September 6, 2018

# Self-Generation Incentive Program Greenhouse Gas Staff Proposal

ENERGY DIVISION, CALIFORNIA PUBLIC UTILITIES COMMISSION

DISTRIBUTED GENERATION RULEMAKING 12-11-005

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# Definitions and Acronyms

## Definitions

**Developer**: The developer for a project is, if not the individual homeowner applying for SGIP incentives for systems located on their own property, the corporate entity registered and in good standing with the Secretary of State of California that handles a substantial amount of the project's development activities (see SGIP Handbook, Section 4.1.5).

**GHG impact of storage:** The GHG impact of a customer's storage device is the difference between the customer's emission profiles with and without the storage.

**GHG signal**: A digitally accessible data feed of current marginal greenhouse gas emissions rates (in units of kg/kWh) that updates at regular intervals (e.g. every 5 minutes) combined with additional data feeds that deliver regularly updated forecasts of grid conditions for use in the optimization of dispatch.

**Legacy projects**: Any project with an application submitted before the "go live" date for new GHG rules (includes all currently installed projects). Staff recommends making the "go live" date four months after a Commission decision on this proposal to allow sufficient time for WattTime, the PAs, Energy Solutions, and market participants to implement the new rules.

**Legacy Fleet:** A developer shall be deemed to have a "Legacy Fleet" subject to fleet compliance requirements if they have a minimum of 10 legacy projects statewide. Projects will enter the fleet on January 1, 2020 and exit on December 31 of their tenth full calendar year (January 1-December 31) in operation.

**New projects**: Any project with an application submitted on or after the "go live" date for new GHG rules. Staff recommends making the "go live" date four months after a Commission decision on this proposal to allow sufficient time for WattTime, the PAs, Energy Solutions, and market participants to implement the new rules.

**New Residential Fleet**: A developer shall be deemed to have a "New Residential Fleet" subject to fleet compliance requirements if they have a minimum of 10 new residential projects statewide. Projects will enter the fleet on January 1$^{st}$ following their operational start date and exit on December 31$^{st}$ of their tenth full calendar year (January 1-December 31) in operation.

**Program Year**: A project's program year is the year its incentive application was accepted by the Program Administrator.

**Rated energy capacity (kWh):** The SGIP Handbook defines the rated energy capacity (kWh) for DC/AC energy storage technologies as the nominal voltage multiplied by the amp-hour capacity multiplied by the applicable efficiency ($V_{DC}$ x Amp-Hours x Applicable Efficiency) (see SGIP Handbook, Section 5.1.2).

**Roundtrip efficiency (RTE)**: The total kWh discharge of the system divided by the total kWh charge over some period of time or number of cycles. SGIP storage systems are currently required to maintain an RTE equal to or greater than 69.6% in the first year of operation in order to achieve a ten-year average RTE of 66.5%, assuming a 1% annual degradation rate (see SGIP Handbook, Section 5.3.1).

**Single-cycle roundtrip efficiency (SCRTE):** The total kWh discharge of the system divided by the total kWh charge after one complete cycle. SCRTE is often verified in the factory and specified on a device's technical specifications sheet.

## Acronyms

**IOU**: investor owned utility

**PA**: program administrator

**PBI**: performance-based incentive

**PDP**: performance data provider

**PY**: program year (see definition above)

**RTE**: roundtrip efficiency (see definition above)

**SCRTE**: single-cycle roundtrip efficiency (see definition above)

**SGIP**: Self-Generation Incentive Program

**WG:** SGIP GHG Signal Working Group

## Executive Summary

California statute limits eligibility for incentives under the Self-Generation Incentive Program (SGIP) to "distributed energy resources that the commission…determines will achieve reductions in emissions of greenhouse gases."[1] To ensure energy storage projects met this requirement, in 2012 the California Public Utilities Commission (Commission) adopted a roundtrip efficiency (RTE) standard, with the implicit assumption that retail rates would incentivize storage to charge during low grid emission times and discharge during high grid emission times.[2]

Subsequent SGIP storage impact evaluations have found that SGIP storage has led to a net increase in greenhouse gases (GHGs), in part because TOU peak periods have not aligned with high grid emission times, and in part because retail rates incentivized customers to prioritize noncoincident demand charge management over time of use (TOU) rate arbitrage. The Commission convened a working group and subsequently directed Energy Division staff to propose new operational requirements based on the emissions of the electric grid to replace the RTE standard, and new verification and enforcement mechanisms to ensure compliance.[3]

This paper presents staff's recommendations for new GHG rules, based in large part on the working group's discussions, modeling effort, and final report. The proposals presented here are designed to ensure that SGIP systems meet minimum statutory requirements to reduce GHG emissions while continuing to support the program's other goals of market transformation and providing grid support.

For **new projects**, defined as those submitting applications after the "go live" date for new rules (likely Q2/Q3 2019), staff recommends different rules for commercial[4] and residential projects:

- *Commercial Projects*: Staff proposes a performance-based incentive structure for all new commercial projects, such that 40% of the incentive is paid upfront and the remaining 60% is paid over five years. PAs would verify each project's GHG reductions annually and, if the project is found to reduce GHGs less than 25 kg $CO_2$ per rated energy capacity (kWh) or increase GHGs, the PA would reduce the project's annual incentive payment in proportion to the GHGs, subject to defined exceedance bands. PAs would provide

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[1] Public Utilities Code Section 379.6(b)(1)
[2] Resolution E-4519
[3] Assigned Commissioner's Rulings in Rulemaking 12-11-005, issued December 29, 2017 and July 26, 2018.
[4] For the purposes of this report, "commercial" projects include all nonresidential projects.

projects with quarterly feedback on GHG performance. The RTE requirement would be eliminated.

- *Residential Projects*: Staff proposes to eliminate the annual RTE requirement and require all new residential projects to enroll in a rate with peak starting at or after 4pm, pair with and charge at least 75% from onsite solar, and have a single-cycle RTE of at least 85%. In addition, staff proposes to require developer fleets of 10 or more new residential projects ("New Residential Fleets") to reduce GHGs and meet aggregate cycling requirements annually. Developers whose fleets were found to increase GHGs or fall short of their aggregated cycling requirement would be temporarily suspended by the PAs, meaning they would not be permitted to submit new applications for 90, 180, or 360 days.

For **legacy projects**, defined as those submitting applications before the "go live" date for new rules, staff proposes to provide two pathways to compliance for all customer classes. Projects may either adhere to the existing rules at the time of application, including the minimum annual RTE standard, or may opt in to a GHG-reducing pathway, whereby projects could choose to forego the minimum RTE requirement and instead commit to operating in a way that achieves annual GHG reductions. Staff proposes a developer fleet approach to verify and enforce compliance with both the RTE and GHG pathways. Developer fleets of 10 or more legacy projects opting in to the same pathway (RTE or GHG) would be required to comply with the requirements of their respective pathways annually. Developers whose fleets were found in breach of the requirements of their respective pathways would be temporarily suspended by the PAs, meaning they would not be permitted to submit new applications for a defined period in proportion to the breach in compliance.

## Introduction

### Background

In accordance with Public Utilities Code 379.6(b)(2), Decision (D.) 15-11-027 reiterated SGIP's goal to promote GHG-reducing distributed energy technologies and updated the minimum RTE standard with the aim of ensuring SGIP energy storage projects yield net zero GHG emissions over the first 10 years of their operation. Itron's 2016 and 2017 SGIP Advanced Energy Storage Impact Evaluations (August 2017 and September 2018) found that regardless of RTE, SGIP storage projects on average increase GHG emissions, which runs counter to the SGIP's GHG emission reduction goal and the program requirement that all SGIP technologies operate in a way that reduces GHG emissions in order to be eligible for SGIP incentives.[5,6]

The Energy Division held a stakeholder workshop on November 15, 2017 to review and discuss the Itron report's findings. During the workshop, participants suggested the CPUC convene a working group tasked with developing new operational requirements to improve SGIP storage project's GHG impacts. Workshop participants also indicated that the availability of a "GHG signal" could help storage systems operate to reduce GHGs to at least zero.

On December 29, 2017, an Assigned Commissioner's Ruling (ACR) established the Greenhouse Gas Signal Working Group (WG) to develop new SGIP storage operational requirements based on the GHG emissions of the electric grid, and new verification and enforcement mechanisms to ensure compliance with the requirements. The ACR also tasked the WG with developing a proposed GHG signal methodology, detailing a number of minimum requirements:

- The marginal GHG emissions of the grid reported for either NP15 or SP15, as applicable.
- In 60, 30, 15, or 5-minute increments as determined by the WG.
- Forecasted for the day ahead.
- Automatically transmitted to the energy storage system, or the controller of the system if systems are controlled remotely.

The WG was facilitated by Alternative Energy Systems Consulting (AESC) and consisted of SGIP PAs, the Office of Ratepayer Advocates (ORA), solar and energy storage companies and trade associations, energy non-profits, and Energy Division staff. From January to June 2018, the WG met regularly to design and carry out a modeling strategy to test alternative operational

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[5] Per D.16-06-055, SGIP's overall program goal is threefold: reduce GHG emissions, provide grid support, and encourage market transformation.

[6] Reports available at: http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=6442454964

requirements to ensure SGIP projects reduce GHGs. The WG used five proprietary models (Tesla, AMS, Stem, Customer Power Solar, and Avalon) and one newly-developed public model to conduct over 5,000 model runs with varying parameters (including system and customer characteristics). AESC executed nondisclosure agreements with all modelers to be able to review all proprietary model runs and to provide aggregated results analysis that informs many of the WG's recommendations. The WG also developed recommendations for verification and enforcement mechanisms. The final corrected version of the WG report is attached to the September 6, 2018 ACR.

