CR6/sf3 12/29/2017

FILED
12/29/17
09:47 AM

BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking Regarding Policies, Procedures and Rules for the California Solar Initiative, the Self-Generation Incentive Program and Other Distributed Generation Issues.	Rulemaking 12-11-005

ASSIGNED COMMISSIONER'S RULING (1) ESTABLISHING AN ENERGY STORAGE GREENHOUSE GAS SIGNAL WORKING GROUP (2) ENTERING A SUMMARY OF THE NOVEMBER 15, 2017 ENERGY STORAGE WORKSHOP INTO THE RECORD

This ruling establishes a working group to develop recommended changes to the Self-Generation Incentive Program (SGIP) to improve greenhouse gas (GHG) emission reductions from energy storage systems. In addition, this ruling enters a summary of the Energy Division staff workshop held on November 15, 2017 into the record. This ruling does not affect any existing SGIP rules and does not address any petitions for modification filed in this proceeding.

Background

In Decision (D.)16-06-055, the Commission adopted changes to SGIP, in large part pursuant to Senate Bill 861 (Committee on Budget and Fiscal Review, 2014). Together with D.15-11-027, this decision imposed operational requirements on energy storage systems to ensure that systems provide GHG emission reductions as well as customer benefits. D.15-11-027 had updated a round-trip efficiency (RTE) metric to determine if SGIP energy storage systems operations resulted in reduced GHG emissions.

On October 11, 2017, the Energy Division issued the 2016 SGIP Energy Storage Impact Evaluation Report prepared by Itron (2016 SGIP Report), which included a detailed evaluation of GHG emissions impacts.[1] The most recent decision addressing SGIP (D.17-10-004) required Energy Division to host a public workshop on the performance of SGIP-funded energy storage systems.

Working Group Purpose, Guidance and Schedule

The Energy Division held its workshop on November 15, 2017. The purpose of the workshop was to review the results of the 2016 SGIP Report and understand the drivers of the results. Reducing GHG emissions is one of the statutory goals for SGIP.[2] As demonstrated in the 2016 SGIP Report and at the workshop, the GHG emission results vary for different sized systems, but in general the average SGIP energy storage project resulted in net GHG emissions in 2016. In general, the 2016 data shows that many systems, especially smaller systems, are not meeting the GHG emission goals set out for SGIP. This requires reconsideration of the operational requirements of the program.

At the workshop, participants discussed varying reasons for the GHG emission increases and put forth different solutions; no participant disputed the results presented in the 2016 SGIP Report. There also was widespread agreement by workshop participants that the RTE metric employed by D.15-11-027 may be an imperfect metric for achieving GHG reductions even

[1] Available at: http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=6442454964.

[2] The statutory goals for SGIP are: increased deployment of energy storage systems, reduced GHG emissions, peak demand reduction, improved electric system reliability and efficiency, and reduced ratepayer costs (Public Utilities Code Section 379.6(a)(1)). Eligibility for SGIP incentives is limited to resources that will achieve reductions in GHG emissions (Public Utilities Code Section 379.6(b)(1)).

though on average those projects achieving the existing RTE metric emitted fewer tons of GHGs than those that failed to meet the metric. A diverse group of participants suggested a working group to help develop alternative operational requirements to improve GHG emissions impacts from storage projects. Many stakeholders also indicated that a "GHG signal" provided to participants in advance could help SGIP energy storage systems to operate (*i.e.*, charge and discharge) to reduce net GHG emissions to at least zero. Such operation is required by SGIP rules, as only those technologies that reduce GHG emissions are eligible for SGIP funding.

Staff has drafted a report summarizing the discussion held during that workshop, and it is attached to this ruling.

I agree that a working group comprised of Program Administrators, SGIP participants, and Commission staff can help advance recommendations to the Commission.

The working group should work efficiently so that new rules can be considered in the next several months. Specifically, the working group should develop operational requirements for SGIP energy storage systems based on the GHG emissions of the electric grid, as well as a verification mechanism to ensure GHG tracking and close monitoring of system performance. The working group should also consider an enforcement mechanism to be used in the event that a system's operation results in net GHG emissions on an annual basis.

The methodology used to produce the GHG signal should include the following minimum characteristics:

- The marginal GHG emissions of the grid reported for either NP15 or SP 15, as applicable,
- In 60, 30, 15 or 5 minute increments as determined by the working group

- Forecasted for the day ahead
- Automatically transmitted to the energy storage system, or the controller of the system if systems are controlled remotely

The working group should begin as quickly as possible. The Energy Division staff will send the date, time and place for the first meeting to the service list for R.12-11-005.

