CALIFORNIA ENERGY CODES & STANDARDS

A STATEWIDE UTILITY PROGRAM

Title 24, Parts 6 and 11
Local Energy Efficiency Ordinances

# 2019 Cost-effectiveness Study: Low-Rise Residential New Construction Addendum – SMUD Analysis


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# 1 Introduction

This addendum presents results from analysis conducted in response to a request from Sacramento Municipal Utility District (SMUD) to more accurately reflect anticipated local energy costs. This report documents cost-effective combinations of measures within SMUD territory that exceed the minimum state requirements, the 2019 Building Energy Efficiency Standards, which become effective January 1, 2020, for new single family and low-rise (one- to three-story) multifamily residential construction. The analysis includes evaluation of both mixed fuel and all-electric homes, documenting that the performance requirements can be met by either type of building design. Compliance package options and cost-effectiveness analysis are presented for California Climate Zone 12 (Sacramento). All proposed package options include a combination of efficiency measures and on-site renewable energy.

This analysis builds upon the results of the 2019 Cost-effectiveness Study: Low-Rise Residential New Construction (Statewide Reach Codes Team, 2019) conducted for the California Statewide Codes and Standards Program and last modified July 17, 2019, which evaluated compliance packages across all sixteen California climate zones.

# 2 Methodology and Assumptions

The same methodology used in the statewide analysis was applied to this analysis with one exception, as described below.

1. SMUD R-TOD electricity rate schedules were applied in place of PG&E electricity rate schedules. Any annual electricity production in excess of annual electricity consumption is credited to the utility account at the net surplus compensation rate of $0.0559/kWh. PG&E gas rates continue to be applied. Appendix A summarizes the utility rate schedules used for this study.

Refer to the 2019 Cost-effectiveness Study: Low-Rise Residential New Construction (Statewide Reach Codes Team, 2019) for further details. Key components of the methodology are repeated below.

### Cost-effectiveness

This analysis uses two different metrics to assess cost-effectiveness. Both methodologies require estimating and quantifying the incremental costs and energy savings associated with energy efficiency measures as compared to the 2019 prescriptive Title 24 requirements. The main difference between the methodologies is the way they value energy and thus the cost savings of reduced or avoided energy use.

- **Utility Bill Impacts (On-Bill)**: Customer-based Lifecycle Cost (LCC) approach that values energy based upon estimated site energy usage and customer on-bill savings using electricity and natural gas utility rate schedules over a 30-year duration accounting for discount rate and energy inflation.
- **Time Dependent Valuation (TDV)**: Energy Commission LCC methodology, which is intended to capture the "societal value or cost" of energy use 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, as well as grid transmission and distribution impacts. This metric values energy use differently depending on the fuel source (gas, electricity, and propane), time of day, and season. 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). This is the methodology used by the Energy Commission in evaluating cost-effectiveness for efficiency measures in Title 24, Part 6.

Results are presented as a lifecycle benefit-to-cost (B/C) ratio, a net present value (NPV) metric which represents the cost-effectiveness of a measure over a 30-year lifetime taking into account discounting of future savings and costs and financing of incremental first costs. A value of one indicates the NPV of the savings over

the life of the measure is equivalent to the NPV of the lifetime incremental cost of that measure. A value greater than one represents a positive return on investment.

### Package Development

Three to four packages were evaluated for each prototype, as described below.

1) **Efficiency – Non-Preempted**: This package uses only efficiency measures that don't trigger federal preemption issues including envelope, and water heating and duct distribution efficiency measures.
2) **Efficiency – Equipment, Preempted:** This package shows an alternative design that applies HVAC and water heating equipment that are more efficient than federal standards. The Reach Code Team considers this more reflective of how builders meet above code requirements in practice.
3) **Efficiency & PV**: Using the Efficiency – Non-Preempted Package as a starting point, PV capacity is added to offset most of the estimated electricity use. This only applies to the all-electric case, since for the mixed fuel cases, 100% of the projected electricity use is already being offset as required by 2019 Title 24, Part 6.
4) **Efficiency & PV/Battery**: Using the Efficiency & PV Package as a starting point, PV capacity is added as well as a battery system.