On July 26, 2018, the CPUC released an ACR directing Energy Division staff to prepare a proposal based on their participation in the WG and the information included in the WG report. In accordance with the ACR, this proposal includes operational requirements across the range of SGIP energy storage customer categories, as well as verification and enforcement mechanisms to ensure compliance with SGIP rules.

## Schedule

The schedule below lays out next steps for a deliberative process and stakeholder participation once the draft Staff Proposal is released:

| Date | Event |
|---|---|
| September 6, 2018 | ACR issuing staff proposal with Final Working Group Report attached and requests comments. |
| September 26, 2018 | Comments on staff proposal due |
| October 22, 2018 | Workshop on staff proposal |
| November 9, 2018 | ACR issuing revised staff proposal with request for comments |
| November 29, 2018 | Comments on revised staff proposal due |
| Q1 2019 | Issue proposed decision |

## Proposal Organization

The remainder of this report is organized into three sections and one appendix:

- The **Proposal for a GHG Signal** section recommends requirements and a timeline for a GHG signal to be made publicly available.
- The **Proposals for New Projects** section recommends operational requirements and verification and enforcement mechanisms for projects applying after the "go-live" date for new rules.
- The **Proposals for Legacy Projects** section recommends operational requirements and verification and enforcement mechanisms for projects applying before the "go-live" date for new rules.

- **Appendix A** presents the complete text of Public Utilities Code Section 379.6, the statute governing SGIP.

## Customer Bill Impacts of Proposals

The WG modeling results show a number of scenarios leading to concurrent customer bill savings and GHG emissions reductions, especially under the "co-optimization" case (when storage is dispatched to optimize both bill savings and GHG reductions). At this time, however, staff is not able to ascertain the actual bill impacts of the proposals laid out in this document. The reason for this uncertainty is that the WG modeling compares customer bill savings to a "zero bill savings" baseline rather than the total bill savings achieved in a scenario where GHG reduction is not required.

The primary purpose of this document, however, is to offer proposals for ensuring compliance with the long-standing statutory requirement that all SGIP-eligible technologies reduce GHG emissions. Therefore, developers and other market participants hold the responsibility to provide potential customers with the knowledge and tools that will help them make informed decisions regarding their energy storage investments.

## Proposed GHG Signal

### Proposal

The Commission should direct the SGIP PAs to contract with WattTime or another qualified entity to provide a GHG signal with the following features:

- A digitally-accessible, real-time, marginal GHG emissions factor for NP15 and SP15 CAISO zones, at 5-minute and 15-minute intervals, in units of $kgCO_2/kWh$;
- An emissions factor signal calculated using the same heat rate-based methodology as in the most recent SGIP program evaluation report, but with updated parameters and data sources more suitable for real-time use.
    - This signal would provide the emissions per kWh for a natural gas-fired power plant producing energy at a price equaling the real-time (5-minute) CAISO Locational Marginal Price, if it faced input costs equal to the most recent publicly available data on gas prices, $CO_2$ prices, and variable operating costs;
- For storage operation planning purposes, a 72 hour-ahead (updated hourly), month-ahead (updated daily), and year-ahead (updated monthly) forecast.

The GHG signal should be made available within four months of a Commission decision to allow program administrators and participants and the GHG signal provider sufficient time for implementation.

NOTE: All subsequent proposals in this report assume the GHG signal will be made publicly available by the time new rules go into effect.

### Discussion

The WG modeling results show that a GHG signal is useful to storage operators looking to safeguard customer bill savings while co-optimizing for GHG emissions reductions. Therefore, we propose the Commission require that a marginal GHG emissions signal, including accurate, relevant real time and forecasted data and reliable, secure software delivery, be made available to SGIP projects.

To ensure timely implementation, we recommend directing the PAs to contract with WattTime, a nonprofit organization with an existing tool for reporting the real-time GHG intensity of the grid available to clients nationwide. WattTime provided technical expertise throughout the WG process to help develop a GHG signal tailored to SGIP and the requirements of the December 2017 ACR. In talks with staff, WattTime has indicated they would be able to deploy a GHG signal within 4-6 months following a Commission decision requiring its availability.

# Proposals for New Projects

This section contains proposals for "new" projects, defined as those submitting an SGIP application on or after the "go live" date for new GHG rules. Staff recommends making the go live date four months after a Commission decision setting rules for SGIP funded energy storage systems to allow sufficient time for WattTime, the PAs, Energy Solutions, and market participants to implement. The July 26, 2018 ACR proposes to issue a Commission decision in Q1 2019, putting the go live date in Q2/Q3 2019.

## Commercial Projects

### Proposal Summary

Staff proposes a performance-based incentive (PBI) structure for all new commercial projects, such that 40% of the incentive is paid upfront and the remaining 60% is paid over five years. PAs would verify each project's GHG reductions annually and, if the project is found to reduce GHGs less than 25 kg $CO_2$ per rated energy capacity (kWh) or increase GHGs, the PA would reduce the project's annual incentive payment in proportion to the GHG emissions, subject to defined exceedance bands. PAs would provide projects with quarterly feedback on GHG performance.

The annual RTE requirement would be eliminated for all new commercial projects. The 130 cycles per year requirement would remain.

### Current Rules

Commercial projects are currently required to meet a ten-year average roundtrip efficiency of 66.5% and cycle 130 times per year. The SGIP Handbook does not explicitly require projects to reduce GHGs.

The current methods for awarding incentives to commercial projects are based on project size. Projects 30 kW and larger ("Performance-Based Incentive" or "PBI" projects) receive 50% of their incentive upfront and the remaining 50% over five years based on annual kilowatt-hours discharged, while projects smaller than 30 kW ("non-PBI" projects) receive 100% of their incentive upfront.

### Detailed Proposal

Staff proposes to make all new commercial projects 40/60 PBI (40% of the incentive is paid upfront and the remaining 60% is paid over five years) and subject to all PBI rules, including the requirement to contract with a Performance Data Provider (PDP) for five years and install revenue grade metering equipment.

### Operational Requirements

- Projects would be required to reduce GHGs a minimum of 10 kg $CO_2$ per rated energy capacity (kWh) annually to recoup full payment
- Annual RTE requirement would be eliminated
- Cycling requirement would remain at 130/year

### Verification Mechanism

- PAs would verify each project's GHG reductions annually using PBI data
- PAs would provide each project with quarterly feedback on GHG performance

### Enforcement Mechanism

- PAs would reduce a project's annual PBI payment in proportion to its GHG impact:

| Annual GHG Impact[7] | PBI Payment Reduced By: |
|---|---|
| *Decrease* of more than 25 kg $CO_2$ per rated energy capacity (kWh) | 0% |
| *Decrease* of less than 25 kg $CO_2$ per rated energy capacity (kWh)[8] | 25% |
| *Increase* of less than 25 kg $CO_2$ per rated energy capacity (kWh) | 50% |
| *Increase* of more than 25 kg $CO_2$ per rated energy capacity (kWh) | 100% |

- PBI payment deductions would be permanently forfeited and returned to the SGIP incentive budget.
- PAs would have discretion to increase or decrease payment deductions or levy other penalties with written approval from Energy Division.

Staff proposes to continue verification and enforcement of GHG performance past a project's five-year PBI term via a fleet compliance approach. Developer fleets of 10 or more new commercial projects would be required to reduce GHGs and meet aggregate cycling requirements annually. Developers whose fleets are found to increase GHGs or fall short of their aggregated cycling requirement would be temporarily suspended by the PAs, meaning they would not be permitted to submit new applications during a defined suspension period. If these new rules go into effect Q3 2019, the first new commercial project would likely receive its

[7] The GHG impact of a customer's storage device is defined as the difference between the customer's emission profiles with and without the storage.
[8] Inclusive of a net zero impact on emissions.

first upfront payment in Q1 2021 and finish its five-year PBI term in Q1 2026, thus fleet compliance for new commercial projects would begin implementation in 2026.

## Discussion

### Commercial Projects 30 kW and Larger

Staff's proposed operational requirements and verification mechanism for commercial projects 30 kW and larger are based on "New PBI Proposal 1" from the WG report, however staff proposes to increase the portion of incentives paid out on a performance basis from 50% to 60% to provide greater incentive to reduce GHGs.

Staff's proposed enforcement mechanism is stricter than the mechanisms proposed by the WG, which ranged from relying solely on existing handbook infraction language to reducing PBI payments by 25%.[9] Staff supports reducing the PBI payment by 25% for small net GHG reductions and by 50% and 100% for net GHG increases to reflect the emphasis statute places on GHG reductions and to provide systems with incentive to reduce GHGs beyond net zero.

### Commercial Projects Under 30 kW

Staff's proposal to make commercial projects under 30 kW PBI is based on "New Non-PBI/Non-Res Proposal 1" from the WG report, where part of a project's incentive is withheld and paid out over several years.

