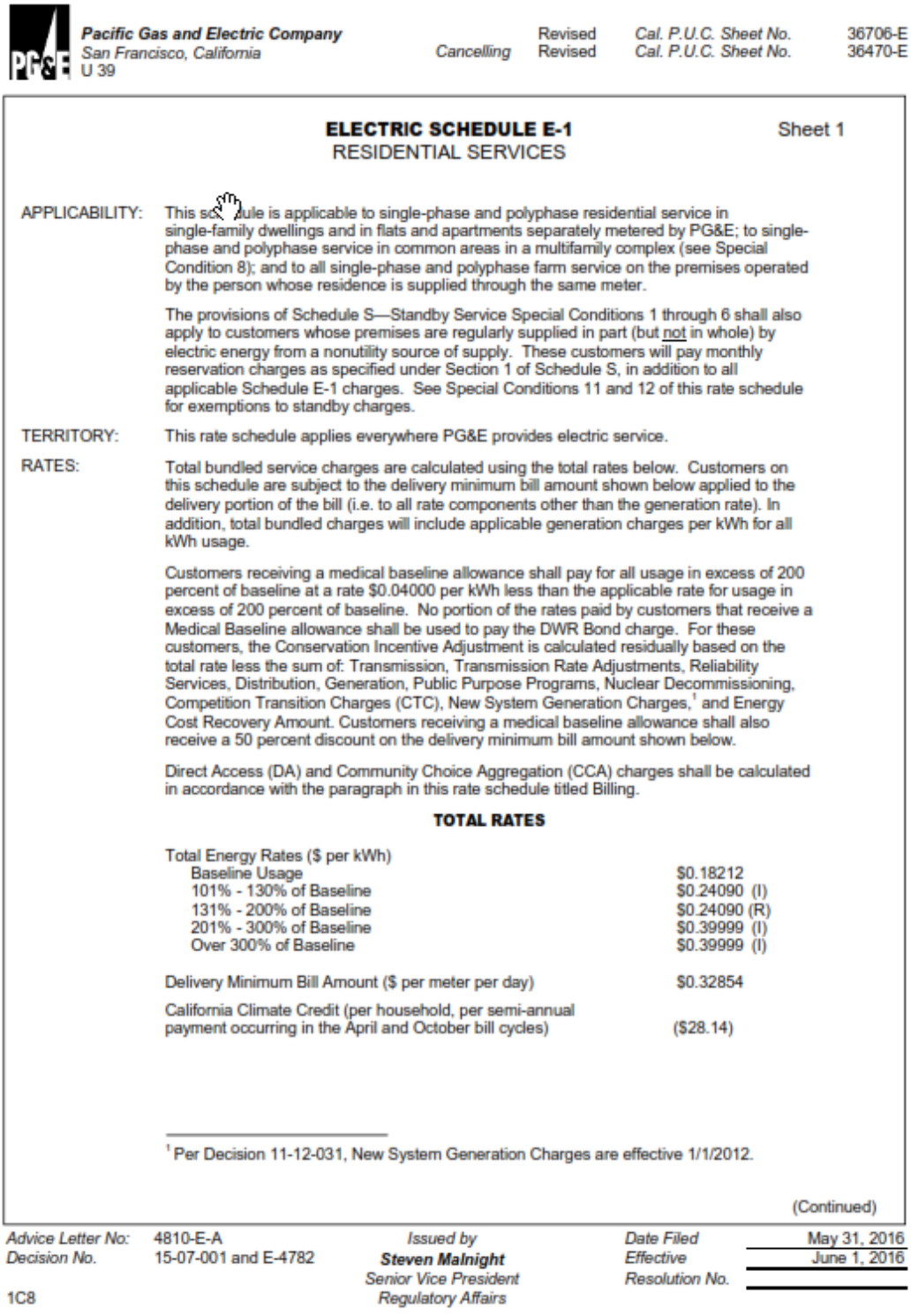
Footnote requirements to TABLE 150.1-A:[10]

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^2. "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^2. "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 timelimiting 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.

[10] Single family buildings are modeled with Option B and multifamily buildings are modeled with Option C.

Appendix B - Utility Rate Tariffs

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 March 2016.



