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March 12, 2012

CPUC Energy Division
Tariff Files, Room 4005
DMS Branch
505 Van Ness Avenue
San Francisco, California 94102

Re: California Energy Storage Alliance Supplemental Protest to Advice Letter 3253-G/3940-E of Pacific Gas & Electric Company; Advice Letter 24-A of California Center for Sustainable Energy; Advice Letter 2651-E-A of Southern California Edison Company; and Advice Letter 4292-A of Southern California Gas Company

Dear Sir or Madam:

Pursuant to the provisions of General Order 96-B, the California Energy Storage Alliance ("CESA") provides this supplemental protest to the above-referenced *Proposed Supplements to Proposed Revisions to the Self-Generation Incentive Program Handbook to Implement Decision D.11-09-015: Implementation of the Hybrid-Performance-Based Incentive Payment Structure; Metering and Monitoring Protocols, Other Amendments* submitted on February 17, 2012 ("Advice Letters").

I. BACKGROUND AND INTRODUCTION.

The Advice Letters submitted by the above-referenced entities on February 17, 2012, propose to revise sections of the SGIP Handbook to implement D.11-09-015 and to make other necessary updates and revisions. Pacific Gas & Electric Company, California Center for Sustainable Energy, Southern California Edison Company, and Southern California Gas Company are referred to collectively as the Program Administrators or "PAs." Proposed amendments to the SGIP Handbook include clarifications to certain sections highlighted as part of related advice letters submitted on October 10, 2011 ("October Advice Letters") and November 7, 2011 ("November Advice Letters"). The following supplemental protest by CESA is related to the redlined version of the SGIP Handbook that is attached to each of the Advice Letters.

CESA reluctantly submits this supplemental protest in order to meet the deadline established by Energy Division Staff. Over the course of the extended period of time to protest or respond to the Advice Letters that was granted by the Energy Division Staff,[1] CESA has worked diligently in a good faith in formal collaborative manner with the PAs and Energy Division staff to arrive at a mutually acceptable methodology for Advanced Energy Storage (AES) systems compliance with the SB 412-mandated SGIP greenhouse gas ("GHG") emission standard eligibility requirement. It is CESA's hope that it will be able to arrive at such a mutually acceptable methodology, thus allowing CESA to withdraw its protest and response, and this supplemental protest, before the Energy Division is required to formally reply to the additional information and explanation of CESA's methodology provided here.[2] CESA hereby withdraws its protest of metering and warranty requirements at this time, and will file a Petition for Modification of D.11-09-015 as soon as possible regarding sizing limitations. Like the Commission, PAs and stakeholders, CESA would like to see the outstanding SGIP issues resolved as soon as is possible so that SGIP may be re-opened.

II. THE ENERGY DIVISION IS REQUIRED TO PREPARE FOR THE COMMISSION'S CONSIDERATION AND PLACE ON A COMMISSION MEETING AGENDA A RESOLUTION CONTAINING THE ENERGY DIVISION'S ANALYSIS AND RECOMMENDATION REGARDING THE ADVICE LETTER.

G.O. 96-B provides that the disposition of an advice letter must be made by resolution adopted by the Commission, except for advice letters that are subject to disposition by Commission staff pursuant to General Rule 7.6.1, which provides that an advice letter is subject to disposition by the reviewing Commission staff whenever such a disposition would be a

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[1]Email transmittal to Service List on February 29, 2012: "Energy Division hereby grants a request by the California Energy Storage Alliance to give parties an additional 10 days for to file protests to Advice Letter 3253-G/3940-E of PG&E; Advice Letter 24-A of CCSE, Advice Letter 2651-E-A of SCE, and Advice Letter 4292-A of SCG. This joint supplemental Advice Letter, which proposed revisions to the Self Generation Incentive Program Handbook to implement D. 11-09-015, was filed on February 17th, 2012. To facilitate a rapid program re-launch, a shortened time period of 10 days was initially given to file responses. Energy Division has considered CESA's request and extends the deadline for filing protests to this joint Advice Letter to March 12th, 2012."

[2]**G.O. 96-B, Section 7.4.2** provides that an advice letter may be protested on the grounds, among others, that (a) the relief requested in the advice letter would violate statute or Commission order, or is not authorized by statute or Commission order on which the utility relies, and (b) the analysis, calculations, or data in the advice letter contain material errors or omissions.

"ministerial act".[3] Whenever such a determination requires more than ministerial action, the disposition of the advice letter on the merits must be by Commission resolution, as provided in General Rule 7.6.2, which provides that, except for ministerial acts, as provided in General Rule 7.6.1, the Commission staff must prepare and place on the Commission's meeting agenda a resolution approving, rejecting, or modifying any advice letter filed with the Energy Division. The resolution must contain the Energy Division's recommended disposition and analysis supporting any such disposition.

III. ADVANCED ENERGY STORAGE, BOTH STANDALONE AND PAIRED WITH ELIGIBLE SGIP TECHNOLOGIES AND PV TECHNOLOGY, SHOULD BE SUBJECT TO APPROPRIATE GHG REQUIREMENTS AND THE SGIP HANDBOOK SHOULD BE CLARIFIED ACCORDINGLY.