### Electrification Scenarios

In comparing mixed fuel and all-electric cases, three scenarios were evaluated for each prototype:

1. **2019 Code Compliant**: Compares a 2019 code compliant all-electric home with a 2019 code compliant mixed fuel home.
2. **Efficiency & PV Package**: Compares an all-electric home with efficiency and PV sized to 90% of the annual electricity use to a 2019 code compliant mixed fuel home. The first cost savings in the code compliant all-electric house is invested in above code efficiency and PV reflective of the Efficiency & PV packages described above.
3. **Neutral Cost Package**: Compares an all-electric home with PV beyond code minimum with a 2019 code compliant mixed fuel home. The PV system for the all-electric case is sized to result in a zero lifetime incremental cost relative to a mixed fuel home.

# 3 Results & Discussion

The analysis found cost-effective, non-preempted packages for both single family and low-rise multifamily buildings, under both mixed fuel and all-electric cases. The results of this analysis can be used by local jurisdictions to support the adoption of reach codes.

For the efficiency-only packages, measures were refined to ensure that the non-preempted package was cost-effective based on one of the two metrics applied in this study, TDV or On-Bill. The preempted equipment package, which the Reach Code Team considers to be a package of upgrades most reflective of what builders commonly apply to exceed code requirements, was designed to be cost-effective based on the On-Bill cost-effectiveness approach. The packages presented are representative examples of designs and measures that can be used to meet the requirements. In practice, a builder can use any combination of non-preempted or preempted compliant measures to meet the requirements.

Table 1 summarizes the target EDR Margins by case. Table 2 and Table 3 present details of the analysis results for single family and low-rise multifamily homes, respectively. Results are presented as EDR Margin instead of compliance margin. EDR is the metric used to determine code compliance for residential buildings in the 2019 cycle. Target EDR Margin is based on taking the calculated EDR Margin for the case and rounding down to the next half of a whole number. Target EDR Margin for the Efficiency Package are defined based on the lower of the EDR Margin of the non-preempted package and the equipment, preempted package. For example, for single

family homes the all-electric non-preempted package has an EDR Margin of 3.5 and the preempted package an EDR Margin of 5.0, the Target EDR Margin is set at 3.5 in this case.

**Table 1: Summary of Climate Zone 12 Target EDR Margins**

| Climate Zone | Mixed Fuel | | All-Electric | | |
|---|---|---|---|---|---|
| | Efficiency | Efficiency & PV/Battery | Efficiency | Efficiency & PV | Efficiency & PV/Battery |
| Single Family | 3.0 | 9.5 | 3.5 | 15.5 | 25.0 |
| Multifamily | 1.5 | 10.0 | 2.5 | 14.0 | 26.5 |

All packages are cost effective based on the TDV approach. The mixed fuel efficiency packages are also cost effective using the On-Bill approach, but the Efficiency & PV/Battery Package is not. None of the all-electric packages are cost effective using the On-Bill approach, except the Efficiency & PV package for multifamily buildings. All-electric buildings were found to be cost effective in all cases when compared to a mixed fuel basecase under both methodologies. A code compliant all-electric design reduces GHG emissions 50% for single family and 43% for multifamily relative to a comparable code compliant mixed fuel design.

The SMUD R-TOD rate is a non-tiered time-of-use rate with usage rates 25%-50% lower than PG&E rates[1]. The R-TOD peak hours are 5-8pm year-round with a summer mid-peak period 12-5pm and 8pm-12am. This differs from the PG&E peak period, which is 4-9pm year-round. A fixed monthly charge of $20.30 is applied under the R-TOD, which results in an annual bill of around $245 for a net-zero customer.

On-bill cost effectiveness using SMUD's rates are similar to PG&E rates in Climate Zone 12 for the mixed fuel packages. On-bill cost-effectiveness is not as favorable using SMUD rates for the all-electric packages but is better for the electrification scenarios.

[1] PG&E's E-TOU Option B which was applied in the statewide study for Climate Zone 12 (Statewide Reach Codes Team, 2019).