Pacific Gas and Electric Company
San Francisco, California
U 39

Cancelling Revised *Cal. P.U.C. Sheet No.* 36706-E
Revised *Cal. P.U.C. Sheet No.* 36470-E

ELECTRIC SCHEDULE E-1 Sheet 1
RESIDENTIAL SERVICES

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,[1] 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	$0.18212
101% - 130% of Baseline	$0.24090 (I)
131% - 200% of Baseline	$0.24090 (R)
201% - 300% of Baseline	$0.39999 (I)
Over 300% of Baseline	$0.39999 (I)
Delivery Minimum Bill Amount ($ per meter per day)	$0.32854
California Climate Credit (per household, per semi-annual payment occurring in the April and October bill cycles)	($28.14)

[1] Per Decision 11-12-031, New System Generation Charges are effective 1/1/2012.

(Continued)

Advice Letter No: 4810-E-A
Decision No. 15-07-001 and E-4782
1C8

Issued by
Steven Malnight
Senior Vice President
Regulatory Affairs

Date Filed May 31, 2016
Effective June 1, 2016
Resolution No.

Pacific Gas and Electric Company
San Francisco, California
U 39

Cancelling Revised Cal. P.U.C. Sheet No. 36713-E
Revised Cal. P.U.C. Sheet No. 36500-E

ELECTRIC SCHEDULE E-TOU Sheet 2
RESIDENTIAL TIME-OF-USE SERVICE

RATES
(Cont'd.):

OPTION A TOTAL RATES

Total Energy Rates ($ per kWh)	PEAK		OFF-PEAK	
Summer				
Total Usage	$0.40327	(I)	$0.32769	(I)
Baseline Credit (Applied to Baseline Usage Only)	($0.11709)	(R)	($0.11709)	(R)
Winter				
Total Usage	$0.28530	(I)	$0.27100	(I)
Baseline Credit (Applied to Baseline Usage Only)	($0.11709)	(R)	($0.11709)	(R)
Delivery Minimum Bill Amount ($ per meter per day)	$0.32854			
California Climate Credit (per household, per semi-annual payment occurring in the April and October bill cycles)	($28.14)			

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[1] based on kWh usage times the corresponding unbundled rate component per kWh, with any residual revenue assigned to Distribution.*

[1] Per Decision 11-12-031, New System Generation Charges are effective 1/1/2012.
* This same assignment of revenues applies to direct access and community choice aggregation customers.

(Continued)

Advice Letter No: 4810-E-A
Decision No. 15-07-001 and E-4782
2C9

Issued by
Steven Malnight
Senior Vice President
Regulatory Affairs

Date Filed May 31, 2016
Effective June 1, 2016
Resolution No.

Pacific Gas and Electric Company
San Francisco, California
U 39

Cancelling Revised Cal. P.U.C. Sheet No. 32682-G
Revised Cal. P.U.C. Sheet No. 32620-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:

	Per Day
Minimum Transportation Charge:**	$0.09863

	Per Therm			
	Baseline		Excess	
Procurement:	$0.20960	(R)	$0.20960	(R)
Transportation Charge:	$0.81592		$1.30547	
Total:	$1.02552	(R)	$1.51507	(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.
** 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)