Consistent with its protest and response filed on November 28, 2011, CESA continues to maintain that Section 1.1, Section 9.5, and Attachment A of the SGIP Handbook related to GHG requirements should expressly state that AES is an emerging technology that will reduce GHG emissions and should therefore (at least temporarily) be deemed in advance to meet GHG reduction requirements. GHG requirements for AES are not addressed in D.11-09-015 and thus, other than general statements, D.11-09-015 does not provide adequate guidance as to how AES should be treated or the basis for analyzing its merits. The latest (and only official) statement filed by the Energy Division Staff addressing GHG reduction requirements for AES was the Staff Proposal published on September 30, 2010 ("Staff Proposal"), which stated:

> "Energy storage technologies do not perform like other generating technologies and therefore the analysis of GHG impacts for energy storage had to be calculated slightly differently. Staff assumed that energy storage technologies, regardless of whether they are coupled with a renewable DG technology, would charge primarily from the grid and primarily during off-peak hours. Staff also assumed that these storage technologies would be discharging exclusively during on-peak hours to help reduce a customer's peak energy and demand charges. Since the emissions profile of the grid differs significantly during on-peak versus off-peak hours with less efficient, higher emitting resources operating during peak hours and more efficient, lower emissions resources operating at night—this analysis used different emissions factors for charging and discharging of energy storage technologies." (p. 59).

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[3]In D.07-01-041, issued January 25, 2007, in which the Commission adopted G.O. 96-B, correction of a calculation that proves to be mistaken was given as an example of what would be considered ministerial. (p. 8, fn. 4).

The number one eligibility requirement of D.11-09-015 for SGIP eligibility is that: "A product or technology must produce fewer GHG emissions than it avoids from the grid." (p. 10). Furthermore, GHG reduction is the "primary screen for establishing technology eligibility for the SGIP." (p. 12). With GHG reduction being the most critical requirement of the SGIP, eligibility must be determined by looking at the big picture and understanding the total impact of the technology and its effect on GHG emissions. CESA maintains that, as an emerging technology, and consistent with D.11-09-015, to facilitate a timely re-opening of the SGIP, AES should be – at least temporarily – deemed in compliance with GHG requirements. The Commission at a later time, once sufficient experience with the program has been developed over the coming months can take up the methodology and basis for GHG compliance for AES.

However, *if minimum round trip energy efficiency is to be used* for GHG compliance of AES, the methodology and baseline emissions factors that are being proposed for all distributed generation ("DG") technologies in the most current proposed revisions to the SGIP Handbook are inappropriate for AES. Directly comparing an AES system to DG is inappropriate in that it fails to recognize how AES will be used on the customer side of the meter and fails to consider the significant benefits of AES in significantly reducing GHG emissions in California. This was in fact quite surprising, as the Staff Proposal published on September 30, 2010 ("Staff Proposal"), clearly stated "Energy storage technologies do not perform like other generating technologies and therefore the analysis of GHG impacts for energy storage had to be calculated slightly differently."

If AES will be held immediately to certain GHG-reducing requirements, CESA proposes implementing a more precise and appropriate methodology for AES GHG compliance pursuant to SB 412 that *does* take into account how energy storage will be utilized in behind the meter applications and its resulting GHG benefits. CESA has proposed a compliance methodology for the SGIP program to ensure that AES reduces GHG emissions; an explanation of this methodology is attached as Appendices A and B to this protest and response. CESA believes that this methodology is comprehensive and conservative. However, the SGIP PAs have offered an alternative GHG methodology[4] that would inadvertently and inappropriately make ineligible for SGIP several types of AES systems – AES systems that if deployed would in fact significantly reduce GHG emissions.

[4] "Supplemental Filing: Proposed Revisions to the Self-Generation Incentive Program Handbook to Implement Decision (D.) 11-09-015: Implementation of the Hybrid-Performance-Based Incentive Payment Structure; Metering and Monitoring Protocols; Other Amendments", Supplement to PG&E's Advice Letter 3253-G/3940-E, et seq., submitted by PG&E on behalf of the SGIP Program Administrators, February 17, 2012

AES can provide significant GHG benefits by utilizing California's cleaner nighttime baseload electric mix (including a percentage of renewable energy that is increasing over time) to "charge" the AES system, storing that cleaner mix, and then "discharging" that energy to offset dirtier peak generation. Thus, the minimum round trip efficiency required for AES to achieve GHG reductions should be based on the inputs (notably nighttime versus peak hours) to the average CO_2/MWh cited in the Decision.

There are two noteworthy assumptions in CESA's methodology. First, when an energy storage system *charges* during off-peak times, it does so over many hours and from any/all of the various grid resources, including renewable energy pursuant to the 33% RPS. Thus, the appropriate emissions profile of the energy used to charge the storage systems is the GHG emissions of the overall off-peak electric mix. Second, when an energy storage system *discharges* during peak times, it will displace the emissions that would otherwise be produced by a natural gas combustion turbine peaker. (Thus, the emissions reductions generated by energy storage is the net of the above first item minus the second item.)

It is worth underscoring why it is appropriate to factor in the entire electric mix during off-peak, nighttime periods, but not factor in the entire mix during the peak times. This is because AES will for the most part be charged using the entire nighttime mix at the margin, not just a single resource (such as a CCGT). Typically AES systems are slow-charged over many hours (to preserves overall life and enhance performance). By contrast, during the day, the stored energy will be discharged only during peak times (to avoid peak demand charges typically) and, by contrast to nighttime charging, only for a couple of hours and only to offset a portion of the customer's highest load. In other words, energy storage will be discharged on peak to clip the customer's marginal kWh consumed during peak times. Thus, it is correct to assume (as the SGIP Program Administrators and CESA do) that energy storage – cycled on the customer side of the meter only for a few hours and only for a portion of that customer's peak demand – is in fact primarily displacing marginal peaker generation, not baseload or overall generation.