The WG debated the split, with 50/50, 70/30, 80/20, and 90/10 all proposed. Staff supports a 40/60 split for the following reasons:

- Alignment with proposed rules for large commercial projects
- Provides greater incentive to reduce GHGs
- Staff did not see clear evidence in the WG report or during WG meetings that a 50/50 or 40/60 split would significantly reduce the finance-ability of smaller commercial projects compared to a 70/30 or 80/20 split

Staff recognizes that making smaller commercial projects subject to all PBI rules will require them to contract with a PDP and install revenue grade metering equipment, two requirements that did not apply to this project class before. It is staff's understanding that most commercial developers already contract with a PDP or are one themselves, so this should not represent a

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[9] Also, the "New PBI Proposal 1b" in the WG report proposed to reduce a project's PBI payments by its annual net GHG increase multiplied by "a 4x multiple of the California Cap and Trade price of carbon at the time in which the project applied to the program". Staff did not determine whether this would tend to come out to more or less than 50% of the PBI payment.

significant additional cost. Staff have also heard anecdotally that installing revenue-grade metering costs roughly $2,000 per project. While this is not an insignificant cost, staff believes requiring such equipment is appropriate when a project's incentive payment relies on accurate metering, and the costs of not requiring such equipment may be greater when one factors in time spent by PAs verifying the technical capabilities of non-standard metering equipment.

### Enforcement Exceedance Bands

Staff supports the adoption of specific exceedance bands for payment reductions to clearly convey pre-defined penalties to program participants and to calibrate payment reductions to the breach in compliance.

SGIP currently uses exceedance bands on PBI payment reductions to penalize *generation* projects that increase GHGs relative to an annual grid emissions factor. Generation projects that increase emissions by 0-5% are not penalized ("buffer band"), projects that increase emissions by 5-10% have their payment reduced by 50%, and projects that increase emissions more than 10% have their payment reduced by 100%.

Staff chose not to adopt a similar buffer band for storage projects because statute requires SGIP projects to *reduce* GHGs, thus incentivized projects should aim below net zero GHGs. To ensure meaningful reductions are achieved, the Commission should require projects to reduce GHGs some minimum amount to recoup full payment. Staff proposes to set this amount at 25 kg $CO_2$ per rated energy capacity (kWh), equivalent to a 0.18% reduction for non-PBI projects and 3.10% reduction for PBI projects in Itron's 2017 evaluated sample.

For projects that increase GHGs, staff chose the 0-25 kg per kWh (0-0.05 metric tons per kW) and 25+ kg per kWh (0.05+ metric tons per kW) values for exceedance bands based on annual net emissions data in the 2017 SGIP Storage Impact Evaluation.[10] As can be seen in the figures below, in 2017 the first exceedance band would have captured roughly one third of small commercial projects and three quarters of large commercial projects, or roughly half of all projects.

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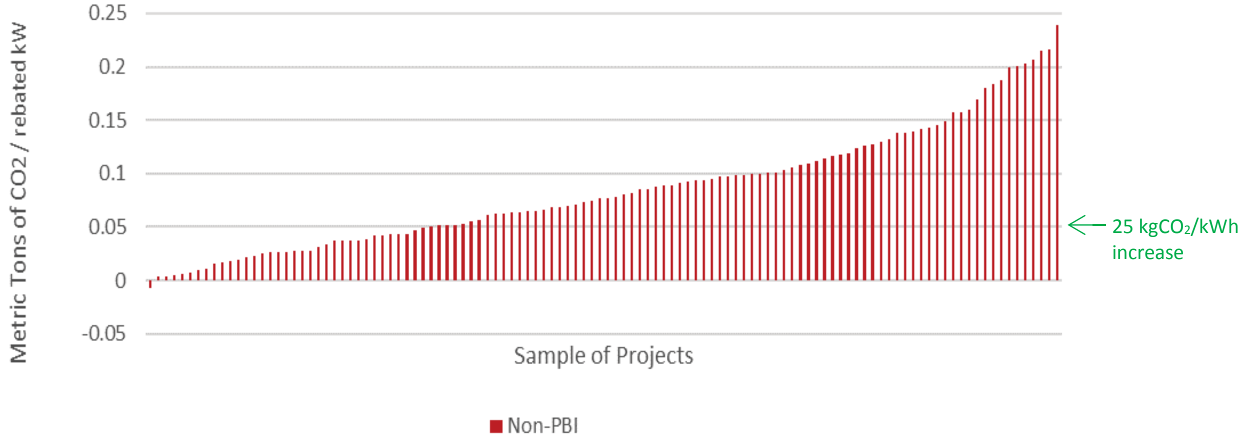
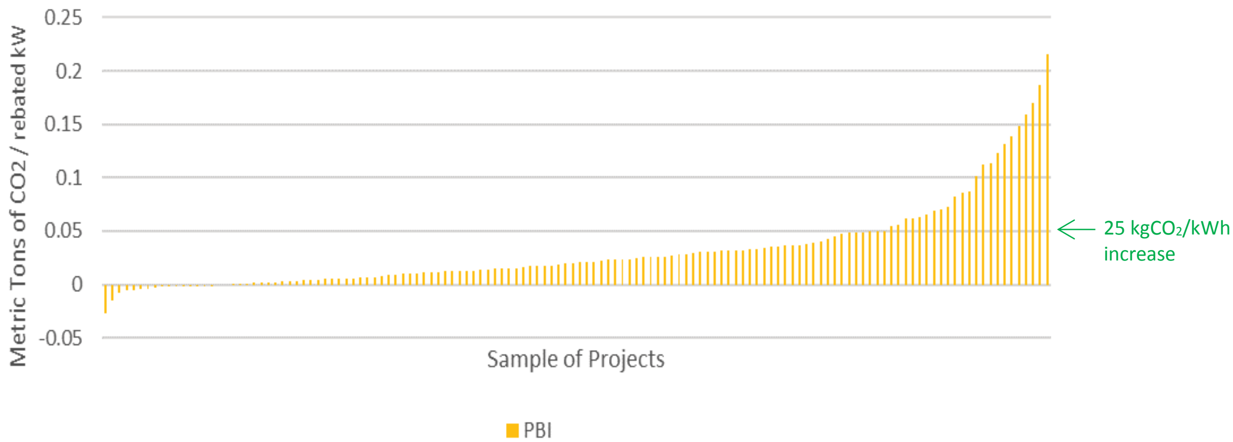
[10] Staff chooses to normalize emissions by kWh rather than kW to align with existing SGIP rules governing incentive calculations. Because the vast majority of projects assessed in the 2017 SGIP Storage Impact Evaluation had a 2-hour duration of discharge, we divide by 2 to convert from the evaluation's per kW figure to a per kWh figure.

***Figure 1: Net $CO_2$ emissions per rebated capacity for non-PBI and PBI projects, reprinted from the 2017 SGIP Storage Impact Evaluation (Figures 4-59 and 4-60) (green content added)***




# Residential Projects

## Proposal Summary

Staff proposes to eliminate the annual RTE requirement and require all new residential projects to enroll in a time-varying rate with peak starting at or after 4pm, pair with and charge at least 75% from a solar system, and have a single-cycle RTE of at least 85%.

In addition, staff proposes to require developer fleets of 10 or more new residential projects to reduce GHGs and meet aggregate cycling requirements annually. Developers whose residential fleets are found to increase GHGs or fall short of their aggregated cycling requirement will be temporarily suspended by the PAs, meaning they will not be permitted to submit new applications during a defined suspension period of 90, 180, or 360 days.

## Current Rules and Impact Evaluation Findings

The SGIP Handbook currently requires residential projects to meet a ten-year average roundtrip efficiency of 66.5% and cycle 52 times per year. The Commission's purposes in establishing the RTE and cycling requirements were to ensure projects reduce GHGs and are used for more than just back-up power, respectively.[11]

Other than requiring host customers to sign an affidavit that they will discharge the storage system a minimum of 52 full discharges per year, the PAs currently do not have a mechanism for verifying or enforcing compliance with the RTE or cycling requirement. Residential projects are currently only required to provide data in the event of an audit. Assessment of residential project performance falls to Itron, which measures RTE, GHGs, and cycling for residential projects as part of the annual SGIP storage impact evaluation. For the 2016 evaluation, Itron was not able to evaluate the residential class due to data availability issues. For the 2017 evaluation, Itron installed meters directly on 30 residential projects (7% of the total residential population subject to evaluation in 2017) and produced statistically significant results based on that sample. For the 2018 evaluation and beyond, Itron expects to receive sufficient data directly from newer projects with more advanced data reporting abilities.

### 2017 Storage Impact Evaluation Findings

The 2017 SGIP Storage Impact Evaluation found that residential projects had a mean observed RTE of 38% and a mean capacity factor of 2.2%, indicating these systems were used almost exclusively to provide backup power.[12] Additionally, Itron found that when not idle or providing backup, systems tended to discharge during PV generating hours and charge in the early evening during the CAISO system peak. On average, residential projects increased emissions by 0.06 metric tons of $CO_2$ per kW, or 30 kg of $CO_2$ per kWh, in 2017.

This is the kind of dispatch behavior that existing SGIP rules are intended to avoid. However, it is important to note that none of the observed projects were enrolled on a TOU rate, and therefore did not have information or financial incentive to dispatch in a way that would reduce GHGs or increase capacity factor.

The impact evaluation also included a simulation of storage behavior under future grid conditions, and found that residential projects, optimizing for customer bill savings on a PG&E

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[11] The Commission adopted the RTE requirement in Resolution E-4519 and originally prohibited SGIP funding for backup-only systems in D.01-03-073.

[12] Interestingly, most residential projects met program cycling requirements of 52 cycles per year, indicating the cycling requirement may be set too low to achieve the Commission's desired capacity factor. The Commission may want to consider raising the residential cycling requirement in the future if the residential fleet's capacity factor stays low even after new GHG rules are implemented.

