
PACIFIC GAS AND ELECTRIC COMPANY

**GUIDE TO ENERGY STORAGE CHARGING ISSUES
FOR RULE 21 GENERATOR INTERCONNECTION**

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1. Purpose and Applicability

This Guide is provided to aid interconnection customers with the Pacific Gas and Electric Company (PG&E) interconnection process for energy storage devices applying under PG&E's [Electric Rule 21](#). Its goal is to provide clarity and set expectations for how PG&E implements the applicable Electric Rules governing utility service to its retail customers deploying energy storage devices. Rule 21 governs much of the process, including prescribed timelines for generation issues, to address interconnection requests for energy storage facilities. This Guide is intended to conform to Rules 2, 15, 16 and 21, as well as the agreements reached between the stakeholders in the Distributed Generation Interconnection Order Instituting Rulemaking, as approved by the California Public Utilities Commission (CPUC) in Decision 16-06-052. The goal of the Guide is to clarify the interactions between these tariffs to help facilitate the interconnection process. In the event of a conflict between this document and Rule 21 or other tariffs, the tariff rules control.

As business needs evolve, PG&E or other parties may identify revisions in the pursuit of efficiency and effectiveness. PG&E will endeavor to keep this Guide relevant and responsive to the needs of interconnection customers by means of the collaborative revision process described in [Section 6](#).

2. How to Get Started

- Learn more about types of energy storage interconnection on the Electric Generation Interconnection (EGI) website at https://www.pge.com/en_US/for-our-business-partners/interconnection-renewables/interconnections-renewables.page and the [energy storage page here](#). These pages address topics including:
 - How to Apply.
 - Costs for various study processes (including both the Fast Track and Detailed Study processes).
- Become familiar with PG&E's Distribution Interconnection Handbook, available here. (https://www.pge.com/en_US/residential/customer-service/home-services/renovating-and-building/renovation-and-building.page).

- For expanding an existing service panel or installing a new service panel, refer to the PG&E Gas and Electric Requirements, “Greenbook” (https://www.pge.com/en_US/business/services/building-and-renovation/overview/greenbook-manual-online/greenbook-manual-online.page?WT.mc_id=Vanity_greenbook), and PG&E’s Building Renovation Service Center (BRSC) (https://www.pge.com/en_US/residential/customer-service/home-services/renovating-and-building/renovation-and-building.page).
- Apply for interconnection using the online application at: <https://yourprojects.pge.com/>.
 - Complete the PG&E on-line applicable form. Note that different application data is required depending on whether the storage system is being added to, or installed with another generator that participates in Net Energy Metering.
 - The Applicant will be required to provide necessary building permits from the local jurisdiction having authority.
 - In order to expedite the application, all documents specified in the application need to accompany the submittal. See www.pge.com/gen for more information.
 - Include storage system load calculations and operating parameters to help verify expected load from the storage system.
 - Other attachments (include drawings that might be helpful. Also refer to PG&E’s Distribution Interconnection Handbook and Greenbook, mentioned above).
 - Review the [generator interconnection process and timelines](#) by clicking on this link, and as described in the following sections of this Guideline.

If the project involves a new, upgraded or relocated electric service panel, then the Applicant will need to make a separate application for service through PG&E’s BRSC. The Applicant needs to follow the steps outlined here:

https://www.pge.com/en_US/residential/customer-service/home-services/renovating-and-building/renovation-and-building.page.

For this application with PG&E’s BRSC, the Applicant will be contacted by a local office where a local service planning representative will assist with PG&E’s requirements regarding the site’s electric service panel.