Consensus of the working group on a recommendation is not required, but consensus is preferred. Energy Division will organize the first working group meeting, but future meetings shall be organized by Pacific Gas and Electric Company and shall be held in San Francisco, California.

The Energy Division will serve on the service list for R.12-11-005 the recommended methodology prepared by the working group or before April 2, 2018. An ACR will follow to address those recommendations.

IT IS RULED that:

1. The Energy Division shall post a notice to the R.12-11-005 service list of the formation of a working group to develop a proposal for a greenhouse gas signal and enforcement mechanism for energy storage systems participating in the Self-Generation Incentive Program to ensure these projects reduce greenhouse gas emissions.

2. The Energy Division shall organize and facilitate the first working group meeting as soon as practicable. Subsequent meetings of the working group shall be organized by Pacific Gas and Electric Company. The SGIP administrators shall be active participants in the working group.

3. The Energy Division shall provide the R.12-11-005 service list a recommended methodology produced by the working group by April 2, 2018.

4. A summary of the November 15, 2017 workshop by the Energy Division is attached to this ruling and entered into the record of R.12-11-005.

Dated December 29, 2017, at San Francisco, California.

/s/ CLIFFORD RECHTSCHAFFEN
Clifford Rechtschaffen
Assigned Commissioner

ATTACHMENT

Workshop Report by Energy Division

Background

CPUC Decision (D.) 17-10-004 required Energy Division to host a public workshop on the operational performance of energy storage systems participating in the Self-Generation Incentive Program (SGIP). The workshop was to consider the implications on the future of SGIP of the observed 2016 performance as described in the 2016 SGIP Energy Storage Impact Evaluation.

D.17-10-004 noted that the Assigned Commissioner may release a ruling after the workshop and party discussion to seek comment on changes to operational requirements for SGIP energy storage projects in light of the workshop discussions.

Energy Division hosted the workshop on the outcomes of the 2016 SGIP Energy Storage Impact Evaluation on November 15, 2017 at the CPUC Auditorium in San Francisco. This report summarizes the off-the-record discussion at the workshop, and includes a summary of recommendations at the end of the report.

Agenda

The agenda for the workshop was as follows:

- Introduction and Background
- Presentation on the 2016 SGIP Energy Storage Impact Evaluation and Causation
- Question and Answer (Q&A) on 2016 Observed Impacts and Causation
- Panel Discussion and Q&A on Potential Measures for SGIP Energy Storage Projects to More Effectively Reduce Utility Costs and Provide Peak Demand Reductions
- Panel Discussion and Q&A on Potential Measures to Enable SGIP Energy Storage Projects to Address Greenhouse Gas (GHG) and Renewable Integration Outcomes
- Discussion on Potential Measures to Address Efficiency, Capacity Factor and Data Reporting Issues
- Wrap Up Discussion and Next Steps

Introduction

The workshop began with a presentation by Energy Division staff on overall goals for the workshop and observations about whether these goals are being achieved. The presenter outlined the CPUC and state policy goals for SGIP energy storage, including GHG reductions, peak demand reductions, avoided utility costs, market transformation and maximization of ratepayer benefits. The presenter also noted that the CPUC's Integrated Resources Planning (IRP) process values specific services that energy storage is capable of providing – namely intra-hourly "reserve" services that allow the CAISO to effectively manage high penetrations of renewable energy on the CAISO grid. The presenter noted that energy storage projects already operating and funded by SGIP have not been successful in achieving many of these goals. In particular, the average SGIP energy storage project resulted in increases in net GHG emissions

in 2016, and that the services provided by the systems were not modeled to provide the services valued by the IRP process if the systems continued to be operated in their existing manner.

Presentation on the 2016 SGIP Energy Storage Impact Evaluation

The presentation by Itron on report's findings and theories of causality covered five main impacts: CAISO peak hour impact, round-trip efficiency (RTE), environmental impacts (namely GHGs), utility marginal cost impacts, and grid integration.

CAISO Peak Hour Impacts

With respect to CAISO peak hour impacts, the presenter noted that large systems performed well during the CAISO's 2016 top 200 hours. Non-Performance Based Incentive (PBI) projects under 30 kilowatts (Kw) in size did not perform well, as they increased load during top 200 CAISO hours. The presenter theorized that one of the causes for this was the consistent charging of these systems, on average, even during peak rate periods. It was suggested that this behavior was necessary in order to be ready for any demand charge reduction that the customer might need at any given time. The presenter also theorized that perhaps the retail energy rate differential was not significant enough to encourage energy arbitrage between peak and off-peak periods. The presenter suggested that demand charges were the elements of retail rate that ultimately drove storage behavior, and that sharp signals like a demand charge are more effective than energy rates, unless there are dramatic differentials in energy rates.