**Table 2: Single Family SMUD Climate Zone 12 Results Summary**

| Climate Zone 12 SMUD/PG&E Single Family | | Annual Net kWh | Annual therms | EDR Margin[4] | PV Size Change (kW)[5] | CO2-Equivalent Emissions (lbs/sf) | | NPV of Lifetime Incremental Cost ($) | Benefit to Cost Ratio (B/C) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Total | Reduction | | On-Bill | TDV |
| Mixed Fuel[1] | Code Compliant | (0) | 390 | n/a | n/a | 2.11 | n/a | n/a | n/a | n/a |
| | Efficiency-Non-Preempted | (0) | 344 | 3.5 | (0.06) | 1.88 | 0.23 | $1,679 | 1.19 | 1.83 |
| | Efficiency-Equipment | 0 | 338 | 3.0 | (0.05) | 1.85 | 0.26 | $654 | 3.33 | 4.65 |
| | Efficiency & PV/Battery | (23) | 344 | 9.5 | 0.04 | 1.76 | 0.35 | $5,568 | 0.61 | 1.72 |
| All-Electric[2] | Code Compliant | 4,492 | 0 | n/a | n/a | 1.05 | n/a | n/a | n/a | n/a |
| | Efficiency-Non-Preempted | 3,958 | 0 | 3.5 | 0.00 | 0.94 | 0.10 | $3,735 | 0.37 | 1.06 |
| | Efficiency-Equipment | 3,721 | 0 | 5.0 | 0.00 | 0.90 | 0.15 | $2,108 | 0.95 | 2.51 |
| | Efficiency & PV | 867 | 0 | 15.5 | 1.97 | 0.51 | 0.53 | $11,520 | 0.86 | 1.41 |
| | Efficiency & PV/Battery | (15) | 0 | 25.0 | 2.62 | 0.29 | 0.76 | $17,586 | 0.79 | 1.48 |
| Mixed Fuel to All-Electric[3] | Code Compliant | 4,492 | 0 | 0.0 | 0.00 | 1.05 | 1.07 | ($5,349) | >1 | 1.89 |
| | Efficiency & PV | 867 | 0 | 15.5 | 1.97 | 0.51 | 1.60 | $6,172 | 1.99 | >1 |
| | Neutral Cost | 2,374 | 0 | 8.0 | 1.35 | 0.76 | 1.36 | $0 | >1 | >1 |

[1]All reductions and incremental costs relative to the **mixed fuel** code compliant home.
[2]All reductions and incremental costs relative to the **all-electric** code compliant home.
[3]All reductions and incremental costs relative to the **mixed fuel** code compliant home except the EDR Margins are relative to the Standard Design for each case which is the **all-electric** code compliant home. Incremental costs for these packages reflect the cots used in the On-Bill cost effectiveness methodology. Costs differ for the TDV methodology due to differences in the site gas infrastructure costs (see Section 2.6).
[4]This represents the Efficiency EDR Margin for the Efficiency-Non-Preempted and Efficiency-Equipment packages and Total EDR Margin for the Efficiency & PV, Efficiency & PV/Battery, and Neutral Cost packages.
[5]Positive values indicate an increase in PV capacity relative to the Standard Design.

**Table 3: Multifamily SMUD Climate Zone 12 Results Summary – Results per Unit**

| Climate Zone 12 SMUD/PG&E Multifamily | | Annual Net kWh | Annual therms | EDR Margin[4] | PV Size Change (kW)[5] | CO2-Equivalent Emissions (lbs/sf) | | NPV of Lifetime Incremental Cost ($) | Benefit to Cost Ratio (B/C) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Total | Reduction | | On-Bill | TDV |
| Mixed Fuel[1] | Code Compliant | (0) | 143 | n/a | n/a | 2.33 | n/a | n/a | n/a | n/a |
| | Efficiency-Non-Preempted | (0) | 135 | 1.5 | (0.02) | 2.21 | 0.12 | $291 | 1.12 | 2.22 |
| | Efficiency-Equipment | 0 | 128 | 2.5 | (0.03) | 2.12 | 0.21 | $434 | 1.27 | 2.22 |
| | Efficiency & PV/Battery | (11) | 135 | 10.0 | 0.03 | 2.03 | 0.30 | $2,394 | 0.48 | 1.75 |
| All-Electric[2] | Code Compliant | 1,963 | 0 | n/a | n/a | 1.34 | n/a | n/a | n/a | n/a |
| | Efficiency-Non-Preempted | 1,792 | 0 | 2.5 | 0.00 | 1.24 | 0.09 | $1,011 | 0.43 | 1.12 |
| | Efficiency-Equipment | 1,744 | 0 | 2.5 | 0.00 | 1.21 | 0.13 | $795 | 0.75 | 1.63 |
| | Efficiency & PV | 472 | 0 | 14.0 | 0.84 | 0.73 | 0.60 | $3,835 | 1.07 | 1.65 |
| | Efficiency & PV/Battery | (8) | 0 | 26.5 | 1.20 | 0.38 | 0.96 | $6,943 | 0.90 | 1.68 |
| Mixed Fuel to All-Electric[3] | Code Compliant | 1,963 | 0 | 0.0 | 0.00 | 1.34 | 1.00 | ($2,337) | 7.19 | 1.66 |
| | Efficiency & PV | 59 | 0 | 14.0 | 0.84 | 0.73 | 1.60 | $1,498 | 2.51 | >1 |
| | Neutral Cost | 872 | 0 | 9.5 | 0.70 | 0.92 | 1.42 | $0 | >1 | >1 |