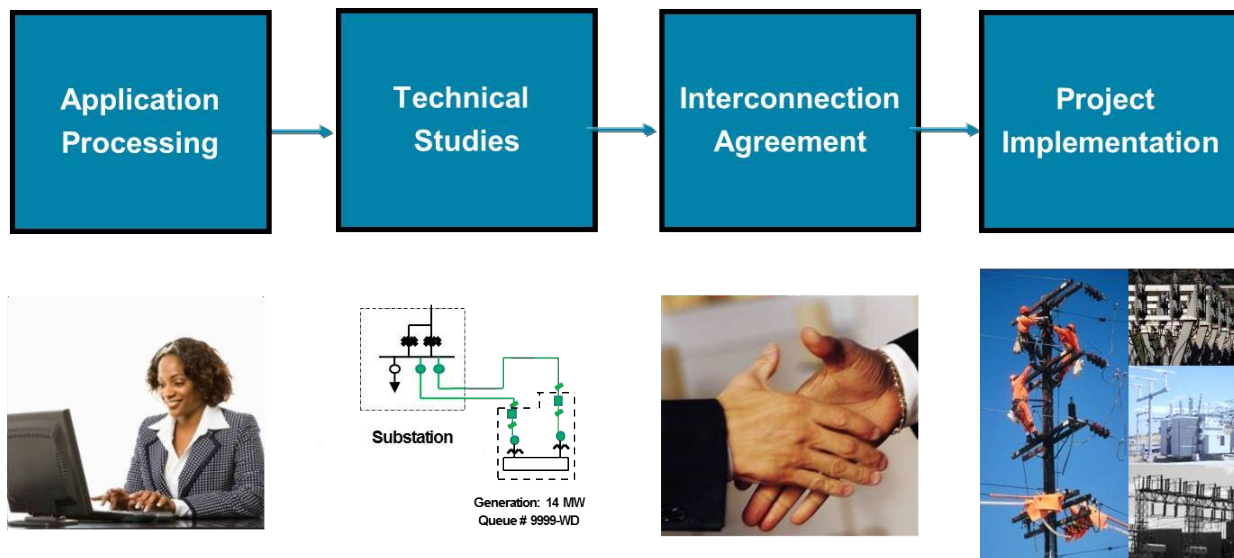
Upon EGI's receipt of the Interconnection Request for the storage system, PG&E will assign an Interconnection Manager (IM). The IM will contact the Applicant to discuss the application and either confirm completion or request more information. The IM will also coordinate closely with the local PG&E office in the event the project requires a separate Application for Service (as described above). The Applicant should continue to work directly through the IM for all matters concerning the storage project.

3. Charging Load Review Process Description

The interconnection process for the interconnection of energy storage devices helps ensure the safe and reliable operation of the: device; the host facility; and the distribution system to which it is connected. Obtaining the required permission to deploy storage in PG&E's service territory can be a multi-faceted process, depending on the specifics of the project. It may involve: submission of multiple documents; payment of various fees; technical reviews by PG&E; potential PG&E electrical system upgrades to accommodate added electric load associated with the operation of the storage device; approvals by the local authority having jurisdiction; and final inspections by PG&E. The process PG&E has developed coordinates efforts from several groups within PG&E to facilitate interconnection of storage systems to its electrical grid in a manner to maintain its ongoing reliability and safety.

The following sections outline: the required forms; information to be submitted; reviews that PG&E will perform with timelines; and approvals for interconnecting energy storage to PG&E's Distribution System. For an explanation of the terms and acronyms used in this Guide, please see the Key Terms in [Section 7](#).

FIGURE 1: BASIC STEPS OF THE INTERCONNECTION PROCESS



Energy storage interconnection applications follow the same basic structure as other types of generators as described in Rule 21. This process has four basic steps:

1. Application Processing;
2. Technical Studies;
3. Interconnection Agreement (IA); and
4. Project Implementation.

The topics of interest for this Guide relate primarily to the first two steps: (1) Application Processing; and (2) Technical Studies. See [Section 6, Further Resources](#), for references to forms and the other resources related to the IA and Project Implementation.