At night, off-peak, the change at the margin due to the addition of advanced energy storage into the mix is a "basket" of existing grid resources and thus the most appropriate way to calculate the marginal emissions changes is to use the average GHG performance of the grid as a close proxy for that "basket".[5]

Additionally, CESA notes that the PAs proposed methodology does not recognize that transmission and distribution line losses increase very significantly with peak demand as more current passes through power lines (the I^2R losses), particularly during hot seasons and warmer daytime temperatures (which is typically the case during peak times). Increased line load elevates the transmission line temperature further. This invariably results in greater line losses per MWh during peak times than during off-peak times. A 2010 Sandia National Laboratory report[6] describes these losses as follows:

> "As with any process involving conversion or transfer of energy, energy losses occur during electric energy transmission and distribution. These T&D energy losses (sometimes referred to as I2R or 'I squared R' energy losses) tend to be lower at night and when loading is light and higher during the day and when loading is heavy. T&D energy losses increase as the amount of current flow in T&D equipment increases and as the ambient temperature increases. Thus, losses are greatest on days when T&D equipment is heavily loaded and the temperature is high."

Thus, deploying AES that shifts consumption (and the associated transmission and distribution) from peak to off-peak times will reduce line losses per MWh and reduce GHG emission commensurately. CESA acknowledges that the precise amount of savings from this shift cannot be determined in advance and we conservatively recommend assuming 5% based upon the available data. The Regulatory Assistance Project states that resistive losses can be "four times as great during the summer afternoon peak as they average over the year"[7] and cites FERC data referring to average annual losses ranging from 6 – 11%.[7] The Center for the Study

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[5] Note, the emission figures used in CESA's proposal are taken directly from the Staff proposal, which outlined the CCGT and CT emission numbers. In CESA's calculation, the off-peak emission figure was weighted to account for the entire electric mix including the non-emitting sources of nuclear and hydro which were inappropriately not accounted for in the Staff's numbers.

[6] Sandia National Laboratory, Energy Storage for the Electricity Grid: Benefits and Market Potential Assessment Guide, Report SAND2010-0815, February 2010, p. 138.

[7] Regulatory Assistance Project (Jim Lazar and Xavier Baldwin), "Valuing the Contribution of Energy Efficiency to Avoided Marginal Line Losses and Reserve Requirements." August 2011.

of Energy Markets estimates average line losses at 6.8%, with minimum losses at 4.3% and maximum losses at 12%.[8]

Recognizing that energy storage is an important but emerging technology there is limited performance data to date and regardless of the methodology chosen by the Commission and the PAs at this juncture, CESA recommends analyzing the salient data from energy storage systems operating in the field under the SGIP in the next year or two to see if changes to the methodology are warranted.

IV. IT IS PARTICULARLY INAPPROPRIATE FOR ADVANCED ENERGY STORAGE COUPLED WITH ELIGIBLE RENEWABLE GENERATION TO NOT BE EXPLICITLY EXEMPT FROM GHG REQUIREMENTS.

The SGIP Handbook inappropriately treats AES charged from renewable generation the same way as it does standalone AES (charged from the grid) with respect to GHG reduction requirements. CESA recommends that AES charged predominately from renewables will reduce GHG emissions as the original source of its energy is GHG-free. Specifically, CESA recommends using the same 75% standard that is used by the federal rules for renewable energy Investment Tax Credits (ITC), and the same basic methodology for determining the 75% performance that is proscribed in the federal tax code. U.S. Treasury Reg. §1.48-9 (d) (6) states that:

> "Such equipment is solar energy property (i) only if its use of energy from sources other than solar energy does not exceed 25 percent of its total energy input in an annual measuring period and (ii) only to the extent of its basis of cost allocable to its use of solar or wind energy during an annual measuring period. An 'annual measuring period' for an item of dual use equipment is the 365 day period beginning with the day it is placed in service or a 365 day period beginning the day after the last day of the immediately preceding annual measuring period."[9]

This standard for AES coupled with renewable energy is not only substantively meritorious but has the additional benefit that because the SGIP program is already linked to the federal renewable energy ITC (as the ITC is deducted from the portion paid by SGIP) and thus provides a harmonized test that applies to both the SGIP as well as the federal ITC. By adopting the same method and criteria, developers using AES with renewable generation would have a

[8] Center for the Study of Energy Markets, University of California Energy Institute (Severin Borenstein) "The Market Value and Cost of Solar Photovoltaic Electricity Production." January 2008.

[9] See, Reg §1.48-9. Definition of energy property. At http://www.gpo.gov/fdsys/pkg/CFR-2011-title26-vol1/pdf/CFR-2011-title26-vol1-sec1-48-9.pdf.

single set of criteria to meet for both federal Investment Tax Credit and SGIP incentive calculation.