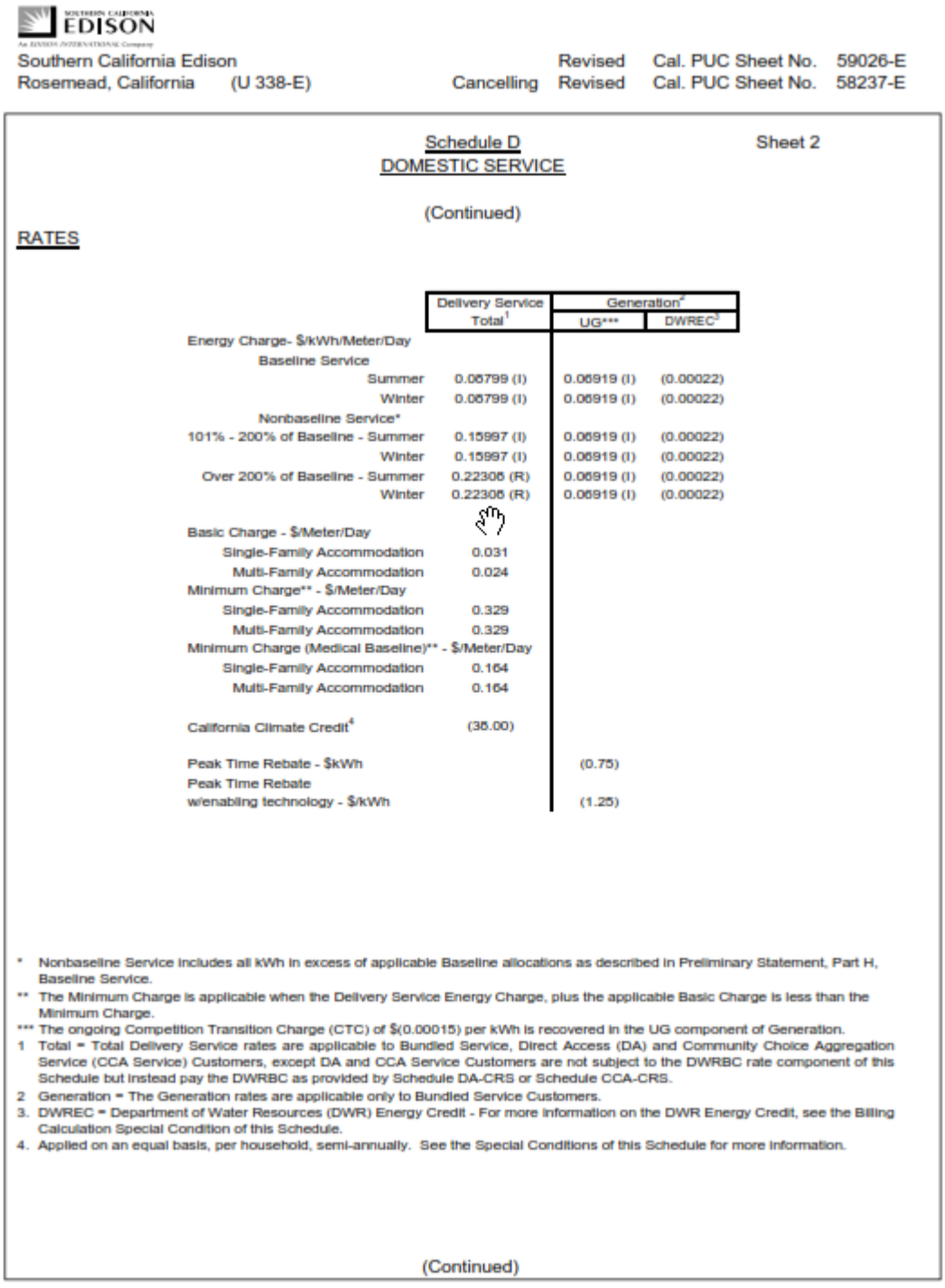
Advice Letter No: 3715-G
Decision No. 97-10-065 & 98-07-025

Issued by
Steven Malnight
Senior Vice President
Regulatory Affairs

Date Filed May 24, 2016
Effective June 1, 2016
Resolution No.

1C6

Following are the SCE electricity tariffs, both standard and time-of-use, and SoCalGas natural gas tariffs applied in this study.



SOUTHERN CALIFORNIA EDISON
An EDISON INTERNATIONAL Company

Southern California Edison — Revised — Cal. PUC Sheet No. 59026-E
Rosemead, California (U 338-E) — Cancelling — Revised — Cal. PUC Sheet No. 58237-E

Schedule D — Sheet 2
DOMESTIC SERVICE

(Continued)

RATES

	Delivery Service Total[1]	Generation[2] UG***	Generation[2] DWREC[3]
Energy Charge- $/kWh/Meter/Day			
Baseline Service			
Summer	0.06799 (I)	0.06919 (I)	(0.00022)
Winter	0.06799 (I)	0.06919 (I)	(0.00022)
Nonbaseline Service*			
101% - 200% of Baseline - Summer	0.15997 (I)	0.06919 (I)	(0.00022)
Winter	0.15997 (I)	0.06919 (I)	(0.00022)
Over 200% of Baseline - Summer	0.22306 (R)	0.06919 (I)	(0.00022)
Winter	0.22306 (R)	0.06919 (I)	(0.00022)
Basic Charge - $/Meter/Day			
Single-Family Accommodation	0.031		
Multi-Family Accommodation	0.024		
Minimum Charge** - $/Meter/Day			
Single-Family Accommodation	0.329		
Multi-Family Accommodation	0.329		
Minimum Charge (Medical Baseline)** - $/Meter/Day			
Single-Family Accommodation	0.164		
Multi-Family Accommodation	0.164		
California Climate Credit[4]	(35.00)		
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 $(0.00015) per kWh is recovered in the UG component of Generation.
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 3401-E
Decision 16-03-030
2C11