TOU rate (E6) and using new TOU periods with an on-peak definition of 4-9pm, still led to an increase in GHGs, just less than on the old rate. This is likely because under new TOU periods, projects are still incentivized to charge during some hours of relatively high emissions (e.g. 2-4pm).

## Detailed Proposal

Staff recommends the Commission adopt upfront eligibility criteria and a fleet approach to verification and enforcement for new residential systems. The proposal for upfront eligibility criteria is based primarily on the WG modeling and WG's recommendations for operational requirements for new residential projects. Staff's proposal for fleet verification and enforcement is very similar to the practice used now - impact evaluation results are communicated to the PAs, who then determine what corrective action to take, if any. Staff proposes to enhance the current practice by establishing a mid-year feedback loop to developers, tightening the timeframe for communicating annual performance to the PAs, and adopting specific penalties for non-compliance.

Definition of "New Residential Fleet": In this section, a developer shall be deemed to have a "New Residential Fleet" subject to fleet compliance requirements if they have a minimum of 10 new[13] residential projects statewide. Projects would enter the fleet on January 1st following their operational start date and exit on December 31st of their tenth full calendar year (January 1-December 31) in operation.

### Operational Requirements

- All new residential projects would be required to meet the following upfront eligibility criteria when applying:
  - Enrolled on a time-varying rate with a peak starting at 4pm or later
  - Paired with solar
  - Single-cycle RTE of at least 85%
  - Sign an affidavit stating they will:
    - Cycle 52 times per year
    - Charge at least 75% from solar[14]

[13] This report defines "new" projects on page 10 as those submitting an SGIP application on or after the go live date for new GHG rules, likely in Q2/Q3 2019.

[14] Charging from solar is defined as charging the storage device during a time interval (e.g. 15-minute) when the on-site solar is generating and not exceeding the amount (kWh) of solar generation in that time interval.

- All New Residential Fleets would be required to reduce GHGs and meet aggregated cycling requirements on an annual basis, for each compliance period January 1-December 31.

## Verification Mechanism

- Staff proposes to task Itron[15] with semiannual verification of fleet GHG and cycling performance. Staff confirms that additional funds from the SGIP administrative budget are available for this purpose.[16]
- Itron would assess performance twice each year: mid-year, to provide feedback on performance, and end-of-year, to verify compliance for the annual compliance period (January 1-December 31). Itron would communicate findings to the PAs by August 15 and February 15 respectively.
- Each developer with a New Residential Fleet would be required to submit complete project-level electrical charge and discharge data to Itron upon request and no later than July 20 of each year and January 20 following each year in which they have an eligible fleet. For each fleet, Itron may determine the most efficient means to collect data to assess performance. For larger fleets, Itron may choose to use sampling, in which case they (Itron) would select the projects sampled.
- The PAs would then communicate findings and any enforcement steps to each fleet developer according to the following schedule:
    - On September 1, the PAs would communicate Itron's findings for the January 1–June 30 period. The PAs would work with fleet developers to review progress reports and make operational adjustments as needed.
    - On March 1, the PAs would communicate Itron's findings for the January 1–December 31 compliance period, and issue any penalties (see "Enforcement Mechanism" immediately below).

## Enforcement Mechanism

[15] This report uses Itron's name in lieu of "SGIP evaluator" because most program participants are familiar with Itron and their role. Should the PAs subsequently hire a different entity to perform this work, that entity would assume the duties ascribed to Itron here.

[16] PG&E and SCE have large overages in their administrative budgets at present, however CSE and SoCalGas may not have sufficient funds to cover additional M&E costs. If the Commission tasks the SGIP evaluator with semiannual verification of fleet compliance, it may want to consider funding the work solely through PG&E and SCE's administrative budgets, or alternatively, re-allocating administrative funds across PAs to ensure each PA has sufficient funds to cover their share of the work.

- Developers whose fleets are found to increase GHGs or fall short of their aggregated cycling requirement would be temporarily suspended by the PAs, meaning they would not be permitted to submit new applications during a defined suspension period. Suspension periods would advance only on days when the residential budget of the "controlling PA"[17] is open and would be proportional to the magnitude of the breach in compliance:
    - 0-10 kg $CO_2$ per energy capacity (kWh) or 80-99% of required cycling → 90-day suspension
    - 10-30 kg $CO_2$ per rated energy capacity (kWh) or 60-79% of required cycling → 180-day suspension
    - >30 kg $CO_2$ per rated energy capacity (kWh) or <60% of required cycling → 360-day suspension
- If a developer incurs suspension periods for non-compliance with both the GHG and cycling requirements, the aggregate suspension period would be the sum of the two suspension periods.
- PAs would have discretion to increase or decrease the suspension period or levy different penalties with written approval from Energy Division.

Following each annual compliance period, Energy Solutions[18] would list and rank each fleet's annual GHG and cycling performance on SelfGenCA.com and/or CaliforniaDGStats.ca.gov, highlighting high-performing developers who were successful in reducing GHGs and achieving high capacity factors in their fleets.

Systematic verification and enforcement of a project's GHG performance would end after its tenth year in a New Residential Fleet.

### Discussion

Staff is encouraged by WG modeling findings that residential storage systems that meet certain criteria are likely to reduce GHGs, and supports adopting those criteria. However, staff does not have sufficient confidence in the modeling to recommend a pure "deemed compliance" approach, as proposed by some in the WG. Staff believes verification and enforcement are necessary to ensure residential storage meets statutory program requirements to reduce GHGs.

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[17] The "controlling PA" for a developer is the PA to whom the developer has submitted the most applications in the past 12 months.

[18] Energy Solutions is SGIP's software provider and manages the SelfGenCA.com and CaliforniaDGStats.ca.gov websites.

The following discussion first addresses upfront eligibility criteria, then verification and enforcement.

## Upfront Eligibility Criteria

The recommendations for upfront eligibility criteria are based primarily on WG modeling showing that residential projects are likely to reduce GHGs if they enroll in a rate with peak starting at or after 4pm, pair with and charge at least 75% from solar, and have a single-cycle RTE of at least 85%. These results are summarized in the following figure from the WG report. The red circle highlights the percentage of model runs with GHG reductions for projects that meet the combination of criteria recommended here.

***Figure 2: Residential summary of GHG and cost impacts for different scenarios, reprinted from the WG Report (page 89 of corrected version)***

| CUSTOMER CLASS | MODEL TYPE INPUT | RETAIL RATE | GHG REDUCTION SOLUTION | SCRTE | MODEL RUNS | % RUNS WITH GHG REDUCTION | MEAN GHG REDUCTION kg/kWh | % RUNS WITH COST REDUCTION | MEAN COST REDUCTION % |
|---|---|---|---|---|---|---|---|---|---|
| Residential | Storage Only | OLD | GHG Signal Co-Optimization | 0.7 | 144.00 | 0.00 | -2.17 | 33.33 | -1.21 |
| | | | | 0.85 | 72.00 | 11.11 | -2.08 | 33.33 | -1.09 |
| | | | No GHG Reduction Solution | 0.7 | 24.00 | 0.00 | -2.99 | 33.33 | -1.21 |
| | | | | 0.85 | 12.00 | 0.00 | -2.90 | 33.33 | -1.09 |
| | | NEW | GHG Signal Co-Optimization | 0.7 | 72.00 | 100.00 | 16.48 | 100.00 | 14.70 |
| | | | | 0.85 | 36.00 | 100.00 | 31.03 | 100.00 | 20.78 |
| | | | No GHG Reduction Solution | 0.7 | 12.00 | 0.00 | -11.15 | 100.00 | 14.70 |
| | | | | 0.85 | 6.00 | 66.67 | 4.07 | 100.00 | 20.78 |
| | Solar Plus Storage | OLD | GHG Signal Co-Optimization | 0.7 | 144.00 | 38.19 | 0.40 | 0.00 | -13.21 |
| | | | | 0.85 | 72.00 | 100.00 | 12.89 | 0.00 | -7.37 |
| | | | No GHG Reduction Solution | 0.7 | 24.00 | 0.00 | -7.32 | 0.00 | -13.21 |
| | | | | 0.85 | 12.00 | 66.67 | 4.20 | 0.00 | -7.37 |
| | | NEW | GHG Signal Co-Optimization | 0.7 | 144.00 | 75.00 | 6.16 | 100.00 | 12.20 |
| | | | | 0.85 | 99.00 | 97.98 | 25.91 | 100.00 | 21.06 |
| | | | No GHG Reduction Solution | 0.7 | 24.00 | 50.00 | -1.43 | 100.00 | 12.18 |
| | | | | 0.85 | 48.00 | 83.33 | 8.34 | 100.00 | 19.68 |

### GHG SIGNAL

Although the modeling clearly shows requiring projects to co-optimize between a GHG signal and bill savings leads to a greater likelihood of GHG reductions than employing no GHG reduction solution, staff questions the feasibility of requiring all new residential projects, including those developed by individual homeowners, to respond to a remote signal. The other eligibility criteria recommended here, combined with the fleet approach to verification and enforcement, should produce GHG reductions without the need to mandate that all projects develop the ability to respond to a GHG signal.