V. **CONCLUSION.**

The SGIP Handbook should be modified and clarified in accordance with the protest and responses set forth above. CESA re-iterates its hope that it will be able to withdraw its protest and response, and this supplemental protest, before the Energy Division is required to formally reply to the additional information and explanation of CESA's methodology provided here, and that the SGIP program will be able to re-open at the earliest opportunity.

Very truly yours,

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APPENDIX A

Appendix A

Detailed Description of CESA Methodology for GHG Reductions of AES in SGIP

12-9-11 *(amended)*

As noted by the Commission, Advanced Energy Storage (AES) can reduce greenhouse gas (GHG) emissions, which is a primary requirement for SGIP eligibility. This document recommends a simple, effective method for implementing the GHG requirement for stand-alone AES. The method considers real generation data for each IOU and provides the PAs a simple way of implementing the GHG requirement through a minimum AES round-trip efficiency (RTE). In addition, any AES that charges more than 75% of the time from a renewable energy resource (thus eligible for federal Income Tax Credit) should automatically be compliant with SGIP GHG reduction requirements. Any such system should be monitored in order to confirm the 75% renewables charging standard.

The recommended methodology for stand-alone AES is based on AES systems charging during off peak hours and discharging during peak hours to achieve peak load reduction. GHG emission reductions are realized when the AES system's energy displaces the energy that would otherwise be generated during peak times with higher emitting conventional peaker plants and higher transmission and distribution (T&D) related losses. Comparing the emissions of the generation mix used to charge the AES during off peak times versus the emissions of a peaker combustion turbine (CT), will provide a measurement for the PAs to ensure that AES will reduce GHG emissions. Furthermore, for accurate emission reductions, the higher T&D line losses during peak times must also be considered in the calculation. Once the minimum RTE (necessary to meet the required GHG emission level) is calculated, the PAs can then require the RTE of all proposed AES systems' RTE to be above that number in order to qualify for the SGIP. The minimum RTE can also be monitored on a simple charge/discharge basis going forward.

The following simple steps (similar to those suggested by the Staff Proposal in September 2010[10]) can be used to calculate the minimum RTE requirement per utility:

1) Calculate the emissions/MWh corresponding to off-peak time:
   .368 Tonne CO2/MWh (emissions of a CCGT) x (100%– Emission Free Generation % per Utility)
2) Account for the T&D loss savings by shifting peak to off-peak load:
   Result from Step #1 x 95% or (Off-Peak/Peak T&D losses per MWh generation)
3) Calculate the ratio of emissions corresponding to charging AES to emissions avoided from peaking generators:
   (Result from Step #2)/ (.575 Tonne Co2 / MWh (emissions from a CT) = Minimum RTE

Calculated per utility, the minimum RTE requirement for stand-alone AES is: 36.8% for PG&E projects, 45% for SCE projects and 51% for SDG&E projects. These calculations should be updated annually as the generation mixes will continue to change. The utilities should be responsible for supplying the PAs with updated generation data annually. In addition, the

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[10] SGIP Staff Proposal Workbook. http://www.cpuc.ca.gov/PUC/energy/DistGen/sgip/proposal_workshops.htm

minimum RTE numbers should be reduced for AES projects that replace backup diesel generators, which have higher GHG emissions than a peaker combustion turbine. For these projects, the minimum RTE for stand-alone AES is: 25% for PG&E projects, 30% for SCE projects and 34% for SDG&E projects. The following pages provide additional detail regarding the recommended methodology.

Rationale for T&D Line Losses

It has been scientifically proven that as more current passes through power lines, particularly during hot seasons and warmer daytime temperatures (which is typically the case during peak times), line losses will increase disproportionately[directly proportional with the transmission load squared (I2) and with the line electrical resistance (R), which in turn increases with temperature]. Increased line load elevates the transmission line temperature further. This invariably results in greater line losses per MWh during peak times than during off-peak times. A Sandia report published in 2010[11] describes these losses as follows:

"As with any process involving conversion or transfer of energy, energy losses occur during electric energy transmission and distribution. These T&D energy losses (sometimes referred to as I2R or 'I squared R' energy losses) tend to be lower at night and when loading is light and higher during the day and when loading is heavy. T&D energy losses increase as the amount of current flow in T&D equipment increases and as the ambient temperature increases. Thus, losses are greatest on days when T&D equipment is heavily loaded and the temperature is high."