Issued by
R. O. Nichols
Senior Vice President

(To be inserted by Cal. PUC)
Date Filed May 2, 2016
Effective Jun 1, 2016
Resolution

SOUTHERN CALIFORNIA EDISON
An EDISON INTERNATIONAL Company

Southern California Edison — Revised Cal. PUC Sheet No. 59059-E
Rosemead, California (U 338-E) — Cancelling Revised Cal. PUC Sheet No. 58249-E

Schedule TOU-D-T — Sheet 2
TIME-OF-USE TIERED DOMESTIC

(Continued)

RATES

	Delivery Service Total[1]	Generation[2] UG***	Generation[2] DWREC[3]
Energy Charge - $/kWh/Meter/Day			
Summer Season - On-Peak			
Level I (up to 130% of Baseline)	0.10523 (I)	0.21660 (R)	(0.00022)
Level II (More than 130% of Baseline)	0.16352 (R)	0.21660 (R)	(0.00022)
Summer Season - Off-Peak			
Level I (up to 130% of Baseline)	0.10523 (I)	0.05311 (I)	(0.00022)
Level II (More than 130% of Baseline)	0.16352 (R)	0.05311 (I)	(0.00022)
Winter Season - On-Peak			
Level I (up to 130% of Baseline)	0.10523 (I)	0.09660 (R)	(0.00022)
Level II (More than 130% of Baseline)	0.16352 (R)	0.09660 (R)	(0.00022)
Winter Season - Off-Peak			
Level I (up to 130% of Baseline)	0.10523 (I)	0.04749 (I)	(0.00022)
Level II (More than 130% of Baseline)	0.16352 (R)	0.04749 (I)	(0.00022)
Basic Charge - $/Meter/Day			
Single-Family Accommodation	0.031		
Multi-Family Accommodation	0.024		
Minimum Charge* - $/Meter/Day			
Single-Family Accommodation	0.329		
Multi-Family Accommodation	0.329		
Minimum Charge (Medical Baseline)** - $/Meter/Day			
Single-Family Accommodation	0.164		
Multi-Family Accommodation	0.164		
California Climate Credit[4]	(36.00)		
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 $(0.00015) per kWh is recovered in the UG component of Generation.
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 3401-E
Decision 16-03-030
2C19

Issued by
R. O. Nichols
Senior Vice President

(To be inserted by Cal. PUC)
Date Filed May 2, 2016
Effective Jun 1, 2016
Resolution

SOUTHERN CALIFORNIA GAS COMPANY Revised CAL. P.U.C. SHEET NO. 52782-G
LOS ANGELES, CALIFORNIA CANCELING Revised CAL. P.U.C. SHEET NO. 52751-G

Schedule No. GR Sheet 1
RESIDENTIAL SERVICE
(Includes GR, GR-C and GT-R Rates)

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	GR	GR-C	GT-R	
Customer Charge, 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[1/]:	33.149¢	33.149¢	33.149¢	
Baseline Rate, per therm (baseline usage defined in Special Conditions 3 and 4):				
Procurement Charge: [2/]	34.536¢	34.536¢	N/A	I
Transmission Charge: [3/]	56.280¢	56.280¢	55.758¢	
Total Baseline Charge:	90.816¢	90.816¢	55.758¢	I
Non-Baseline Rate, per therm (usage in excess of baseline usage):				
Procurement Charge: [2/]	34.536¢	34.536¢	N/A	I
Transmission Charge: [3/]	82.280¢	82.280¢	81.758¢	
Total Non-Baseline Charge:	116.816¢	116.816¢	81.758¢	I

[1/] 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.)