Round-Trip Efficiency Impacts

With respect to RTE impacts, the presenter noted the methodological difference between calculating the RTE based on a "duty cycle" approach vs. accounting for ancillary loads in the RTE calculation. The presented suggested that calculating the RTE as a function of the duty cycle is hard as you don't know where to draw lines. Instead, the approach suggested is to use the total amount of energy consumed by battery system, including the constant draw during idle periods. The presented noted that simply increasing the capacity factor of a system is not necessarily the answer, and that if an operator increased discharge during the "wrong" hours, you would get more of a bad thing. But if the operator improved capacity during good hours, then that can improve the results. The presenter stated that, generally, discharge requirements without specific conditions don't make sense and should be avoided.

Greenhouse Gas Impacts

With respect to GHG impacts, the presenter first noted that if a battery charges from solar, it decreases solar that goes to customer, and so increases load from marginal generator. Therefore, pairing a system with solar does not necessarily decrease the GHG impact of the storage system. The presenter suggested that one can only claim the GHG benefits of solar paired with a storage system if the solar system is only installed because the SGIP storage system was installed as well. Establishing this "but for" relationship could prove difficult in practice.

[Later in the Q&A session, a speaker asked if one potential solution on GHGs would be to require that SGIP systems were installed with new solar in order to ensure that the GHG benefits of the solar generation were assignable to the SGIP storage system. Other parties noted that this approach could

unduly limit the timing of the storage system's charging and therefore the operation of the storage system.]

The presenter noted that SGIP as a whole significantly reduces GHGs; but storage systems do lead to net increases in GHGs.

The discussion then turned to the issue of retail rates as a driver of GHG outcomes. The presenter noted that energy price differentials applicable to the customers using energy storage systems were not as strong or "sharp" as demand charges or the prices associated with demand response (DR) events. The presenter suggested that redrawing TOU periods to shift the peak period for energy charges is unlikely to affect meaningful change in behavior, and that increasing participation in DR programs or CAISO markets would help. Finally, the presenter theorized that real-time pricing (RTP) or critical peak pricing (CPP) may better transmit signals to customers and improve opportunities for SGIP energy storage systems to improve grid support and GHGs. Another speaker noted that non-coincident demand charges incentivize customers away from optimal dispatch, and that shifting peak periods is insufficient compared to the need for real-time rates. With specific reference to demand charges, a presenter noted that as a general rule of thumb, if coincident demand charges are used then they would expect GHG and utility cost performance to improve.

Following on from this discussion, the question arose of how to ensure that customers receive a signal specifically for grid support services? One speaker noted the existence of San Diego Gas & Electric's (SDG&E's) vehicle-grid-integration (VGI) rate. It is a dynamic and real-time rate that is also known as the "grid integration rate for electric vehicles (Evs)." It is also an opt-in rate, which helps with buy in from the customer. The speaker noted that in order to get a subsidized EV charger from SDG&E, the customer would need to go on that rate.

The presenter noted that WattTime also has a real-time model for when GHGs are highest. They also asserted that their modeling shows that all systems can reduce GHGs, even those with low RTEs.

Key takeaways from the presentation on the 2016 Energy Storage Impact Evaluation were:

- There is a misalignment between customer non-coincident peak and system peak
- There is a lack of a strong system signal to discharge in any other way than to provide customer benefits
- Time-varying price differentials are not as sharp a signal as demand charges or demand response events
- Redrawing peak periods will not be enough to incent changes in customer behavior
- Real time or critical peak pricing mechanisms may better transmit utility marginal costs and improve grid services behavior
- RTE alone is not a predictor of improved grid impact and environmental benefits

IRP Analysis and Grid Support

Another presenter discussed the specific forms of grid support that can be provided by energy storage and the value placed on these use cases. According to this presenter, energy storage has value in the IRP process through providing "reserves" that allow the system to use high amounts of renewables.. These

reserve services can be defined as: 1) hourly load-following reserve, which means that in the morning or evening you need hour-to-hour increases in generation; 2) intra-hour flexibility need, which means helping CAISO deal with forecast error, and balancing out 5 or 15 minute dips; and 3) short term frequency response. The dominant constraint faced by CAISO is hourly and sub-hourly load-following reserve. Frequency response is less valued.