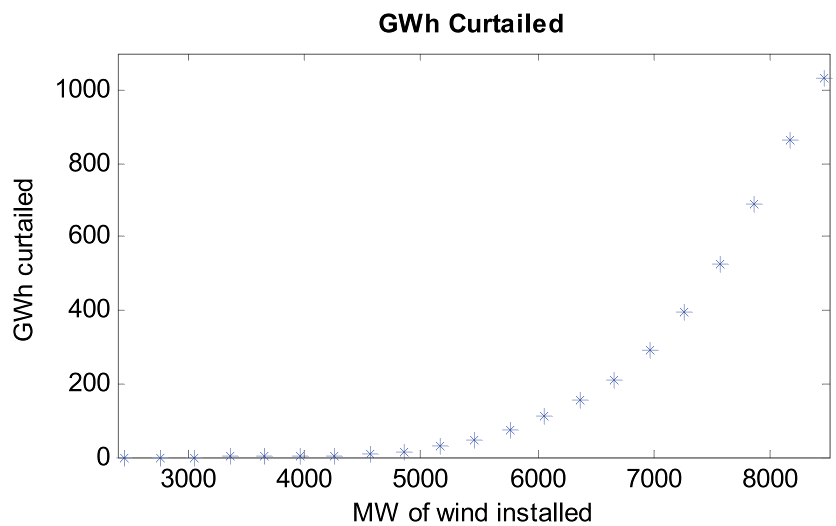
Emissions Peak vs. Off-Peak Times

The Staff Proposal from 9-30-2010 recommended on-peak emissions be equal to "a combustion turbine ("CT") with a heat rate of 10,807 Btu/kWh, which translates into an emissions factor of approximately .575 Tonne CO2E/MWh" and off-peak emissions be equal to a CCGT "with a heat rate of 6,917 Btu/kWh, which translates into an emissions factor of approximately .368 Tonne CO2/MWh." Although, we recommend using these numbers for the CT and CCGT, there are other factors to consider. As peak load is reduced, the less efficient CT's generation will be curbed making this an accurate number to use for peak time emission comparison. However, energy storage systems deployed under the SGIP will not be solely charged by a CCGT – they will be charged from either on-site renewable energy systems or grid energy during off peak times. Grid energy tends to be much cleaner than pure CCGT output, as it represents a mix of gas generation, renewables and base-load hydro and nuclear generation.

Secondly, the emissions profile of off-peak generation will, over time, increasingly factor in more renewable generation, and potentially, the over-generation of wind power. Renewable over-generation (occurring during off-peak times) is forecasted to be quite significant by 2020. The following chart was presented by E3 at the November 10, 2010 PLS Workshop. The underlying analysis assumes wind penetration of 8800 MW and a resulting 1700 hours of over-

[11] Eyer, Jim and Garth Corey. Energy Storage for the Electricity Grid: Benefits and Market Potential Assessment Guide. Sandia Report SAND2010-0815. February 2010. Page 138

generation, occurring for the most part in the spring and off-peak hours. If energy storage systems are absorbing the wind over generation during these times, then there will be no need to curtail the valuable wind generation in the system.



The above over-generation analysis also implies that California's off-peak energy mix will become cleaner over time, as more and more renewable generation is phased in. This also implies that off-peak charging of energy storage systems will become cleaner over time making the SGIP GHG-neutral minimum round trip efficiency requirement a moving target that is decreasing over time. Thus, any minimum RTE requirement established today must be revisited on a regular basis, annually at a minimum.

As described above, California's off-peak generation mix will increasingly become cleaner as renewable, especially wind penetration increases. Therefore, using only CCGT emissions assumptions will not be accurate for the actual emissions profile of the resource that will be used to "charge" the energy storage systems during off-peak times.

Recommended Minimum RTE Calculation Approach

CESA recommends the following approach to calculate the minimum round trip efficiency required for GHG neutrality. Specifically, CESA's approaches use the following assumptions:

1. Keep assumptions for CT (0.575 Tonne CO2E/MWh) and CCGT (0.368 Tonne CO2/MWh) the same key assumptions as used by the Staff Proposal on 9-30-2010.
2. Use separate assumptions for on-peak line losses and off-peak line losses based on the information presented above, assuming a 5% differential.
3. Calculate the off-peak charging emissions profile based on the entire generation mix, not solely the marginal CCGT emissions as GHG-free assets within the generation mix include nuclear, large hydro, and renewables (the CCGT and CT emissions has already been adjusted for renewables in the CO2/MWh emissions estimate from the Staff Proposal and is excluded from CESA's GHG neutral generation mix to avoid double counting of GHG benefits).

4. Calculate the on-peak discharging emissions reduction using the same methodology as the Staff Proposal from 9-30-2010 — storage is a CT substitute.
5. When the project replaces a diesel generator, additional emissions savings should be factored in by weighting the result by 67%. (see diesel generator replacement calculations below regarding the 67% factor)

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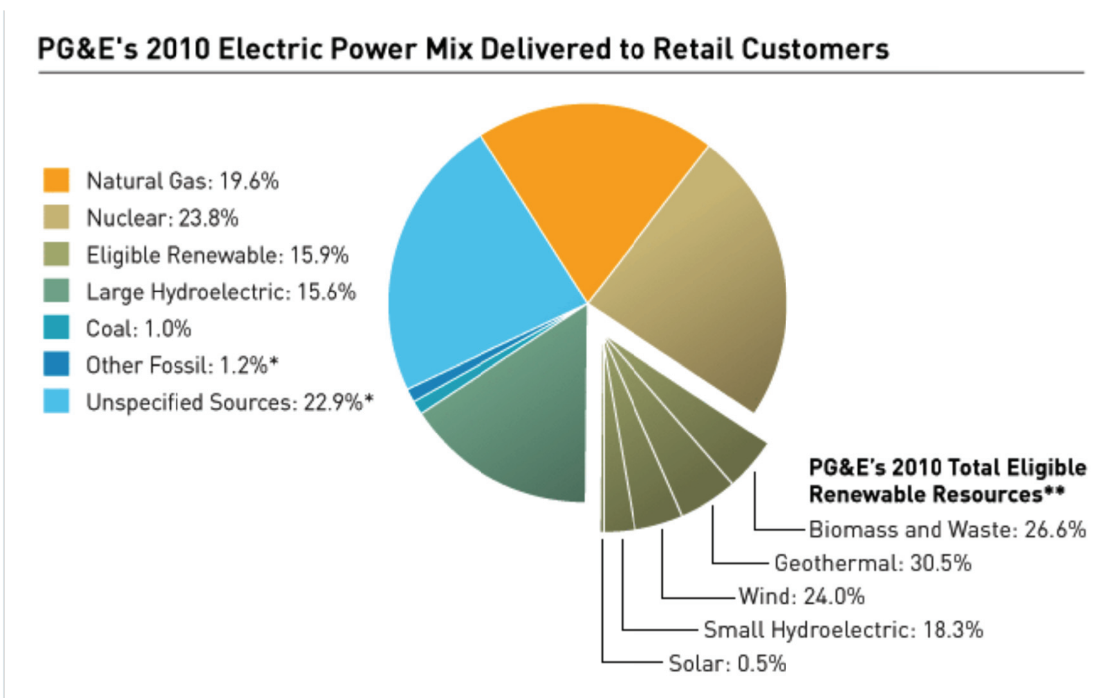
- [12]