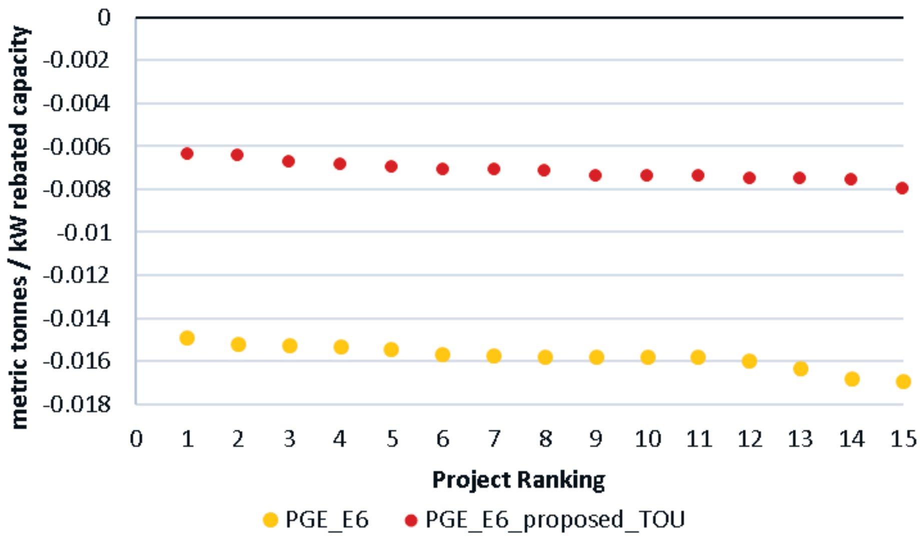
## RATES

Time-varying residential rates with peak periods starting at 4pm or later are already available in PG&E, SCE, and SDG&E service territories.[19] Staff believes these new TOU rates, with peak periods better aligned with grid emissions, will provide residential projects with *some* additional information and incentive to dispatch in a way that reduces GHGs. This is supported by the WG modeling, which found that for 85% SCRTE residential projects not responding to a GHG signal, switching from old to new rates[20] increases the likelihood projects will be GHG-reducing by 67% for stand-alone storage and 16% for storage paired with solar (see Figure 2 above).

However, as noted above, Itron's simulated dispatch results in the 2017 report found that residential projects on a new PG&E TOU rate optimizing for customer bill savings still led to an increase in GHGs, just less than on the old rate. The figure below shows negative GHG savings (i.e. increased emissions) for both projects on the new E6 rate with a 4-9pm peak and projects on the old E6 rate with a 1-7pm peak.

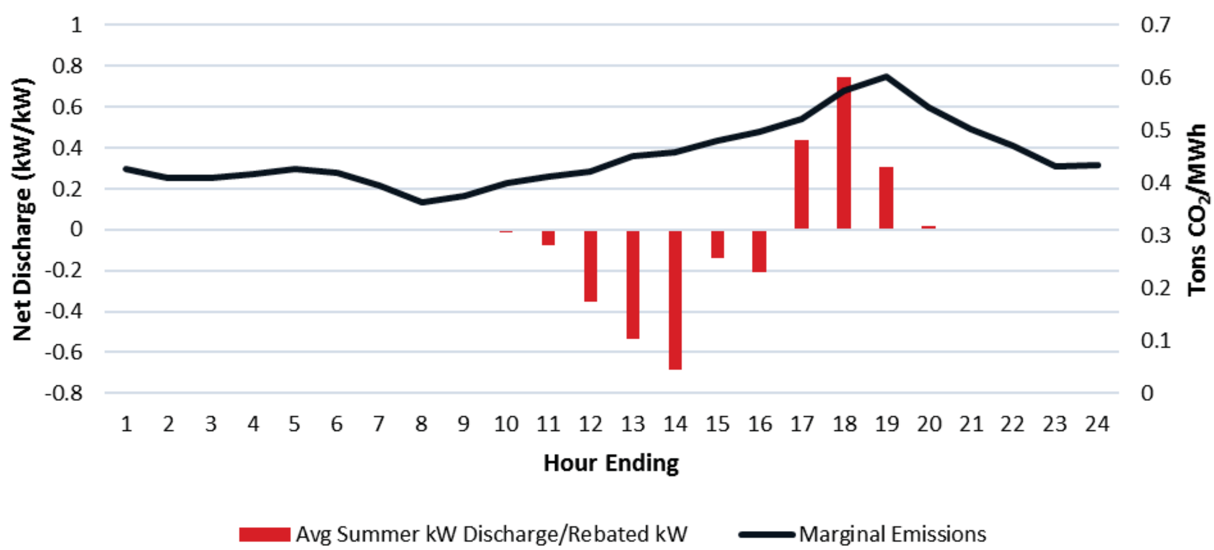
[19] Staff have not yet been able to confirm with Los Angeles Department of Water and Power and other municipal utilities that time varying rates with peak periods starting at 4pm or later are available in their service territories, or if not, whether there are plans to adopt such rates between now and when new rules would go into effect.
[20] The WG report (p. 30 of the corrected version) refers to "new" rates as "rate plans proposed by the utilities (and in a few cases already in effect) that are subject to TOU schedules substantially different to the conventional TOU rates of the last 30 years. These TOU rates shift the on-peak period much further into the evening hours, thereby better aligning period of high cost with periods of high marginal grid emissions."

***Figure 3: $CO_2$ emissions savings per kW resulting from customer dispatch approach, by project, for PG&E residential customers (N = 15), reprinted from 2017 SGIP Storage Impact Evaluation (Figure 5-32)***




The figure below compares marginal grid GHGs to the dispatch behavior of residential customers using the new E6 rate. Although projects did discharge during peak times, they also charged during times when grid emissions are relatively high, producing a net increase in emissions.

***Figure 4: PG&E residential customer average net summer discharge per rebated kw as compared to marginal emissions rate (N = 15), reprinted from 2017 SGIP Storage Impact Evaluation (Figure 5-33)***



Staff surveyed residential rates either available now or proposed in recent or pending rate cases, and identified several with super off peak periods for much of the year that may provide more granular signals about when marginal grid emissions are at their lowest, notably PG&E's EV-A rate (just approved in D.18-08-013) and SCE's TOU-D-PRIME (proposed in the A.17-06-030 settlement). However, without additional modeling to clearly show that customers on these rates would reduce GHGs, staff does not have enough information to conclude that new TOU rates alone will produce GHG-reducing dispatch. Other eligibility requirements are needed to achieve a minimum level of confidence that residential projects will reduce GHGs.

### PAIRING WITH SOLAR

The WG modeling found that for residential projects on new rates and not responding to a GHG signal, adding the requirement to pair with and charge at least 75% from solar increases the likelihood projects will be GHG-reducing by 16%, from 67 to 83% (see Figure 2). The WG posited that the reason for this is that requiring a project to pair with solar makes it more likely for the developer to set the device's operation mode to "solar self-consumption", which forces the storage to charge during PV-generating hours, the cleanest hours on the grid.[21] Essentially, this sets charge and discharge timing constraints that are better aligned with grid emissions than TOU periods, which don't generally differentiate between low and lowest grid emission times.

This theory for why pairing with solar leads to more GHG-reducing dispatch is plausible, begging the question why not just recommend charge and discharge timing constraints. The WG modeled timing constraints on charge and discharge as one of the GHG reduction solution options, but mysteriously found that they increase GHGs in some instances (see Appendix G of the WG report). Thus, staff does not have an analytical basis to consider their adoption at this time. Staff notes that the vast majority of residential systems are paired with solar anyway, and expect this trend to continue independently of SGIP requirements.

### 85% SINGLE-CYCLE RTE

Staff supports the WG proposal to include 85% SCRTE as an eligibility criterion for new residential projects. WG modeling shows that under new rates and no GHG reduction solution, projects with 85% SCRTE are 33% more likely to reduce GHGs than projects with 70% SCRTE

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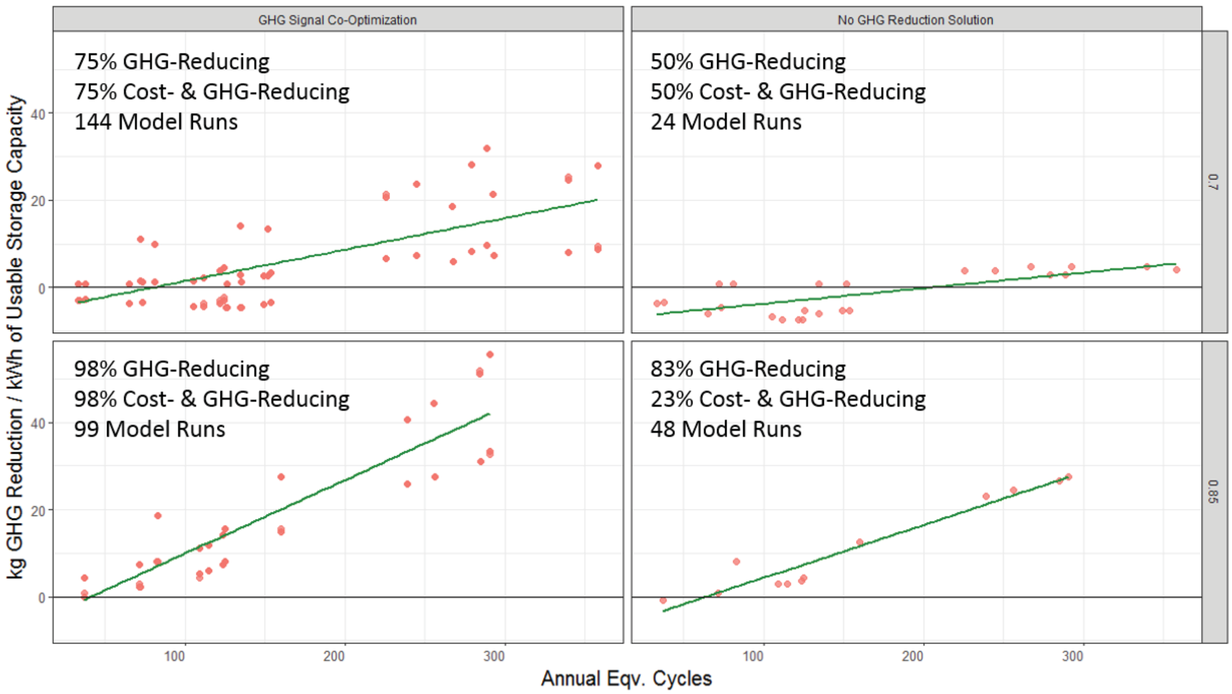
[21] Note that when calculating the GHG impacts of a storage device paired with a solar system, the device is assumed to charge from the grid, not the solar. GHG reductions from the solar are not attributed to the storage device because it is assumed that the solar would have been installed regardless of the storage. Also, it's not technically possible to track the source of energy used to charge the device for many systems, particularly AC-paired systems where the storage and solar are behind separate inverters. Therefore, the calculated GHG reductions associated with solar self-consumption stem from the timing of charge and discharge, not from energy generated by an on-site zero-emissions source.