[1]All reductions and incremental costs relative to the **mixed fuel** code compliant home.
[2]All reductions and incremental costs relative to the **all-electric** code compliant home.
[3]All reductions and incremental costs relative to the **mixed fuel** code compliant home except the EDR Margins are relative to the Standard Design for each case which is the **all-electric** code compliant home. Incremental costs for these packages reflect the cots used in the On-Bill cost effectiveness methodology. Costs differ for the TDV methodology due to differences in the site gas infrastructure costs (see Section 2.6).
[4]This represents the Efficiency EDR Margin for the Efficiency-Non-Preempted and Efficiency-Equipment packages and Total EDR Margin for the Efficiency & PV, Efficiency & PV/Battery, and Neutral Cost packages.
[5]Positive values indicate an increase in PV capacity relative to the Standard Design.

# 4 References

Statewide Reach Codes Team. 2019. 2019 Cost-effectiveness Study: Low-Rise Residential New Construction. Prepared for Pacific Gas and Electric Company. Prepared by Frontier Energy. July 2019. https://localenergycodes.com/download/800/file_path/fieldList/2019%20Res%20NC%20Reach%20Codes

# Appendix A – Utility Tariff Details

## Electric Rates

Following are the SMUD electricity tariffs applied in this study.

### Residential Time-of-Day Service
### Rate Schedule R-TOD

**I. Applicability**

This Rate Schedule 1-R-TOD applies to single- and three-phase service for the following types of residential premises:

1. Individual or dual metered residences with digital communicating meter installed, including single-family homes, duplexes, apartments, and condominiums; and
2. General farm service where the meter also serves the residence or additional meters on a farm where the electricity consumed is solely for domestic purposes.

Master-metered service to a qualifying multifamily accommodation or mobile home parks are not eligible for Time-of-Day rates under rate schedule R-TOD.

For the purposes of this schedule a "month" is considered to be a single billing period of 27 to 34 days.

**A. Time-of-Day (5-8 p.m.) Rate (rate category RT02)**

1. The TOD (5-8 p.m.) Rate is the standard rate for SMUD's residential customers. Customers who have an eligible renewable electrical generation facility under Rate Schedule 1-NEM that was approved for installation by SMUD after December 31, 2017 must be on the TOD (5-8 p.m.) Rate.
2. Existing eligible customers on the Legacy Rate, with rate categories RSCH, RWCH, RSEH, RWEH, RSGH and RWGH under Rate Schedule R, will gradually transition as determined by SMUD to the TOD (5-8 p.m.) Rate beginning the first full billing cycle in January 2019, and complete transition no later than December 31, 2019.
3. After being transitioned to the TOD (5-8 p.m.) Rate, eligible customers can elect the Fixed Rate under Rate Schedule R as an alternative rate.
4. Customers who move-in or transfer service to premises with an eligible renewable electrical generation facility after December 31, 2017 must be on the TOD (5-8 p.m.) Rate.
5. This rate has five kilowatt-hour (kWh) prices, depending on the time-of-day and season as shown below. Holidays are detailed in Section V. Conditions of Service.