In the IRP reference case where 42 million metric tons (MMT) of GHGs are assumed, it is not until 2030 that there is a need for some "short duration" energy storage to provide reserve services. In the IRP's 30 MMT case, there is a need for short-term storage in 2026, and by 2030 there is a need for long-duration storage (i.e., load shifting from day to night).

One speaker noted that for thermal and hydro storage, there is an efficiency component that outweighs parasitic losses.

Another speaker asked if Itron was considering any forward-looking research on systems to be built. In response, it was noted that impact evaluations are by their nature retrospective.

Questions and Answers with Itron/E3 on Data and Methodologies

A speaker asked if there is there a data bias in the report? Were the data solely from developers that have been able to succeed in market so far and therefore are not representative of all use cases? In response it was noted that there is some degree of bias in the 2016 evaluation. There was de facto bias toward what data the evaluators could get, but it was noted that the sample used for the 2016 evaluation was an unprecedented fraction of the total population (approximately 80%). There was also a healthy distribution of different system capacities in the sample, as well as across building types and facility load profiles.

Another speaker asked about the data for non-PBI systems and whether it was as complete as the dataset for PBI systems. In response it was noted that for residential customers, there were significant gaps in the data. Summaries of residential data were sometimes showing 1000% RTEs. With respect to the cause of this problem, it was suggested that small residential systems might not have the best data acquisition systems. However, there was a good relationship with non-residential non-PBI data. The evaluators had storage dispatch data and customer load data, to compare against utility load data for the customer.

A speaker asked how solar paired with storage will help with GHGs in the future if the performance of a given storage system is constrained so that it can only charge during the day and not overnight or practically ever from the grid during curtailment events. In that case, pairing with solar would not necessarily improve GHG performance. In response, it was noted that if the solar generation is installed because of storage, perhaps due to some regulatory requirement to do so, then SGIP could claim benefits of solar on GHG and system load, and therefore claim the GHG benefits that result from the solar generation itself.

However, in that case, requiring the storage to charge only from solar can limit the ability of storage to meet ancillary grid needs during peaks. In a hypothetical where there are three cloudy days in a row, the storage system may not have the charge to respond to CAISO needs. There is also an investment tax credit (ITC) compliance issue, where some developers may be worried that they will be audited for grid

charging, and therefore don't participate in ancillary markets that could help SGIP systems achieve grid support goals. A speaker asserted that the bottom line is that stand-alone systems can deliver grid and GHG benefits, and RTEs can mislead as a 100% RTE system wouldn't necessarily deliver GHG benefits.

Another speaker asked if it was possible to do an assessment of a 100% renewable portfolio standard (RPS) and the impact on the value given to energy storage? In response it was noted that that work is underway in the IRP, and that storage plays a larger role in those portfolios.

One speaker stated that the ITC won't sunset completely in 2022, and that for commercial customers it may continue in perpetuity at 10%.

A speaker asked about the marginal emission profile of the grid in 2016 vs. 2015, and how much solar penetration changed how it looks? In response it was noted that 2017 had much more curtailment than 2016; but it is not yet to the point where it has a dramatic effect on overall GHG impact on solar and storage.

A speaker asked why new TOU periods don't help with the GHG emissions issue faced by SGIP energy storage systems, given that new TOU periods purportedly better align with the peak GHG marginal emissions of the grid. A presenter noted that they had looked at demand charge reduction as primary driver of storage operation. They see storage systems charging and discharging during peak periods to make sure battery is ready to go at all times, and as a result peak period energy arbitrage is not that important. Shifting those periods may not change the basic trade-offs present in the rates so long as the peak periods remained several hours in duration. The incentives created by demand charges to charge and discharge during the same peak period would not necessarily be changed.

A speaker noted that a rate that would be good for storage would have the following characteristics: 1) a high peak to off peak differential, 2) the appropriate peak time period, 3) a super off-peak (curtailment) period, and 4) demand charges, although it was tricky to determine the right proportion of coincident to non-coincident demand charges (NCDs). There were real costs that NCDs recovered. And there were real costs that CDs can recover for distribution system. The speaker also noted that DR participation could help.

A different speaker stated that new rates won't come into effect in enough time for SGIP anyway, and that they can't change the rules on old projects.