(see figure below). It is staff's understanding that almost all new residential storage systems are lithium ion batteries and easily meet this requirement.

***Figure 5: Cycles and GHGs for storage with solar on new rates by GHG reduction solution and SCRTE (residential), reprinted from the WG report (page 73 of corrected version)***




## Verification and Enforcement

Although staff has sufficient confidence in the accuracy of the WG modeling effort to use it as a basis for proposals on eligibility criteria for new residential projects, it does not have sufficient confidence in the modeling to support a pure "deemed compliance" approach. Staff believes a belt and suspenders approach, with eligibility criteria as the belt and verification and enforcement as the suspenders, is necessary to ensure storage is operated in a way that reduces GHGs.

Staff believes the WG modeling may be flawed for several reasons. The final results combined findings from six different modelers, each using different assumptions for electric rates, SCRTE, system size, and parasitic losses in their proprietary models. Additionally, not all modelers modeled all scenarios; several scenarios had over four hundred model runs, while one had only six. Presumably, all runs for the latter scenario came from a single modeler, making it difficult to tell whether the results for that scenario are reflective of real impact or simply unique assumptions made by the modeler. When combined, the aggregated modeling sometimes also produced odd results. For example, it found that for projects paired with solar, on a new rate, and responding to a GHG signal, removing the criteria that the storage system is paired with solar raised the number of GHG-reducing runs from 84% to 100% (see Figure 2).

Because staff does not have credible modeling results showing that projects that meet these eligibility criteria are highly likely to reduce GHGs, staff recommends the Commission adopt a fleet compliance approach and put the onus on developers to ensure their projects comply with the statutory requirement to reduce GHGs. The WG modeling indicates that projects that respond to a GHG signal are more likely to reduce GHGs compared to projects that don't respond to a GHG signal. We expect each developer to determine for themselves to what degree they need to supplement TOU rates and solar self-consumption with the GHG signal to achieve fleet-wide GHG reductions.

In a few years, the Commission should have enough data on storage dispatch under new rates to determine whether systems that meet certain upfront criteria can be reasonably assumed to reduce GHGs, rendering verification and enforcement unnecessary. Staff recommends the Commission re-assess the need for systematic verification and enforcement for residential projects at that time, and no later than the program's sunset in 2025.

### PROJECT- VS. FLEET-LEVEL ENFORCEMENT

Enforcing GHG reductions at the individual project level is infeasible given the number of projects and lack of sophistication of smaller developers and individual homeowners. A fleet compliance approach is less costly to implement, is targeted at larger developers with the ability to report performance data, and has the benefit of allowing developers to determine the most efficient way to achieve GHG reductions across its fleet. Staff chose to set the lower limit for fleets to 10 projects because at that number, most projects are captured and the total number of fleets is kept manageable for verification and enforcement purposes.[22]

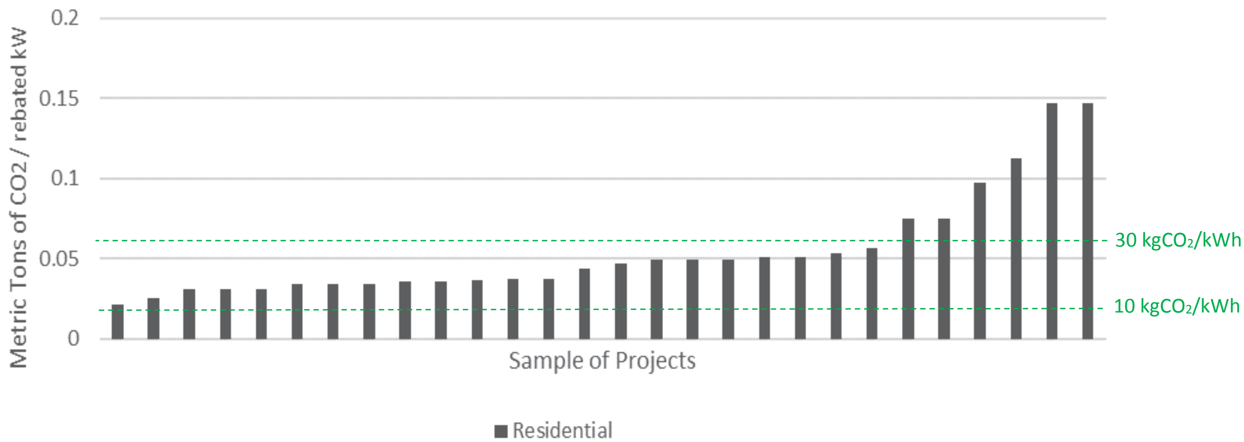
### ENFORCEMENT EXCEEDANCE BANDS

Staff supports the adoption of specific exceedance bands to clearly convey pre-defined penalties to developers, and to calibrate penalties to the breach in compliance. Staff chose the 0-10 kg per kWh (0-0.02 metric tons per kW), 10-30 kg per kWh (0.02-0.06 metric tons per kW) and 30+ kg per kWh (0.06+ metric tons per kW) values for exceedance bands based on project-level emissions data in the 2017 SGIP Storage Impact Evaluation (see figure below). Three

[22] As of August 6, 2018, there were 30 developers with ten or more residential projects paid or reserved, capturing 93% of all residential projects (SGIP Weekly Statewide Report, posted August 6, 2018).

exceedance bands balance the need to make enforcement rules simple with the need to not overly penalize fleets with small net increases in GHGs.

***Figure 6: Net $CO_2$ emissions per rebated capacity for residential projects, reprinted from the 2017 Itron Storage Impact Evaluation (Figure 4-71) (green content added)***



## Proposals for Legacy Projects

This section contains proposals for "legacy" projects, defined as those submitting an SGIP application before the "go live" date for new GHG rules, likely in Q2/Q3 2019 (see discussion on page 10).

### Proposal Summary

Staff proposes to provide two pathways to program compliance for all legacy projects, *regardless of customer class*. Projects may either adhere to the existing rules at the time of application, including the minimum annual RTE standard, or may opt in to a GHG reduction pathway, whereby projects could choose to forego the minimum RTE requirement and instead commit to operating in a way that achieves annual GHG emissions reductions. Under the GHG reduction pathway, the annual cycling requirement for projects interconnected under older rules requiring 260 annual cycles would be stepped down to the current 130 annual cycling requirement.

Staff proposes to verify and enforce compliance with both the RTE compliance and GHG reduction pathways on a developer fleet basis. Developer fleets of 10 or more legacy projects opting in to the same pathway (RTE or GHG) would be required to comply with the requirements of their respective pathways annually. Developers whose fleets are in breach of the requirements of their respective pathways will be suspended by the PAs, meaning they will not be permitted to submit new applications for a defined period in proportion to the breach in compliance.

Itron would determine developer fleet compliance on a semiannual basis, which will then be communicated to developers by the PAs. Enforcement would take place shortly following each program year.

### Current Rules

The SGIP Handbook does not explicitly require energy storage projects to reduce GHGs at present. All projects are instead required to meet a roundtrip efficiency of 66.5% averaged over ten years. Commercial systems are required to discharge a minimum of 130 full discharges per year. Residential systems are required to discharge a minimum of 52 full discharges per year.

### Detailed Proposal

Staff proposes to offer two alternative compliance pathways for legacy projects:

1. Meet the SGIP minimum annual RTE requirement (no change from old rules), or
2. Opt in to a GHG reduction pathway that would exempt participants from the minimum RTE requirement and establish a 130 cycle annual requirement for older projects operating under the 260 annual cycles rule.

### Operational Requirements

- At the time of implementation, PAs would email host customers/applicants[23]/ developers for all legacy projects and offer them the choice to opt in to one of the two available pathways. Projects that don't respond would be defaulted to the RTE compliance pathway.
- Through this selection process, the PAs would develop two fleets per developer/applicant: a GHG reduction fleet and an RTE compliance fleet. A developer shall be deemed to have a "Legacy Fleet" (GHG or RTE pathway) subject to fleet compliance requirements if they have a minimum of 10 legacy projects statewide in any one pathway.
  Existing projects will enter the Legacy Fleet on January 1, 2020 and exit on December 31 of their fifth full calendar year (January 1-December 31) in operation. Energy Solutions will make developer/applicant fleet enrollment lists available online.