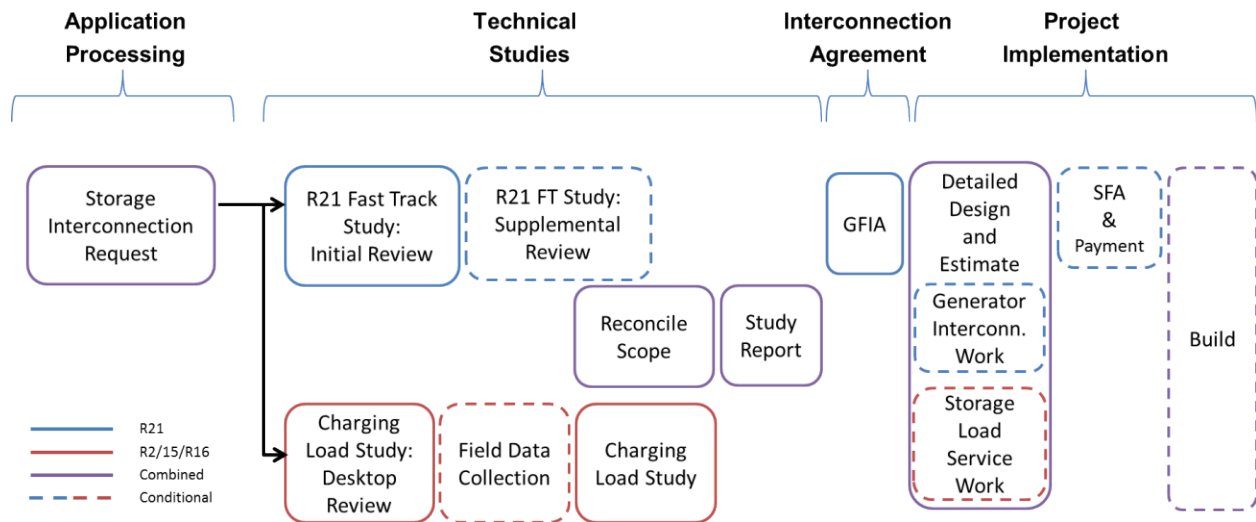
Figure 2 shows an overview of the process that applies to applications to connect storage systems located behind a customer's existing PG&E electric meter.

See [Electric Rule 21](#) for further detail on all of these steps, and for other study process options beyond the Fast Track described below.

Once an Interconnection Request is received, and is administratively complete—meaning all its components have been received by PG&E and are ready for study—the Technical Study step of the process (as shown in Figure 2 below) begins. The study defines if any upgrades are needed to the Service Facilities and/or the Distribution System in order to support the energy storage device. Following completion of the applicable studies, an IA is drafted for execution by the Applicant and PG&E. Once the

agreement is in place, PG&E proceeds to prepare a detailed design and final estimate for the scope of work identified. For work to be done at the Applicant's expense, a Special Facilities Agreement is prepared to specify the final costs. Payment is collected, based on this amount, and any upgrades or mitigations are then built. Final inspection and testing of the newly-interconnected storage device is the last step before PG&E can issue a Permission To Operate or PTO.

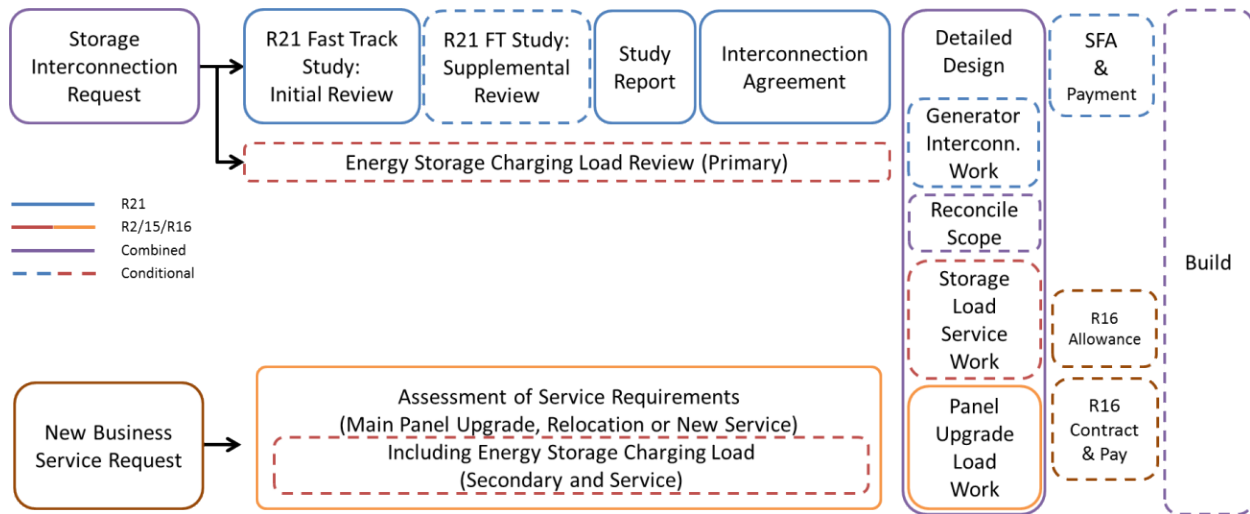
FIGURE 2: STORAGE INTERCONNECTION PROCESS OVERVIEW



If the storage project includes the Applicant: performing a service panel upgrade; relocating the service panel; or adding a new electric service, then additional steps are needed. For these projects, the charging aspects of the energy storage device will also be addressed as part of the Application for Service.