A speaker suggested that if there was a program requirement on the timing of peak discharge, that would be helpful. Signals are good. Increased capacity without harming the customer should be encouraged. The key issue with peak periods is not just the timing of the periods themselves, but also the differential. Real world modeling is needed to optimize peak period management for GHG reductions.

Another speaker noted that shifting toward coincident peak signals will be more useful in GHG reduction, but system vs. distribution capacity (coincident to the feeder or line segment level) will also need to be addressed.

Another speaker stated that discharging during peak periods is fine, but developers need the signals to inform when the GHGs are actually high. Uncertainty around future rate design is keeping SGIP take-up slow.

Panel Discussion and Q&A on Potential Measures for SGIP Energy Storage Projects to More Effectively Reduce Utility Costs and Provide Peak Demand Reductions

Grid Support Presentations

A presenter noted that there were four areas where energy storage could play a role in grid support and management: 1) system peak, 2) future grid capacity (as indicated by the IRP), 3) distribution system and deferral, and 4) renewable integration on both the distribution and system scales (flexible capacity). The presenter argued that current rate signals, as utilized by customer-sited energy storage, aren't sufficient to promote these areas of grid support. This implies that while customer bills may be lowered and market transformation goals achieved through SGIP energy storage response to existing retail rate signals, grid support will not be maximized. There is a need to balance grid support goals with SGIP's market transformation goals. The presenter noted that more cycling for its own sake can be counter-productive, as increases in cycling that are not timed to peak demand events would not provide grid support while increasing the cost of operating the system. Storage can provide needed response where signals exist. Sharper signals may be more effective.

The presenter also suggested that revised peak periods will address the root-cause issue of incentive misalignment. They recommended a working group (WG) be established to develop concrete recommendations to address the grid support issues. The WG would start in Q1 2018, with a WG report and recommendations in Q2 2018.

WG discussion topics could include: 1) opt-in tariff with a GHG signal, 2) additional funding to projects to direct additional behavior, 3) additional funding to projects for expansion, 4) opt-in tariffs to direct cycling timing, and 5) coincident peak emphasis in rate design.

Another presenter noted that developers don't have access to all the necessary value streams that they believe are necessary at this time. The presenter argued that as new signals are developed, developers can aggregate units to operate as a virtual power plant. A new CAISO load shift product under development [ESDER 3] may help. This will allow storage to absorb excess generation during oversupply periods. Hopefully this product will be available by spring 2019. The presenter noted that storage needs flexibility to provide grid support services. Cycle prescriptions during certain periods limit the ability of storage to provide services during those times. Cycling to meet an RTE requirement is likely to increase GHG.

The presenter proposed several solutions: 1) provide a 15-minute GHG signal, 2) adopt event-based riders, 3) switch to new GHG periods that better match GHG emissions, 4) shift demand toward coincident peaks, 5) move toward RTP with a GHG forecast element, 6) create innovate CAISO products, add 7) allow for more rate options in addition to competitive solicitations.

Another presenter noted that there is a lot of storage being built that isn't taking SGIP. One large developer had no representation in the SGIP evaluation sample for the 2016 Impact Evaluation. So the GHG baseline observed in the 2016 evaluation might change over time. The presenter noted that a

developer can aggregate SGIP systems to provide demand response auction mechanism (DRAM) response. And other DR programs can lead to ideal charging behavior. But the presenter argued that requiring DRAM is not the solution. One large developer is discharging during top 200 hours, but still not the majority of discharge. Need some sort of signal to get more of that.

The presenter suggested the following solutions: 1) apply new PBI rules to all existing projects 30Kw and over (i.e., don't require old projects to go along with old rules); 2) in a WG look at the evaluation of customer DR programs, but note that not all customer DR programs are available to all customers; 3) encourage SGIP systems to be compliant with automated demand response (ADR) systems; and 4) expand the scope of future M&E reports to include a 2-year time horizon so that new projects have time to come online and contribute to findings.

Another presenter highlighted the difference between the grid on the local scale and state-wide scale, and how benefits for either scale might occur at different times. The presenter noted that one could use the upcoming locational net benefits analysis (LNBA) from the Distributed Resources Proceeding (DRP) to do an SGIP cost-effectiveness analysis, but in the absence of that product at the moment one could use deferral heat maps as the next best alternative. But in order to capture locational value, operational requirements are very specific. Would there be "no-go" hours and must charge hours?

Questions and Answers on Grid Support

One speaker suggested that for residential SGIP projects, the participants could be placed in the default TOU pilots due to begin start next March.