### Verification Mechanism

- Staff proposes to task Itron with semiannual verification of GHG and RTE performance, as relevant to each Legacy Fleet. Staff confirms that additional funds from the SGIP administrative budget are available for this purpose.[24]
- Each developer with a Legacy Fleet (GHG or RTE pathway) would be required to submit complete project-level electrical charge and discharge data to Itron upon request and no later than July 20 and January 20 of each year in which they have an eligible fleet. For each fleet, Itron may determine the most efficient means to collect data to assess performance. For larger fleets, Itron may choose to use sampling, in which case developers would not have discretion to choose which projects are sampled.

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[23] The term "applicant" precedes the developer decision established in PY 2017. Per the February 2016 SGIP Handbook an "Applicant is the entity that is responsible for completing and submitting the SGIP application and serves as the main point of contact for the SGIP Program Administrator throughout the application process. Host Customers may act as the Applicant, or they may designate a third party (e.g. a party other than the Program Administrator or the utility customer) to act as the Applicant on their behalf. Applicants may be third parties such as, but not limited to, engineering firms, installation contractors, equipment distributors, Energy Service Companies (ESCO), equipment lessors, etc. Host Customers may elect to change the Applicant at their discretion.

[24] See Footnote 14.

- Itron would assess performance twice each year: mid-year, to provide feedback on performance, and end-of-year, to verify compliance for the annual compliance period (January 1-December 31). Itron would communicate findings to the PAs by August 15 and February 15 respectively.
- The PAs would communicate findings and any enforcement steps to each fleet developer as follows:
  - On September 1, the PAs would communicate Itron's findings for the January 1-June 30 period. The PAs would work with fleet developers to review progress reports and make operational adjustments as needed.
  - On March 1, the PAs would communicate Itron's findings for the January 1 – December 31 compliance period, and issue any penalties (see "Enforcement Mechanism" immediately below).
- For all legacy fleets (RTE and GHG pathways), Itron would submit an initial report to the PAs on February 15, 2020 for the 2019 period. This report would provide developers with information about their fleet performance in 2019 but would not be used to verify compliance.

### Enforcement Mechanism

- Developers whose fleets are found to be in breach of the rules under the relevant legacy pathway would be temporarily suspended by the PAs, meaning they would not be permitted to submit new applications during a defined suspension period. Suspension periods would advance only on days when the residential budget of the "controlling PA"[25] is open and would be proportional to the magnitude of the breach in compliance.
- RTE compliance pathway penalty structure:
  - 75-99% of required RTE or 75-99% of required cycling → 180-day suspension
  - <75% of required RTE or <75% of required cycling → 360-day suspension
- GHG reduction pathway penalty structure:
  - 0-10 kg CO2 per energy capacity (kWh) or 80-99% of required cycling → 90-day suspension
  - 10-30 kg $CO_2$ per rated energy capacity (kWh) or 60-79% of required cycling → 180-day suspension
  - >30 kg $CO_2$ per rated energy capacity (kWh) or <60% of required cycling → 360-day suspension

[25] See Footnote 17.

To keep in line with current SGIP M&E requirements, staff proposes to continue monitoring legacy projects' RTE or GHG performance for ten years. However, prior to the program's end in 2025, staff recommends the Commission assess whether sufficient rate reform has taken place to incentivize desired dispatch, and should reconsider the need for systematic verification and enforcement of SGIP rules at that time.

As an added advantage to developers who choose the GHG reduction pathway, Energy Solutions would list and rank fleets' annual GHG performances on SelfGenCA and/or DG stats, highlighting high-performing developers who were successful in achieving GHG emissions reductions associated with their fleets.

## Discussion

### Strengthening SGIP Minimum RTE Verification and Enforcement

SGIP's overall legacy fleet poses a special policy challenge to uphold SGIP's long-standing statutory GHG emissions reductions goals without retroactively modifying the rules under which older projects were installed and operating. For this reason, staff proposes to maintain the current RTE requirement for the overall SGIP legacy fleet. Projects with application dates before the new SGIP rules go into effect would default into the existing RTE compliance pathway, unless they choose to opt in to the GHG reduction pathway.

While the existing minimum RTE requirement would remain unchanged under our proposal, staff is concerned about the efficacy of verification and enforcement measures currently in place to ensure compliance. Based on the findings of past program evaluations, SGIP non-PBI and residential projects consistently fail to meet this requirement. The 2017 SGIP Storage Impact Evaluation shows that the mean RTE for non-residential non-PBI (systems less than 30 kW) was 51% and only 38% for residential projects.[26] Regardless of how effective a tool the minimum RTE standard may or may not be for predicting energy storage system's GHG performance, SGIP applicants receiving incentives are bound by all program rules in effect at the time they entered into contract with and received incentives from SGIP. Therefore, Staff proposes more stringent RTE verification and enforcement processes to improve compliance.

To encourage developers to choose to uphold the statutory requirement for all SGIP systems to reduce GHGs, staff proposes stricter non-compliance penalties for legacy fleets that opt in to the RTE compliance pathway. Stricter penalties for RTE fleets are also warranted because SGIP legacy projects have had several years of experience in energy storage operations, and

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[26] *See* 2017 SGIP Advance Energy Storage Impact Evaluation (Itron) at 1-6.

developers have had ample time since the annual RTE requirement was introduced to adjust their storage operations to follow SGIP rules.

Staff proposes engaging Itron's expertise to develop a more robust methodology for verifying RTE compliance. In addition, we propose semiannual progress check-ins with developers to determine whether operational adjustments will be needed to achieve the annual requirement. Furthermore, while Itron may employ a sampling strategy to assess whether a developer's fleet of projects is operating in accordance with SGIP program rules, once a performance report is filed with the PAs, a large sample of projects in breach of the RTE requirement will necessitate a request for project-level performance data. The latter will be used to determine the magnitude of the developer's breach in compliance and the appropriate penalties.

Staff proposes to calculate RTE compliance as a percentage of the total capacity (MW) of a developer's fleet. As an illustrative example, a developer with two projects, one with 1 kW and one with 1 MW capacity, would be evaluated based on the actual RTE achieved for 1.001 MW of capacity. In this example, two extremely divergent system sizes are used to demonstrate the weight given to larger projects when evaluating a legacy fleet's RTE compliance. By basing the developer's overall RTE compliance on the sum of all projects' capacities, larger projects, with more potential for causing GHG and grid impacts, take on a size-proportionate obligation to maintain RTEs at the required level.

### Legacy Projects and the GHG Signal

n staff's view, although the RTE requirement proved to be an imperfect proxy for a storage GHG emission reduction standard, compliance with longstanding statutory requirements[27] that all SGIP technologies reduce GHG emissions should remain a program priority.

When considering possible solutions to meet the requirements of the December 2017 ACR, the WG determined early on that, to ensure long-term market sustainability, customer value proposition also merits consideration when optimizing storage operations for GHG savings. As a result, the GHG co-optimization model was designed to, where possible, maximize both GHG and customer bill savings.

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[27] Senate Bill (SB) 412 (Kehoe, Stats. 2009, ch. 182) directed the California Public Utilities Commission (Commission) to adopt rules that limit eligibility for the program to "distributed energy resources that the commission, in consultation with the State Air Resources Board (ARB), determines *will achieve reductions of greenhouse gas emissions…*" (Emphasis added.) SB 412 is codified in Public Utilities Code Section 379.6, as well as other code sections. In response, SGIP adopted a minimum annual RTE, later updated in D.15-11-027, to ensure energy storage projects receiving incentives reduce GHG emissions.

As can be seen in the "GHG Signal Benefit Comparisons by Scenario" table taken from the WG report (see figure below), compared to the "no GHG reduction model" for all scenarios– including systems operating under old rates, the GHG signal co-optimization model nearly always led to bill savings ("cost reductions") while reducing GHGs. This holds especially true for commercial projects, which even under old rates[28], were able to reduce GHGs and achieve customer bill savings for about 24% of model-runs under a stand-alone storage scenario and 40% of model-runs under a solar plus storage scenario. While these results seem less than ideal given SGIP's GHG reduction goals, the alternative "no GHG reduction" scenario yielded 0% for standalone storage projects and 24% for paired-solar commercial projects operating under old rates.