| | | |
|---|---|---|
| **Summer (Jun 1 - Sept 30)** | **Peak** | Weekdays between 5:00 p.m. and 8:00 p.m. |
| | **Mid-Peak** | Weekdays between noon and midnight except during the Peak hours. |
| | **Off-Peak** | All other hours, including weekends and the holidays[1]. |
| **Non-Summer (Oct 1 - May 31)** | **Peak** | Weekdays between 5:00 p.m. and 8:00 p.m. |
| | **Off-Peak** | All other hours, including weekends and holidays[1]. |

[1] See Section V. Conditions of Service

**B. Optional Time-of-Day (4-7 p.m.) Rate (rate category RT01) Closed**

1. The TOD (4-7 p.m.) Rate is closed for enrollment to residential customers who did not have an eligible renewable electrical generation facility under Rate Schedule 1-NEM that was approved for installation by SMUD before January 1, 2018.
2. Customers who have an eligible renewable electrical generation facility under Rate Schedule 1-NEM that was approved for installation by SMUD before January 1, 2018, and are enrolled on the TOD (4-7 p.m.) Rate may remain on this closed rate until December 31, 2022.
3. The TOD (4-7 p.m.) Rate will terminate for customers with an eligible renewable electrical generation facility under Rate Schedule 1-NEM on their first full billing cycle that closes in 2023, and customers will then transition to SMUD's residential standard rate.
4. If a customer with an eligible renewable electrical generation facility under Rate Schedule 1-NEM on this rate category elects an open rate, the customer cannot return to the TOD (4-7 p.m.) Rate.

SACRAMENTO MUNICIPAL UTILITY DISTRICT
Resolution No. 18-09-09 adopted September 20, 2018

Sheet No. 1-R-TOD-1
Effective: No later than December 31, 2019
Edition: January 1, 2019

## Residential Time-of-Day Service
## Rate Schedule R-TOD

5. Existing customers who have an eligible renewable electrical generation facility under Rate Schedule 1-NEM that was approved for installation by SMUD before January 1, 2018 may enroll in the TOD (5-8 p.m.) Rate at any time; however, once enrolled in the TOD (5-8 p.m.) Rate, the customer cannot return to the TOD (4-7 p.m.) Rate.

6. Existing customers on the TOD (4-7 p.m.) Rate who do not have an eligible renewable electrical generation facility under Rate Schedule 1-NEM will transition as determined by SMUD to the TOD (5-8 p.m.) Rate no later than December 31, 2019 and will no longer be eligible for the TOD (4-7 p.m.) Rate.

7. This rate has three kilowatt-hour (kWh) prices, depending on the time-of-day and season as shown below. Holidays are detailed in Section V. Conditions of Service.

| | | |
|---|---|---|
| **Jun 1 - Sep 30** | **Summer Super Peak** | Weekdays between 4:00 p.m. and 7:00 p.m. |
| **Year-round (Jan 1 - Dec 31)** | **Peak** | Weekdays between 9:00 a.m. and 9:00 p.m. except during the Summer Super Peak hours. |
| | **Off-Peak** | All other hours, including weekends and the holidays[1]. |

[1] See Section V. Conditions of Service

### II. Firm Service Rates

| **A. Time-of-Day (5-8 p.m.) Rate** | **Rate Category RT02** |
|---|---|
| **System Infrastructure Fixed Charge per month** | $20.30 |
| **Non-Summer Prices* – October 1 through May 31** | |
| **Electricity Usage Charge** | |
| Peak $/kWh | $0.1338 |
| Off-Peak $/kWh | $0.0969 |
| **Summer Prices - June 1 through September 30** | |
| **Electricity Usage Charge** | |
| Peak $/kWh | $0.2835 |
| Mid-Peak $/kWh | $0.1611 |
| Off-Peak $/kWh | $0.1166 |

* Non-Summer Season includes Fall (Oct 1 – Nov 30), Winter (Dec 1 – Mar 31) and Spring (Apr 1 – May 31) periods.

## Natural Gas Rates

The following provides details on the PG&E natural gas tariffs applied in this study. For Climate Zone 12 PG&E baseline territory S was applied.

The PG&E monthly gas rate in $/therm was applied on a monthly basis for the 12-month period ending January 2019 according to the rates shown below.