In response to question about whether the size of the system explained the poor peak demand performance of systems less than 30Kw in size, a speaker stated that the size of the system is not determinative, and we shouldn't design solutions just for them. System size is not the issue, but system configuration and what we are trying to accomplish. Smaller systems can aggregate to provide system peak reductions, but they need signals to provide the incentives. The signal is most important, and is not strictly technological.

In response it was noted that those systems > 30Kw are subject to PBI rules. Problems are different and solutions will be as well. Are you trying to do peak demand reduction or energy arbitrage? Very tight signals could allow for optimal system operation.

One speaker said that they were looking forward for ADR compliance for 30-100kw systems. The speaker identified barriers to current DR participation by SGIP systems as: 1) temporary nature of DR programs, 2) critical peak pricing is not available for NEM systems, 3) certain DR rates exclude SGIP, and others are expiring.

Another speaker noted that it is possible to design rates to align all incentives, perhaps with the exception of some distribution costs. They suggested there was a false conflict between coincident energy charges and demand charges, as one could narrowly focus on a 2-3 hour peak period with very high rates.

A speaker addressed the issue of the scale of the "grid" that we refer to when we talk about "grid support" (i.e., the CAISO-level grid as opposed to a local distribution circuit), and noted that a solution to

the system peak vs. local peak issue is to move to coincident peak demand. SGIP could measure performance by grid benefits that can currently be quantified. If SGIP responded to local price signals, then evaluation could look at that rather than system peak reduction. However, it is more challenging to look at local peak reduction.

A speaker noted that it would be helpful to have more DRAM data for evaluations. We need information from developers on when they were responding to DR signals in order to have a more granular evaluation.

Another speaker stated that we need to make capacity payments available under DR programs. DRAM is a pilot with a limited number of megawatts that can be recruited, and there is no certainty around future availability of DR programs. The market can't bear it if the programs don't exist. The speaker also noted that NEMA and VNEM rates are not compatible with CPP.

Panel Discussion and Q&A on Potential Measures to Enable SGIP Energy Storage Projects to Address Greenhouse Gas (GHG) and Renewable Integration Outcomes

Presentations on GHGs

A presenter stated that it is not necessary to come up with complicated solutions, and instead the effort should be on trying to come up with a simple solution. Simply identify high GHG hours and require projects to avoid charging during those times. What about a 12-9pm "no charge" period? This would mean that SGIP systems avoid charging during all high emission hours. There may be an absence of a price signal, but one does have the right information on where the high GHG hours are. If that seems like too long a time, how about 4-9pm? This method doesn't require 100 different DR programs or arguing about rates.

Another presenter noted that there are no smooth curves in GHG data that would allow system operators to predict the hours of the day at which GHG emissions are the highest. The presenter took E3 data and modeled a representative SGIP system, assuming a coming day's GHG were known. If you know what GHG emissions will be, then you can operate system to avoid GHGs. The presenter queried whether RTE was the right metric to assess GHGs.

A presenter noted that GHG emissions from SGIP are trending in the wrong direction but still very small. Paired systems will arguably change the picture, and none of the systems installed for the evaluation were paired. SDG&E's new DG-R rate will incent the right behavior. Agree that rates should have high differentials, more dynamic pricing, and that all demand charges should be made coincident. The SCE RTP rate is another example of a rate that can be used. It does have NCDs, but it's a starting point that can be used today. Bigger batteries are required to address both peak load and GHGs, but the presenter was not a strong proponent of this idea. They wanted a more long-term solution. Any penalties need to be tailored to the right entity. Would this be the storage project developer?

Questions and Answers on GHGs

A speaker said that there should be no more proxies for determining GHG compliance, and therefore the RTE standard should be suspended. The speaker also argued against prescribed dispatch as well.

Instead, the speaker asked that we establish the actual numbers on what GHG intensity are for each hour.

In reference to the hourly operational periods suggested by one of the presenters, a speaker made a recommendation for a "no charge" period rather than a "no discharge" period. If there was a "no charge" period and a high capacity factor requirement then SGIP systems would meet our goals.

Another speaker noted that a least-cost-best-fit (LCBF) approach could also be used to prioritize the selection of SGIP projects that will provide greater grid support and lower GHG emissions at the lowest cost, This project selection method has worked for utility scale renewable energy programs, and creates the right incentives and signals for the market to design projects that meet program goals. This kind of approach may not require DR or discharge blocks, but SGIP incentives could be prioritized for those projects with the attributes that we want.