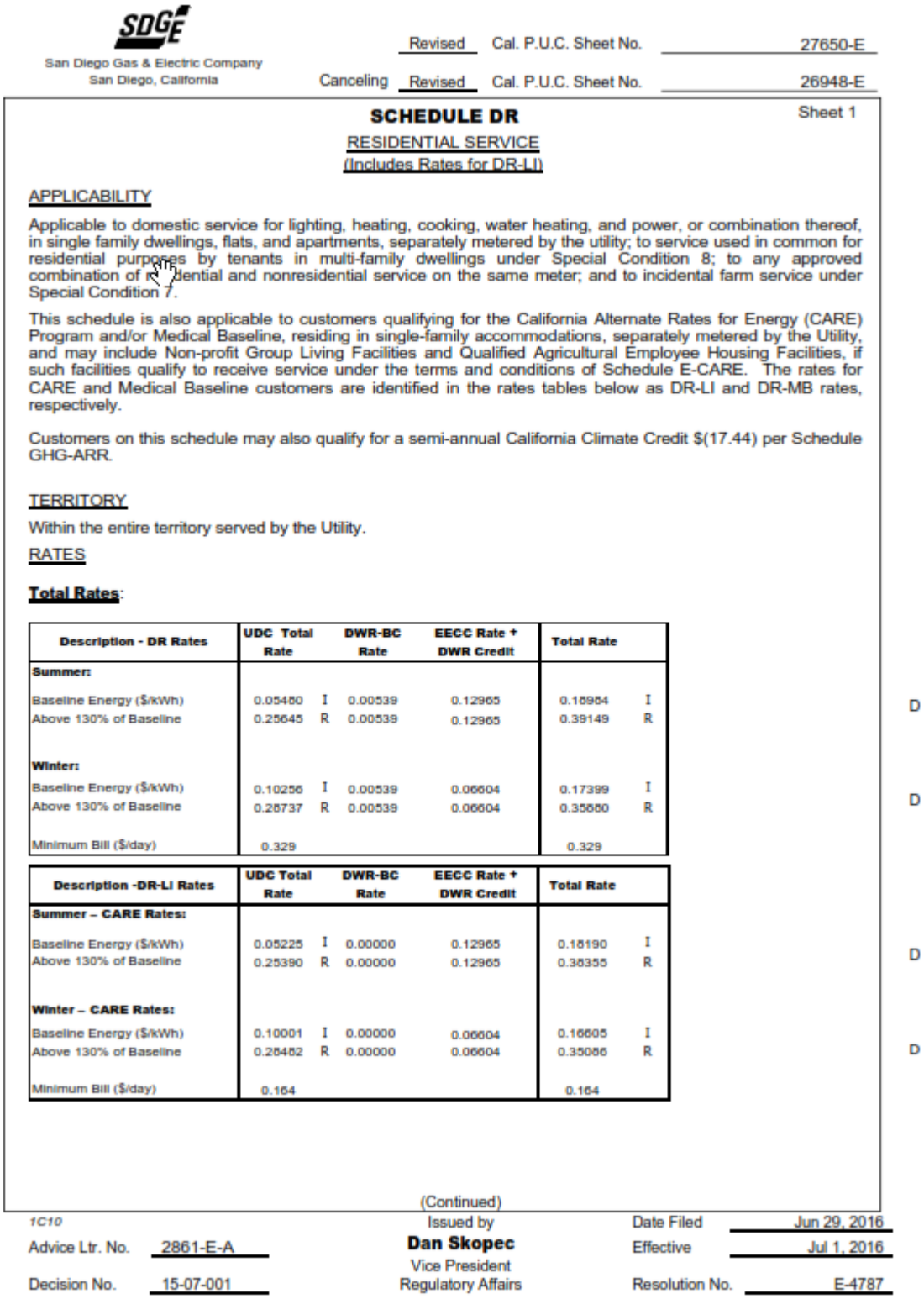
(Continued)

(TO BE INSERTED BY UTILITY)
ADVICE LETTER NO. 4989
DECISION NO.
1C6

ISSUED BY
Dan Skopec
Vice President
Regulatory Affairs

(TO BE INSERTED BY CAL. PUC)
DATE FILED Jul 7, 2016
EFFECTIVE Jul 10, 2016
RESOLUTION NO. G-3351

Following are the SDG&E electricity, both standard and time-of-use, and natural gas tariffs applied in this study.



SDGE

San Diego Gas & Electric Company
San Diego, California

Revised Cal. P.U.C. Sheet No. 27650-E
Canceling Revised Cal. P.U.C. Sheet No. 26948-E

Sheet 1

SCHEDULE DR

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 $(17.44) 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		
Summer:							
Baseline Energy ($/kWh)	0.05480	I	0.00539	0.12965	0.18984	I	D
Above 130% of Baseline	0.25645	R	0.00539	0.12965	0.39149	R	
Winter:							
Baseline Energy ($/kWh)	0.10256	I	0.00539	0.06604	0.17399	I	D
Above 130% of Baseline	0.28737	R	0.00539	0.06604	0.35880	R	
Minimum Bill ($/day)	0.329				0.329		