***Figure 7: GHG signal benefit comparisons by scenario, reprinted from WG report (page 31 of corrected version)***

| CUSTOMER CLASS | MODEL TYPE INPUT | RETAIL RATE | GHG REDUCTION SOLUTION | MODEL RUNS | % RUNS WITH GHG REDUCTION | MEAN GHG REDUCTION kg/kWH | % RUNS WITH COST REDUCTION | MEAN COST REDUCTION % |
|---|---|---|---|---|---|---|---|---|
| Commercial and Industrial | Storage Only | OLD | GHG Signal Co-Optimization | 985 | 23.86 | -7.73 | 99.99 | 12.53 |
| | | | No GHG Reduction Solution | 153 | 0 | -16.78 | 97.32 | 11.45 |
| | | NEW | GHG Signal Co-Optimization | 792 | 40.4 | -3.63 | 99.12 | 21.20 |
| | | | No GHG Reduction Solution | 112 | 17.86 | -10.64 | 88.68 | 13.20 |
| | Solar Plus Storage | OLD | GHG Signal Co-Optimization | 667 | 60.12 | 3.32 | 100.00 | 16.08 |
| | | | No GHG Reduction Solution | 148 | 24.32 | -3.45 | 100.00 | 13.29 |
| | | NEW | GHG Signal Co-Optimization | 418 | 85.41 | 9.89 | 100.00 | 21.30 |
| | | | No GHG Reduction Solution | 176 | 69.32 | 10.52 | 100.00 | 12.92 |
| Residential | Storage Only | OLD | GHG Signal Co-Optimization | 216 | 3.7 | -2.14 | 33.33 | -1.17 |
| | | | No GHG Reduction Solution | 36 | 0 | -2.96 | 33.33 | -1.17 |
| | | NEW | GHG Signal Co-Optimization | 108 | 100 | 21.33 | 100.00 | 16.73 |
| | | | No GHG Reduction Solution | 18 | 22.22 | -6.07 | 100.00 | 16.73 |
| | Solar Plus Storage | OLD | GHG Signal Co-Optimization | 216 | 58.8 | 4.57 | 0.00 | -11.27 |
| | | | No GHG Reduction Solution | 36 | 22.22 | -3.48 | 0.00 | -11.27 |
| | | NEW | GHG Signal Co-Optimization | 243 | 84.36 | 14.21 | 100.00 | 15.81 |
| | | | No GHG Reduction Solution | 72 | 72.22 | 5.08 | 100.00 | 14.68 |

With residential solar-paired storage systems, the outcome is slightly better, as around 59% of projects reduced GHGs when using the GHG signal under old rates.[29] As discussed in the new residential projects section, however, enforcing GHG reduction at this level is difficult given the number of projects in this category, as is requiring these small individual projects to receive and operate according to a GHG signal. Furthermore, the WG modeling results show that under the

[28] Legacy projects are most likely to be operating under old rates.
[29] Ninety-seven percent of all existing SGIP residential projects are paired with solar: SGIP Weekly Statewide Report, August 10, 2018.

old rates, the GHG signal co-optimization approach does not lead to customer bill savings in the majority of cases.

Given the discussion above, staff proposes the GHG signal be made available to all legacy systems as an opt-in pathway to reducing GHGs. This will allow developers the flexibility to determine when their system profiles (onsite load, rate tariff, etc.) are conducive to meeting the SGIP GHG reduction goal. Once this pathway is selected, however, the system will be entered into a developer's GHG emission reduction fleet, which will be subject to the relevant enforcement and verification processes to ensure compliance.

## Appendix A: Public Utilities Code Section 379.6

**PUBLIC UTILITIES CODE - PUC**
**DIVISION 1. REGULATION OF PUBLIC UTILITIES [201 - 3260]**
*( Division 1 enacted by Stats. 1951, Ch. 764. )*

**PART 1. PUBLIC UTILITIES ACT [201 - 2120]**
*( Part 1 enacted by Stats. 1951, Ch. 764. )*

**CHAPTER 2.3. Electrical Restructuring [330 - 400]**
*( Chapter 2.3 added by Stats. 1996, Ch. 854, Sec. 10. )*

**ARTICLE 6. Requirements for the Public Utilities Commission [360 - 380.5]**
*( Article 6 added by Stats. 1996, Ch. 854, Sec. 10. )*

**379.6.**

(a) (1) It is the intent of the Legislature that the self-generation incentive program increase deployment of distributed generation and energy storage systems to facilitate the integration of those resources into the electrical grid, improve efficiency and reliability of the distribution and transmission system, and reduce emissions of greenhouse gases, peak demand, and ratepayer costs. It is the further intent of the Legislature that the commission, in future proceedings, provide for an equitable distribution of the costs and benefits of the program.

(2) The commission, in consultation with the Energy Commission, may authorize the annual collection of not more than double the amount authorized for the self-generation incentive program in the 2008 calendar year, through December 31, 2019. The commission shall require the administration of the program for distributed energy resources originally established pursuant to Chapter 329 of the Statutes of 2000 until January 1, 2021. On January 1, 2021, the commission shall provide repayment of all unallocated funds collected pursuant to this section to reduce ratepayer costs.

(3) The commission shall administer solar technologies separately, pursuant to the California Solar Initiative adopted by the commission in Decisions 05-12-044 and 06-01-024, as modified by Article 1 (commencing with Section 2851) of Chapter 9 of Part 2 of Division 1 of this code and Chapter 8.8 (commencing with Section 25780) of Division 15 of the Public Resources Code.

(b) (1) Eligibility for incentives under the self-generation incentive program shall be limited to distributed energy resources that the commission, in consultation with the State Air Resources Board, determines will achieve reductions in emissions of greenhouse gases pursuant to the

California Global Warming Solutions Act of 2006 (Division 25.5 (commencing with Section 38500) of the Health and Safety Code).

(2) On or before July 1, 2015, the commission shall update the factor for avoided greenhouse gas emissions based on the most recent data available to the State Air Resources Board for greenhouse gas emissions from electricity sales in the self-generation incentive program administrators' service areas as well as current estimates of greenhouse gas emissions over the useful life of the distributed energy resource, including consideration of the effects of the California Renewables Portfolio Standard.

(c) Eligibility for the funding of any combustion-operated distributed generation projects using fossil fuel is subject to all of the following conditions:

(1) An oxides of nitrogen (NOx) emissions rate standard of 0.07 pounds per megawatthour and a minimum efficiency of 60 percent, or any other NOx emissions rate and minimum efficiency standard adopted by the State Air Resources Board. A minimum efficiency of 60 percent shall be measured as useful energy output divided by fuel input. The efficiency determination shall be based on 100 percent load.

(2) Combined heat and power units that meet the 60-percent efficiency standard may take a credit to meet the applicable NOx emissions standard of 0.07 pounds per megawatthour. Credit shall be at the rate of one megawatthour for each 3,400,000 British thermal units (Btus) of heat recovered.

(3) The customer receiving incentives shall adequately maintain and service the combined heat and power units so that during operation the system continues to meet or exceed the efficiency and emissions standards established pursuant to paragraphs (1) and (2).

(4) Notwithstanding paragraph (1), a project that does not meet the applicable NOx emissions standard is eligible if it meets both of the following requirements:

(A) The project operates solely on waste gas. The commission shall require a customer that applies for an incentive pursuant to this paragraph to provide an affidavit or other form of proof that specifies that the project shall be operated solely on waste gas. Incentives awarded pursuant to this paragraph shall be subject to refund and shall be refunded by the recipient to the extent the project does not operate on waste gas. As used in this paragraph, "waste gas" means natural gas that is generated as a byproduct of petroleum production operations and is not eligible for delivery to the utility pipeline system.

(B) The air quality management district or air pollution control district, in issuing a permit to operate the project, determines that operation of the project will produce an onsite net air emissions benefit compared to permitted onsite emissions if the project does not operate. The commission shall require the customer to secure the permit prior to receiving incentives.

(d) In determining the eligibility for the self-generation incentive program, minimum system efficiency shall be determined either by calculating electrical and process heat efficiency as set forth in Section 216.6, or by calculating overall electrical efficiency.

(e) Eligibility for incentives under the program shall be limited to distributed energy resource technologies that the commission determines meet all of the following requirements:

(1) The distributed energy resource technology shifts onsite energy use to off-peak time periods or reduces demand from the grid by offsetting some or all of the customer's onsite energy load, including, but not limited to, peak electric load.

(2) The distributed energy resource technology is commercially available.

(3) The distributed energy resource technology safely utilizes the existing transmission and distribution system.

(4) The distributed energy resource technology improves air quality by reducing criteria air pollutants.

(f) Recipients of the self-generation incentive program funds shall provide relevant data to the commission and the State Air Resources Board, upon request, and shall be subject to onsite inspection to verify equipment operation and performance, including capacity, thermal output, and usage to verify criteria air pollutant and greenhouse gas emissions performance.

(g) In administering the self-generation incentive program, the commission shall determine a capacity factor for each distributed generation system energy resource technology in the program.

(h) (1) In administering the self-generation incentive program, the commission may adjust the amount of rebates and evaluate other public policy interests, including, but not limited to, ratepayers, energy efficiency, peak load reduction, load management, and environmental interests.

(2) The commission shall consider the relative amount and the cost of greenhouse gas emissions reductions, peak demand reductions, system reliability benefits, and other measurable factors when allocating program funds between eligible technologies.

(i) The commission shall ensure that distributed generation resources are made available in the program for all ratepayers.

(j) In administering the self-generation incentive program, the commission shall provide an additional incentive of 20 percent from existing program funds for the installation of eligible distributed generation resources manufactured in California.

(k) The costs of the program adopted and implemented pursuant to this section shall not be recovered from customers participating in the California Alternate Rates for Energy (CARE) program.

(l) The commission shall evaluate the overall success and impact of the self-generation incentive program based on the following performance measures:

(1) The amount of reductions of emissions of greenhouse gases.

(2) The amount of reductions of emissions of criteria air pollutants measured in terms of avoided emissions and reductions of criteria air pollutants represented by emissions credits secured for project approval.

(3) The amount of energy reductions measured in energy value.

(4) The amount of reductions of customer peak demand.

(5) The ratio of the electricity generated by distributed energy resource generation projects receiving incentives from the program to the electricity capable of being produced by those projects, commonly known as a capacity factor.

(6) The value to the electrical transmission and distribution system measured in avoided costs of transmission and distribution upgrades and replacement.

(7) The ability to improve onsite electricity reliability as compared to onsite electricity reliability before the self-generation incentive program technology was placed in service.

*(Amended by Stats. 2016, Ch. 658, Sec. 1. (AB 1637) Effective January 1, 2017.)*