A speaker noted that the multi-use application "wheel" is the key for developers to improve economics. Cycling frequently is fine if it helps the customer. Otherwise it reduces ability to meet customer need and system need through reduced battery life. Can we do CPP-like price as an add-on to current rates? Can we implement that in the short term to enable grid benefit provision? This approach might require non-traditional CPUC activity. We need a replacement for RTE, better to use a rider on current tariffs. Increasing capacity factor during DR events or peaks is fine. But replacing the inverters is too expensive. There is also a DR prohibited resource issue. If a system shows a failure to meet the RTE standard, then the project can't qualify for DR. That's a real barrier to DR participation.

Another speaker noted that residential systems more or less are required to connect on new peak period rates.

A speaker noted that the danger with "no charge" hours approach is that you get caught in your own web. This is also an issue with ITC systems. Those systems can't charge overnight. That means the customer may be forced to charge when retail rates are high during 12-4pm hours.

A speaker noted that rates may be chasing a moving target. Wholesale markets may be where the right signals need to come from. It would be beneficial to bring dynamic inputs into the rate structure.

On the question of which hours are high GHG hours, a speaker noted that average curves don't tell us which marginal unit is being fired at any given time. If automated demand response (ADR) is on the table, then use real time signals on GHGs. Each day is different, and each day will have different marginal units fire up.

On this point, a speaker noted that WattTime data is proprietary, so it's not transparent even if it's a good idea. If we use it, it needs to be vetted. Right now it's a black box.

Another speaker noted that increasing the energy capacity of a storage system would help, but it is hard to know what the right number is. SGIP is supposed to come up with rules that will reduce GHGs, but rules so far don't do that.

On this point, another speaker said that more money for bigger batteries is fine, but we need a bigger budget to do that. There was a need to stretch the existing budget as much as we can.

A speaker noted that operational requirements will keep players out of the market as the value proposition for customers would be destroyed, and we would have less storage in California overall.

If a GHG signal was available, then a speaker noted that non-compliance on GHGs should be punishable, but to what degree? Would a cap and trade payment for the tons emitted be sufficient?

For longer duration systems, a speaker noted that you could give them a different RTE standard to get the systems in the program. We would need more data on what the low RTE systems do to see if they can provide the services we need.

Another speaker noted that bigger energy capacity sounds good, but they have a much bigger footprint and might be used less optimally if they are forced to cycle more.

A speaker wondered if bigger storage systems could be used to charge Evs or shared Evs, with the larger storage unit being eligible for SGIP.

Another speaker asserted that enforcing the RTE rule may lead to greater GHGs. Preliminary modeling shows increase in GHGs from one developer's projects if the RTE rule is enforced.

For projects that have already been deployed, it's a tough ask to have them abide by signals without prices. Need more time in a working group to discuss.

One recommendation to deal with the vampire loads for storage systems is to operate the battery such that there is a constant discharge to match idle load, and then deeply charge during low GHG hours.

A question was asked about the potential for a non-price GHG signal. Speakers responded that it may lead to less customer savings, and that there should be some sort of incentive for reducing GHGs if one were to replace the RTE standard. There was some debate between speakers as to whether RTEs were negatively correlated to GHG emissions or not.

With respect to whether there is alignment between GHG goals and grid support goals, one speaker said that it was hard right now to say if GHG periods don't match up well with locational benefits to the grid. System level grid benefits and GHGs are well correlated. But hard to say on locational.

Another speaker on this point said that distribution peaks a little earlier, because desert solar is depressing CAISO prices a bit later in the afternoon.

A speaker said that there was a need to consider the customer experience when optimizing for GHGs. Should we create a mini cap and trade for SGIP to compensate SGIP customers that over-perform on GHGs? This would benefit some customers who took steps to reduce their GHG intensity. This would necessarily be an ex post analysis.

On the WG question, a speaker said that if we follow that path, we need to move quickly. Would industry be willing to participate in a pilot that would increase RTE and see if GHG performance got better? Pilot would include a price signal for GHGs.

Another speaker offered a potential solution of taking SGIP money and creating extra PBI payments that are tied to GHG reductions. On a pilot basis?

On the point, a speaker asked if we can convert existing PBI payments into GHG payments. A pilot should test what we want to see rather than arbitrary goals like increased RTE.

Discussion on Potential Measures to Address Efficiency, Capacity Factor and Data Reporting Issues

A presenter noted that the efficiency issues were dealt with in depth in earlier sessions and so did not require focus in this session.