Description -DR-LI Rates	UDC Total Rate		DWR-BC Rate	EECC Rate + DWR Credit	Total Rate		
Summer – CARE Rates:							
Baseline Energy ($/kWh)	0.05225	I	0.00000	0.12965	0.18190	I	D
Above 130% of Baseline	0.25390	R	0.00000	0.12965	0.38355	R	
Winter – CARE Rates:							
Baseline Energy ($/kWh)	0.10001	I	0.00000	0.06604	0.16605	I	D
Above 130% of Baseline	0.28482	R	0.00000	0.06604	0.35086	R	
Minimum Bill ($/day)	0.164				0.164		

(Continued)

1C10
Issued by
Dan Skopec
Vice President
Regulatory Affairs

Date Filed Jun 29, 2016
Effective Jul 1, 2016
Resolution No. E-4787

Advice Ltr. No. 2861-E-A
Decision No. 15-07-001

San Diego Gas & Electric Company
San Diego, California

Revised Cal. P.U.C. Sheet No. 26962-E
Canceling Revised Cal. P.U.C. Sheet No. 26908-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 $(17.44) per Schedule GHG-ARR. I

TERRITORY

Within the entire territory served by the Utility.

RATES

Total Rates:

Description – DR-SES Rates	UDC Total Rate		DWR-BC Rate		EECC Rate + DWR Credit		Total Rate	
Energy Charges ($/kWh)								
On-Peak – Summer	0.12635	I	0.00539	I	0.33023	R	0.46397	R
Semi-Peak– Summer	0.12635	I	0.00539	I	0.09530	R	0.22904	R
Off-Peak – Summer	0.12635	I	0.00539	I	0.07332	R	0.20706	R
Semi-Peak – Winter	0.12635	I	0.00539	I	0.08159	R	0.21533	R
Off-Peak – Winter	0.12635	I	0.00539	I	0.06826	R	0.20200	R
Minimum Bill ($/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 $(0.00021) 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. I

(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 ($/kWh)																		
On-Peak – Summer	0.02943	I	0.06367	R	0.01241	I	0.00052	I	0.00160	I	0.00039	I	0.00013	R	0.00000	I	0.12635	I
Semi-Peak – Summer	0.02943	I	0.06367	R	0.01241	I	0.00052	I	0.00160	I	0.00039	I	0.00013	R	0.00000	I	0.12635	I
Off-Peak - Summer	0.02943	I	0.06367	R	0.01241	I	0.00052	I	0.00160	I	0.00039	I	0.00013	R	0.00000	I	0.12635	I
Semi-Peak - Winter	0.02943	I	0.06367	R	0.01241	I	0.00052	I	0.00160	I	0.00039	I	0.00013	R	0.00000	I	0.12635	I
Off-Peak - Winter	0.02943	I	0.06367	R	0.01241	I	0.00052	I	0.00160	I	0.00039	I	0.00013	R	0.00000	I	0.12635	I
Minimum Bill ($/day)			0.329														0.329	

(Continued)

1C9

Issued by
Dan Skopec
Vice President
Regulatory Affairs

Date Filed Dec 29, 2015
Effective Jan 1, 2016
Resolution No.

Advice Ltr. No. 2840-E
Decision No.

SDGE

San Diego Gas & Electric Company
San Diego, California

Revised Cal. P.U.C. Sheet No. 21921-G

Canceling Revised Cal. P.U.C. Sheet No. 21908-G

Sheet 1

SCHEDULE GR

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

	GR	GR-C		GTC/GTCA[1/]
Baseline Rate, per therm (baseline usage defined in Special Conditions 3 and 4):				
Procurement Charge:[2/]	$0.34561	$0.34561	I	N/A
Transmission Charge:	$0.90805	$0.90805		$0.90805
Total Baseline Charge:	$1.25366	$1.25366	I	$0.90805
Non-Baseline Rate, per therm (usage in excess of baseline usage):				
Procurement Charge: [2/]	$0.34561	$0.34561	I	N/A
Transmission Charge:	$1.08354	$1.08354		$1.08354
Total Non-Baseline Charge:	$1.42915	$1.42915	I	$1.08354

[1/] 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.

[2/] 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.

(Continued)

1C5

Issued by
Dan Skopec
Vice President
Regulatory Affairs

Date Filed Jul 7, 2016
Effective Jul 10, 2016
Resolution No.

Advice Ltr. No. 2489-G
Decision No.