An overview of how this process varies from the simpler case illustrated in Figure 2 is shown in Figure 3 below.

FIGURE 3: STORAGE INTERCONNECTION WITH SERVICE REQUEST



a. Definition of Charging Operational Modes

In the Interconnection Request, the Applicant describes the charging behavior of the proposed energy storage system. This behavior can be grouped into three Operating Modes which are relevant to interconnection. Determining the Operating Mode is a critical factor determining the extent that PG&E will need to study the charging of the storage system. These studies will use information from the Interconnection Request to assess whether the operating characteristics of the storage system could impact the customer's Service Facilities and/or the Distribution System.

- Operational Mode 1: No Grid Charging – This mode of operation involves a storage system that is coupled with on-site generation, whereby the storage system is charged without the use of PG&E's Distribution System. Because such storage systems are solely charged by the on-site generation there is no increase to the customer's instantaneous load under this Operating Mode. As such, a load review is not required. However, it is important for PG&E to review the storage discharging characteristics for any impacts on the PG&E Distribution System as a result of this storage system operating while physically connected with the utility grid. These impacts are evaluated according to the study process as detailed in Rule 21, which is not repeated in this Guide.
- Operational Mode 2: Peak Shaving – The storage system is charged by the PG&E grid. Under this Operating Mode, the storage system is then discharged during times of peak customer load with the intent of reducing the net load needed from

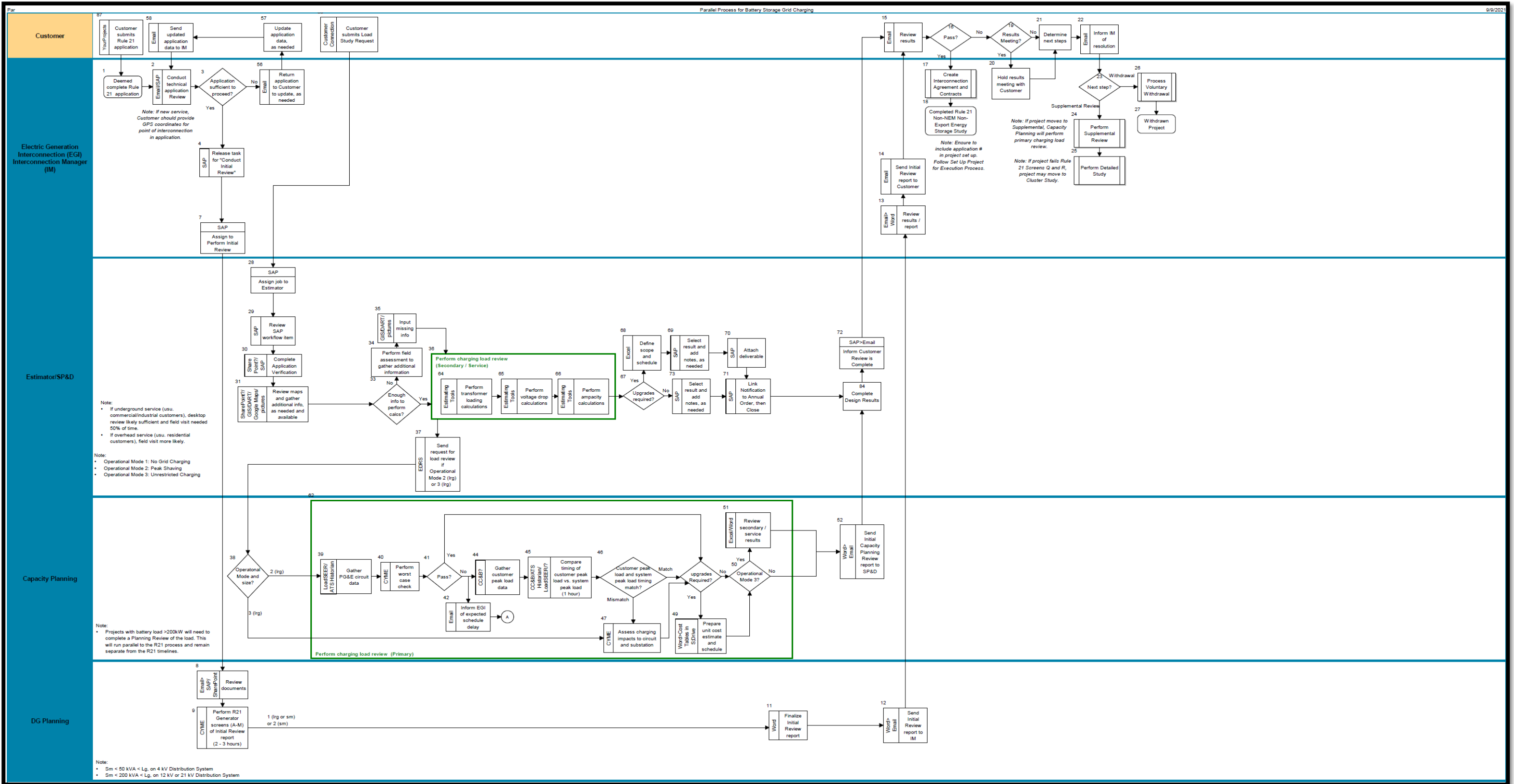
PG&E's system at that time. This includes use cases referred to as: "demand management"; "peak load reduction" or "peak shaving"; and "load shifting," all of which serve to decrease the customer's measured and billed demand per the customer's applicable PG&E rate schedule. PG&E's review of this type of application will include a study of both the storage device's load (charging) characteristics, as well as its generation (discharging) characteristics, to determine impact to the customer's service facilities and Distribution System. For a storage system that does not cause the total facility load to exceed the existing peak demand, the impact on the existing system is expected to be negligible. The Applicant will need to describe how this will be achieved. For instance, this description could include programming the storage device to charge only between 10 P.M. and 10 A.M., when site loads are minimal; monitoring total facility power flows in the storage system's control scheme; and controlling the ramp rate for charging at no more than 10 percent/second (from zero to rated value).