[12] PG&E. 2010 Corporate Responsibility and Sustainability Report. http://www.pgecorp.com/corp_responsibility/reports/2010/index.html/

The percentage of carbon neutral generation (nuclear and large hydro) in PG&E territory is 39.4%, as a percentage of total generation. Assuming the rest of the mix is marginal CCGT generation, the CCGT emissions should be weighted by 60.6%, and further adjusted for net reduction in T&D line losses due to the distributed nature of the SGIP projects. Using these assumptions, one can then solve for the minimum round-trip efficiency similar to the process used in the Staff Proposal's GHG Analysis Workbook from 2010.[13]e[14] to the process used in the Staff 2010 Proposal's GHG Analysis Workbook1:

1. GHG Neutral Generation Mix for this equation is 15.6% for large hydro + 23.8% for nuclear = 39.4%. The weighted generation percentage for the equation would be 100% - 39.4% = 60.6%
2. The marginal CCGT emissions is weighted by 60.6% to account for the GHG neutral generation mix: 0.368 Tonne CO2/MWh * 60.6% = 0.223 Tonne CO2/MWh
3. Step #2 result is adjusted for net T&D line loss reductions: 0.223 Tonne CO2/MWh * (100%-5%) = 0.212 Tonne CO2/MWh
4. The minimum round trip efficiency required to equal CT on-peak emissions given the result in Step #3 is solved for: 0.212 Tonne CO2/MWh / 0.575 Tonne CO2/MWh = 36.8% RTE

SCE Calculation – 45% Minimum RTE Requirement

The calculation steps for getting to a 45% minimum round trip efficiency requirements for GHG neutrality are similar[5] to the process used in the Staff 2010 Proposal's GHG Analysis Workbook:

1. GHG Neutral Generation Mix for this equation is 5% for large hydro + 21% for nuclear15= 26%. The weighted generation percentage for the equation would be 100% - 26% = 74%
2. The marginal CCGT emissions is weighted by 74% to account for the GHG neutral generation mix: 0.368 Tonne CO2/MWh * 74% = 0.272 Tonne CO2/MWh
3. Step #2 result is adjusted for net T&D line loss reductions: 0.272 Tonne CO2/MWh * (100%-5%) = 0.259 Tonne CO2/MWh
4. The minimum round trip efficiency required to equal CT on-peak emissions given the result in Step #3 is solved for: 0.259 Tonne CO2/MWh / 0.575 Tonne CO2/MWh = 45% RTE

SDG&E Calculation – 51.1% Minimum RTE Requirement

[13] CPUC Staff Proposal Filed 9-30-10. Attachment 1. http://docs.cpuc.ca.gov/efile/RULINGS/124214.pdf

[14] These calculations use the same guiding principles as the staff workbook referenced in Footnote 1. Charging Emissions / Discharging Emissions = Minimum RTE. The formula also uses the same emission numbers for CCGTs and CTs. The calculation differs by factoring in the line loss difference of peak vs. off peak and by factoring in the Emission Free Generation per Utility.

[15] "Southern California Edison Proposed State's First Major 'Early Action' Greenhouse Gas Reduction Plan." May 16th, 2008. http://www.edison.com/pressroom/pr.asp?id=7036

The calculation steps for getting to a 51.1% minimum round trip efficiency requirements for GHG neutrality are similar[5] to the process used in the Staff 2010 Proposal's GHG Analysis Workbook1:

1. GHG Neutral Generation Mix for this equation is 0% for large hydro + 16% for nuclear = 16%.[16] The weighted generation percentage for the equation would be 100% - 16% = 84%
2. The marginal CCGT emissions is weighted by 84% to account for the GHG neutral generation mix: 0.368 Tonne CO2/MWh * 84% = 0.309 Tonne CO2/MWh
3. Step #2 result is adjusted for net T&D line loss reductions: 0.309 Tonne CO2/MWh * (100%-5%) = 0.2937 Tonne CO2/MWh
4. The minimum round trip efficiency required to equal CT on-peak emissions given the result in Step #3 is solved for: 0.2937 Tonne CO2/MWh / 0.575 Tonne CO2/MWh = 51.07% RTE