A presenter asked for comment on the best approach for defining renewable integration goals for the purpose of SGIP. Should the goal be to move renewably generated energy to those periods where intermittent renewable energy penetration is minimal? Or should the emphasis be on discharging renewable energy at times when the rate of demand of grid resources is high while intermittent renewable penetration is low?

Several speakers addressed this point and generally agreed that the objective of renewable integration is create space and opportunity for the deployment of additional renewable resources, which practically means reducing the "ramp" that is required to go from high solar output in the late afternoon to high customer demand in the early evening. Therefore, SGIP storage should seek to reduce grid demands during the early evening hours through discharge, and charge during strong solar hours, in order to optimize renewable integration.

On the capacity factor question, the presenter wanted to know whether the issue was similar to RTE in the sense that increasing system discharge to satisfy the capacity factor requirements was helpful. Speakers generally responded that capacity factor increases could lead to good or bad results depending on whether the discharges were occurring during times of low or high GHG intensity, or times when the grid needed support.

On data reporting, speakers generally agreed that data reporting from residential systems could be improved, and that it was expected to be improved in 2017. There was some discussion as to the preferred precision of inverters that track the input and output of a storage system. Some speakers suggested that modern inverters could deliver data that is accurate to within 0.5%, which would be good enough for most purposes.

Summary of recommendations

The main workshop objective was to develop potential solutions to the sub-optimal performance of SGIP energy storage systems observed in 2016. Participants at the workshop offered several proposals, which are summarized below. This summary is non-exclusive and a complete record of suggestions appears throughout this report.

With respect to grid support, participants suggested:

- Increase sharpness of coincident demand charges

- Dramatic differentials in energy rates (such as SDG&E's electric vehicle rates) may also incent greater grid support, including a "super off-peak" period
- Increasing participation in DR programs or CAISO markets, bearing in mind that not all DR programs are available to SGIP customers
- Real-time pricing (with a GHG signal) or critical peak pricing (CPP) may better transmit signals to customers and improve opportunities for SGIP energy storage systems to improve grid support
- Opt-in tariffs with sharp price signals to direct cycling timing
- For distribution-level grid support, considering using the "heat maps" currently used in the DRP to estimate where distribution-level resources would benefit from energy storage, until the LNBA is complete
- Bear in mind that in order to capture locational value of grid support, operational requirements need to be very specific with respect to charge and discharge
- Adopt event-based riders
- Create and use innovative CAISO products like ESDER 3
- Allow for more rate options in addition to competitive solicitations
- Apply new PBI rules to all existing projects 30Kw and over (i.e., don't require old projects to go along with old rules)
- Encourage SGIP systems to be compliant with automated demand response (ADR) systems
- Make capacity payments available under DR programs

With respect to GHG emissions, participants suggested:

- A signal for developers to respond to high and low GHG hours dynamically – each day is different, and each day will have different marginal units fire up
- Removing proxies for GHG compliance, such as the RTE
- An opt-in tariff with a GHG signal, either 5 or 15 minutes
- Operate the battery such that there is a constant discharge to match idle load, and then deeply charge during low GHG hours
- Additional funding for projects to direct additional GHG behavior
- Additional funding to projects for energy capacity expansion
- Incenting more storage systems paired with solar
- Using new rates such as SDG&E's DG-R rate or SCE's existing RTP rate to more granularly direct behavior
- In general, rates should have high differentials, more dynamic pricing, and that all demand charges should be made coincident
- Enforcing a "no-charge" rule for a certain block of hours, either 12-9pm or 4-9pm
- Tailor any penalties for GHG non-compliance to right party
- A mini "cap and trade" for SGIP to compensate SGIP customers that over-perform on GHGs
- Use a least-cost-best-fit (LCBF) approach, prioritizing incentives for those projects with the attributes that minimize GHGs and maximize grid support
- Converting existing PBI incentives into higher or lower incentives based on GHG performance
- Bearing in mind that ITC and SGIP rules may enforce solar charging, which limits the flexibility of a system to respond to high GHG hours
- Bearing in mind that cycle prescriptions during certain periods limit the ability of storage to provide services during those times. Cycling to meet an RTE requirement may increase GHGs.

With respect to the process for further consideration of these issues, participants suggested:

- Convening a working group (WG) to develop concrete recommendations to address the workshop's goals. The WG would start in Q1 2018, with a WG report and recommendations in Q2 2018.
- Create pilot programs within SGIP, perhaps using the residential retail rates pilots, to test operational changes that may lead to improved grid support and lower GHGs

(END OF ATTACHMENT)