- Operational Mode 3: Unrestricted Charging – This Operating Mode is the most flexible for the customer, as it implies that the storage system could charge from PG&E's system at any time, including when other on-site loads are high. This means that the storage device is a new, additional load on the PG&E system, subject to the rules in place which govern new load. Thus, the choice of this Operating Mode results in the most rigorous review and potential to impact the electrical grid the most, resulting in the highest likelihood of requiring upgrades to service facilities. Applicants should also keep in mind that charging in such a fashion could result in additional demand or energy charges on their electric bill. While future programs could motivate customers to request unrestricted charging, Applicants should only request this additional service capacity if they expect to use it. The interconnection process could be significantly longer and/or more costly in order to safely accommodate unrestricted charging.

First, the Applicant submits an Interconnection Request through PG&E's on-line portal to PG&E's Electric Grid Interconnection Department. EGI is responsible for managing PG&E's processes to interconnect generators such as storage devices to its electric grid. The Interconnection Managers in EGI—IMs—work with customers to manage these applications. The IM will work with the various internal departments within PG&E to complete all aspects of the generator interconnection.

EGI reviews the Interconnection Request for completeness and will verify the Operational Mode selected. Once the Interconnection Request is complete, the IM will forward the application package to the PG&E technical team to proceed with the generation related study process. See Figure 4: Technical Study Process Details for a more complete overview of the steps for various scenarios.

FIGURE 4: TECHNICAL STUDY PROCESS DETAILS



b. Study Process Details

The details of the Study Process step depend on the Operational Mode selected as follows:

1) Study Process for Operational Mode 1 (No Grid Charging):

All Operational Mode 1 applications, regardless of size, avoid the Charging Load Review, for both primary and secondary facilities. The Applicant's commitment not to use the grid to charge the storage device will be memorialized in the IA. As such, no further technical review of load aspects is needed.

For all cases, PG&E's Distribution Planning Engineer will still analyze the operation of the storage facility under the Rule 21 study process. Several study process options exist under Rule 21: refer to that Tariff for details.