Diesel Generator Replacements

In addition to these stand-alone minimum RTE calculations, it should be noted that some projects may include the replacement of diesel backup generators, which have even higher emissions than the CTs. These projects should be encouraged and qualified correctly. Using data from CARB[17], diesel generators emit 1.7 lbCO2/kWh while conventional CTs emit 1.145 lbCO2/kWh. Therefore, the AES replacing a diesel generator could be weighted by a 67% reduction (1.145/1.7). Taking the PG&E territory as an example; if the minimum system RTE needed to be 36.8% for a stand-alone base case, then also replacing a diesel generator would further reduce the minimum RTE to 24.7% (in order to achieve GHG reductions -36.8% x 67%). In the SDG&E territory, the AES system would need to have a minimum RTE of 34% (51.1% x 67%) and in the SCE territory, the AES system would need to have a minimum RTE of 30% (45% x 67%)

Summary

In summary, CESA strongly recommends that round trip efficiency should be based on the minimum efficiency required to be "on par," from a GHG perspective, with a centralized natural gas-fueled CT power plant. This assumes that the energy storage system is "charged" with a reasonable mix of base load power, which over time will contain more and more renewables, particularly when factoring in renewable energy over-generation. Certainly, energy storage charged primarily with renewables should be completely exempt from having to meet any minimum round trip efficiency requirement at all.

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[16] SDG&E 2010 Power Content Label. http://www.sdge.com/billinserts/regulatory.shtml

[17] "Air Pollution Emission Impacts Associated with Economic Market Potential of Distributed Generation in California" Prepared for CARB June 2000. Page 8, http://www.arb.ca.gov/research/apr/past/97-326.pdf

To guarantee accurate and effective implementation of this methodology, CESA recommends the program administrators use the next 1-2 years to gather and analyze the necessary data from energy storage systems operating in the field under the SGIP. As an emerging technology, this sector lacks proper baseline real data, which should be gathered prior to implementing **any** GHG reduction methodology. Sample data collection includes: actual times of day of discharge, actual times of day of charge, runtimes, overall effect on the grid and local systems, system average round trip efficiency in the field, etc. After this data is collected and analyzed, the PAs can compare the field data to this methodology, making any changes to make it most accurate, and then implement the minimum RTE requirement per utility sector based on the modified methodology.

APPENDIX B

Appendix B

GHG Reduction for SGIP Compliance

CESA Methodology for Advanced Energy Storage

CESA strongly supports the intention of SB 412, and subsequent Commission decisions and staff proposals, to ensure that SGIP-eligible resources "will achieve reductions of greenhouse gas emissions."[18] CESA has proposed a compliance methodology for the SGIP program to ensure that Advanced Energy Storage (AES) reduces GHG emissions.[19] We believe that this methodology is comprehensive and conservative. However, the SGIP Program Administrators propose adopting an alternative GHG methodology[20] that would inadvertently and inappropriately make ineligible for SGIP several types of AES systems – systems that if deployed would in fact significantly reduce GHG emissions.

CESA would like to underscore the rationale for our proposed GHG compliance methodology. There are two key assumptions in CESA's methodology:

1. When an energy storage system *charges* during off-peak times, it does so over many hours and from any/all of the various grid resources, including renewable energy pursuant to the 33% RPS. Thus, the appropriate emissions profile of the energy used to charge the storage systems is the GHG emissions of the overall off-peak electric mix.

2. When an energy storage system *discharges* during peak times, it will displace the emissions that would otherwise be produced by a natural gas combustion turbine peaker.

In other words, the emissions reductions generated by energy storage is the net of above Item 1 minus Item 2.

At first this may appear to be inconsistent, that is *Why is it appropriate to factor in the entire electric mix during <u>off-peak, nighttime periods</u>, but not factor in the entire mix during the <u>peak times</u>?* The explanation is that AES will for the most part[21] be charged *using the entire nighttime mix at the margin, not just a single resource* (such as a CCGT). Typically AES systems are *slow-charged over many hours* – this preserves their overall life. By contrast, during the day, the stored energy will be discharged *only during peak times* – to avoid peak demand charges typically

[18] SB 412, signed by the Governor October 11, 2009, Section 1, page 3. AB 2514 makes a similar finding, "Expanded use of energy storage systems…can avoid or reduce the use of electricity generated by high carbon-emitting electrical generating facilities during those high electricity demand periods." (Section 1, page 3)