**Pacific Gas and Electric Company**

**Residential Non-CARE and CARE Gas Tariff Rates**
**January 1, 2018, to Present**
**($/therm)[1/]**

| Effective Date | Advice Letter Number | Minimum Transportation Charge[2/] (per day) | Procurement Charge | Transportation Charge[2/] | | TOTAL Residential Non-CARE Schedules Charge[3/] | |
|---|---|---|---|---|---|---|---|
| | | | | | | (Non-CARE) | |
| | | | | Baseline | Excess | Baseline | Excess |
| 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 | $0.91828 | $1.46925 | $1.23931 | $1.79028 |
| 04/01/18 | 3959-G | $0.09863 | $0.34783 | $0.91828 | $1.46925 | $1.26611 | $1.81708 |
| 05/01/18 | 3969-G | $0.09863 | $0.26995 | $0.91828 | $1.46925 | $1.18823 | $1.73920 |
| 06/01/18 | 3980-G | $0.09863 | $0.21571 | $0.91828 | $1.46925 | $1.13399 | $1.68496 |
| 07/01/18 | 3984-G | $0.09863 | $0.22488 | $0.93438 | $1.49502 | $1.15926 | $1.71990 |
| 08/01/18 | 3995-G | $0.09863 | $0.28814 | $0.93438 | $1.49502 | $1.22252 | $1.78316 |
| 09/01/18 | 4008-G | $0.09863 | $0.25597 | $0.93438 | $1.49502 | $1.19035 | $1.75099 |
| 10/01/18 | 4018-G | $0.09863 | $0.27383 | $0.93438 | $1.49502 | $1.20821 | $1.76885 |
| 11/01/18 | 4034-G | $0.09863 | $0.35368 | $0.93438 | $1.49502 | $1.28806 | $1.84870 |
| 12/01/18 | 4046-G | $0.09863 | $0.42932 | $0.93438 | $1.49502 | $1.36370 | $1.92434 |
| | | | | | | | |
| 01/01/19 | 4052-G | $0.09863 | $0.43394[7/] | $0.99414 | $1.59063 | $1.42808 | $2.02457 |

[1/] Unless otherwise noted
[2/] 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.
[3/] 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.
[4/] CARE Schedules include California Solar Initiative (CSI) Exemption in accordance with Advice Letter 3257-G-A.
[5/] Per dwelling unit per day (Multifamily Service)
[6/] Per installed space per day (Mobilehome Park Service)
[7/] This procurement rate includes a charge of $0.03686 per therm to reflect account balance amortizations in accordance with Advice Letter 3157-G.
[8/] **Residential bill credit of ($29.85) per household, annual bill credit occurring in the October 2018 bill cycle, thereafter in the April bill cycle.**
**Seasons**: **Winter** = Nov-Mar **Summer** = April-Oct

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

Revised *Cal. P.U.C. Sheet No.* 34735-G
*Cancelling* Revised *Cal. P.U.C. Sheet No.* 34691-G

**GAS SCHEDULE G-1** Sheet 1
RESIDENTIAL SERVICE

APPLICABILITY: This rate schedule[1] 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.

Per D.15-10-032 and D.18-03-017, transportation rates include GHG Compliance Cost for non-covered entities. Customers who are directly billed by the Air Resources Board (ARB), i.e., covered entities, are exempt from paying AB 32 GHG Compliance Costs through PG&E's rates.[2] A "Cap-and-Trade Cost Exemption" credit for these costs will be shown as a line item on exempt customers' bills.[3, 4]

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:[5] | $0.09863 | | | |
| | Per Therm | | | |
| | Baseline | | Excess | |
| Procurement: | $0.43394 | (I) | $0.43394 | (I) |
| Transportation Charge: | $0.99414 | (I) | $1.59063 | (I) |
| Total: | $1.42808 | (I) | $2.02457 | (I) |
| California Natural Gas Climate Credit (per Household, annual payment occurring in October 2018 bill cycle, and thereafter in the April bill cycle) | ($25.45) | (I) | | |

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.

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1 PG&E's gas tariffs are available online at www.pge.com.
2 Covered entities are not exempt from paying costs associated with LUAF Gas and Gas used by Company Facilities.
3 The exemption credit will be equal to the effective non-exempt AB 32 GHG Compliance Cost Rate ($ per therm) included in Preliminary Statement – Part B, multiplied by the customer's billed volumes (therms) for each billing period.
4 PG&E will update its billing system annually to reflect newly exempt or newly excluded customers to conform with lists of Directly Billed Customers provided annually by the ARB.
5 The Minimum Transportation charge does not apply to submetered tenants of master-metered customers served under gas rate Schedules GS and GT.

(Continued)

| | | | | |
|---|---|---|---|---|
| *Advice* | 4052-G | *Issued by* | *Submitted* | December 21, 2018 |
| *Decision* | 97-10-065 & 98-07-025 | ***Robert S. Kenney*** *Vice President, Regulatory Affairs* | *Effective* *Resolution* | January 1, 2019 |

# Appendix B –Detailed Results

## Table 4: Efficiency Package Cost-Effectiveness Results

| Climate Zone | BASECASE | | | | | Non-Preempted | | | | | | | | Equipment - Preempted | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Final EDR | Efficiency EDR | CALGreen Tier 1 EDR Target | lbs CO2 per sqft | PV kW | Final EDR | Efficiency EDR | EDR Margin | % Comp Margin | lbs CO2 per sqft | PV kW | On-Bill B/C Ratio | TDV B/C Ratio | Final EDR | Efficiency EDR | EDR Margin | % Comp Margin | lbs CO2 per sqft | PV kW | On-Bill B/C Ratio | TDV B/C Ratio |
| Mixed Fuel SF | 25.5 | 44.8 | 12 | 2.1 | 3.0 | 22.5 | 41.3 | 3.5 | 14.9% | 1.9 | 2.9 | 1.2 | 1.8 | 22.5 | 41.4 | 3.4 | 14.4% | 1.9 | 3.0 | 3.3 | 4.6 |
| All-Electric SF | 30.9 | 50.1 | 13 | 1.0 | 3.0 | 27.1 | 46.3 | 3.8 | 15.3% | 0.9 | 3.0 | 0.4 | 1.1 | 25.8 | 45.0 | 5.1 | 20.4% | 0.9 | 3.0 | 0.9 | 2.5 |
| Mixed Fuel MF | 25.9 | 55.3 | 12 | 2.3 | 14.9 | 24.3 | 53.4 | 1.9 | 8.8% | 2.2 | 14.8 | 1.1 | 2.2 | 23.5 | 52.5 | 2.8 | 12.8% | 2.1 | 14.7 | 1.3 | 2.2 |
| All-Electric MF | 32.0 | 59.9 | 13 | 1.3 | 14.9 | 29.4 | 57.3 | 2.6 | 11.4% | 1.2 | 14.9 | 0.4 | 1.1 | 29.0 | 57.0 | 2.9 | 13.0% | 1.2 | 14.9 | 0.8 | 1.6 |

"<1" = indicates cases where there is both first cost savings and annual utility bill savings.

## Table 5: Efficiency & PV-PV/Battery Package Cost-Effectiveness Results

| Climate Zone | BASECASE | | | | Efficiency & PV | | | | | | | Efficiency & PV/Battery | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Final EDR | CALGreen Tier 1 EDR Target | lbs CO2 per sqft | PV kW | Final EDR | EDR Margin | % Comp Margin | lbs CO2 per sqft | PV kW | On-Bill B/C Ratio | TDV B/C Ratio | Final EDR | EDR Margin | % Comp Margin | lbs CO2 per sqft | PV kW | On-Bill B/C Ratio | TDV B/C Ratio |
| Mixed Fuel SF | 25.5 | 12 | 2.1 | 3.0 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | 15.9 | 9.6 | 28.9% | 1.8 | 3.0 | 0.6 | 1.7 |
| All-Electric SF | 30.9 | 13 | 1.0 | 3.0 | 15.2 | 15.7 | 15.3% | 0.5 | 5.0 | 0.9 | 1.4 | 5.6 | 25.4 | 29.3% | 0.3 | 5.62 | 0.8 | 1.5 |
| Mixed Fuel MF | 25.9 | 12 | 2.3 | 14.9 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | 15.6 | 10.3 | 17.8% | 2.0 | 15.2 | 0.5 | 1.7 |
| All-Electric MF | 32.0 | 13 | 1.3 | 14.9 | 17.6 | 14.4 | 11.4% | 0.7 | 21.7 | 1.1 | 1.6 | 5.4 | 26.6 | 20.4% | 0.4 | 24.5 | 0.9 | 1.7 |

"<1" = indicates cases where there is both first cost savings and annual utility bill savings.