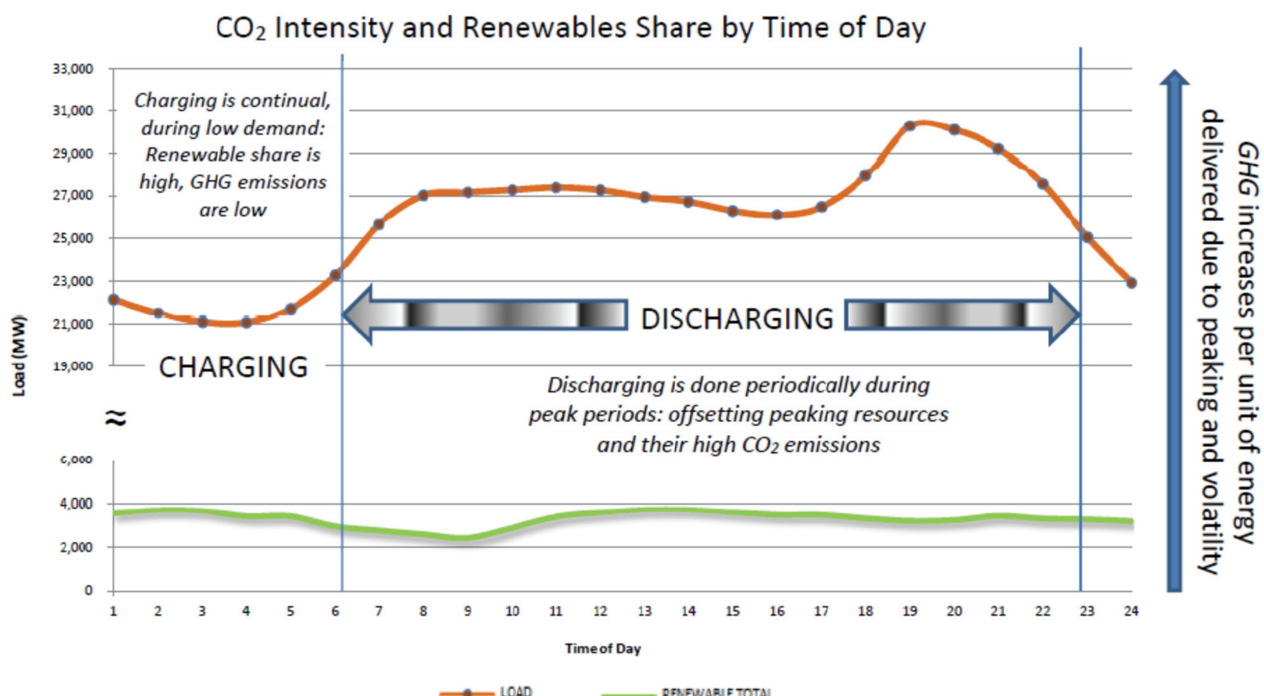
[19] This document follows up on CESA's "GHG Reduction Compliance Recommendations" December 9, 2011, which (amended) is attached as Appendix A.

[20] "Supplemental Filing: Proposed Revisions to the Self-Generation Incentive Program Handbook to Implement Decision (D.) 11-09-015: Implementation of the Hybrid-Performance-Based Incentive Payment Structure; Metering and Monitoring Protocols; Other Amendments", Supplement to PG&E's Advice Letter 3253-G/3940-E, et seq., submitted by PG&E on behalf of the SGIP Program Administrators, February 17, 2012

[21] Some AES systems paired with renewable energy maybe charged during the day, for example a.m. PV generation.

– and, by contrast to nighttime charging, only for a couple of hours and only to offset a portion of the customer's load. In other words, energy storage will be discharged on peak to "clip" the customer's marginal kWh consumed during peak times – storage will *not* be used to take that customer's baseline demand to zero during peak or otherwise spread out over the entire day. Thus, it is correct and appropriate to assume (as the PAs and CESA do) that energy storage – cycled on the customer side of the meter only for a few hours and only for a portion of that customer's peak demand – is in fact primarily displacing marginal peaker generation, not baseload or overall generation.

At night, off-peak, the change at the margin due to the addition of advanced energy storage into the mix is a "basket" of existing grid resources and thus the most appropriate way to calculate the marginal emissions changes is to use the average GHG performance of the grid as a close proxy for that "basket".



Example:
3,800MW renewable/22,000MW overall = *17.27% GHG-free during charging*
3,800MW renewable/30,000MW peak = *12.66% GHG free at peak during discharging*

Data Source: CAISO daily load for Feb 29, 2012 http://content.caiso.com/green/renewrpt/DailyRenewablesWatch.pdf

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Additionally, CESA notes that:

- Energy storage charged predominately with renewables[22] should be deemed to be compliant with any SGIP GHG methodology, and not be subject to having to meet any other GHG compliance methodology (e.g. minimum round trip efficiency).

- The emission figures used in CESA's proposal are taken directly from the Staff proposal, which outlined the CCGT and CT emission numbers. In CESA's calculation, the off-peak emission figure was weighted to account for the entire electric mix including the non-emitting sources of nuclear and hydro which were inappropriately not accounted for in the Staff's numbers.

- T&D line losses increase very significantly with peak demand (I^2R losses) and with temperature. Thus, deploying AES that shifts consumption (and the transmission & distribution) from peak to off-peak times will *reduce line losses per MWh*.[23]

- Additionally, recognizing that energy storage is an important but emerging technology, there is limited performance data to date and regardless of the methodology chosen by the Commission and the PAs, CESA recommends analyzing the salient data from energy storage systems operating in the field under the SGIP in the next year or two to see if changes to the methodology are warranted.

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[22] CESA recommends using the same 75% standard as the federal renewable energy Income Tax Credits; such systems should still be monitored to confirm field performance with the 75% standard.

[23] Sandia National Laboratory: "As with any process involving conversion or transfer of energy, energy losses occur during electric energy transmission and distribution. These T&D energy losses…tend to be lower at night and when loading is light and higher during the day and when loading is heavy. T&D energy losses increase as the amount of current flow in T&D equipment increases and as the ambient temperature increases. **Thus, losses are greatest on days when T&D equipment is heavily loaded and the temperature is high**." [Emphasis added]. Sandia National Laboratory, Energy Storage for the Electricity Grid: Benefits and Market Potential Assessment Guide, Report SAND2010-0815, February 2010, p. 138.