The goal of the Rule 21 review is to determine the impact the discharging (or generation) aspects of the storage system would have on the Service Facilities or Distribution System with respect to voltage, flicker, fault duty, etc. The study will also detail modifications needed to address those impacts. Once the study report is complete, the IM will forward it to the Applicant. Under the Rule 21 Fast Track Study Process, the Rule 21 Initial Review Screens will indicate any need for more involved study. If needed, then PG&E will confirm with the Applicant whether they wish to proceed to a Supplemental Review, as described in Rule 21.

2) Study Process for Operational Mode 2 (Peak Shaving):

Operational Mode 2 storage facilities may not require charging load review, depending on the power rating of the storage devices. A cursory review suffices if the load associated with the charging of the storage system can quickly be deemed to have negligible impact on PG&E's Electric System.

The thresholds to qualify for such a cursory review are based on the voltage of the project's local PG&E distribution system, as compared to the storage facility's aggregate nameplate charging power capacity rating (including all storage devices at the same Point of Common Coupling), as follows:

- For projects with a PG&E distribution system voltage of 4 kilovolts (kV), the review threshold is 50 kilovolt-ampere (kVA) or less, for the storage facility capacity.

- For projects with a PG&E distribution system voltage of 12 kV or 21 kV, the review threshold is 200 kVA or less, for the storage facility capacity.

Operational Mode 2 Storage facilities that exceed the above thresholds will require a Charging Load Review. Under this scenario, it cannot be known whether the storage charging load would impact the customer's Service Facilities or PG&E's Distribution System until after the study is complete. In this review PG&E's Distribution Planning group compares the load characteristics of the storage facility to the existing loading on the respective distribution circuit and substation to determine if there is an impact to the Distribution System.

As stated above, PG&E will also study the generation aspects of the storage device according to the Rule 21 study process.

This process assumes no service panel upgrade, relocation, or a new service. In the event of any of these scenarios, then the application would follow the process described for Operational Mode 3. Generally, installations under Operational Mode 2 can be accomplished without a panel upgrade, so long as the storage device adds no new peak load to the panel.

3) Study Process for Operational Mode 3 (Unrestricted Charging):

Existing and Unmodified Service Panels

Applicants requesting the ability to charge storage devices at any time, regardless of other site loads, will be treated as new added load to the PG&E system. This net incremental increase in peak load demand is subject to the existing Electric Rules 2, 3, 15, and 16, which govern how PG&E provides service to new load.

If the Applicant proposes to add new charging load without modifying their existing service panel, PG&E considers this a notification of added load per Rule 3, and will perform a Charging Load Review to ensure that all primary and secondary voltage facilities serving the project are adequate.

With the complete Interconnection Request, the assigned IM will notify Applicant of the need for a Charging Load Review. Applicant will be responsible for submitting a separate Application for Service through the Your Projects application portal to initiate the Charging Load Review. See Figure 4: Technical Study Process Details for the sequence of steps.

Please note that the Charging Load Review, nor any associated mitigation

requirements, will delay Permission to Operate for a Rule 21 generating facility. However, it is the customer's responsibility to obtain energy storage load study results and complete any Rule 16 required mitigation work before charging from the grid.

Charging Load Review for secondary/service facilities should be expected to require up to 30 business days when no field visit is necessary to obtain the requisite technical detail for impact assessment. When a field visit is required to verify the capability of existing facilities, the Charging Load Review will require up to 60 business days.

Service Panel Upgrades, Panel Relocation, and New Service Panels

If the project includes a service panel upgrade, relocation, or a new service, then there are additional steps to address the complete service requirements. This includes a separate Application for Service, which will address—at the service and secondary level—both the charging load and the other service facility needs related to the panel. Applications for Service which include a new energy storage device must clearly identify its charging load, along with its other technical submittals.

PG&E will follow its established procedures for reviewing these types of applications. This procedure involves the local Service Planning team who will analyze the electric service facilities to meet the customer's site loads, including the storage facility. This local Service Planning Representative will also contact the Applicant directly regarding the service application and PG&E's electric service requirements and standards. This representative will also coordinate with local PG&E teams regarding PG&E design and construction requirements to accommodate the service application.

The charging load impacts at the primary level (including distribution circuit and substation impacts) will be evaluated concurrently to determine the complete

requirements for the project. In addition to these two studies, PG&E will also review the discharging operations of the storage facility under Rule 21.

4. Further Resources

- Electric Rules (See especially Rules 2, 3, 15, 16, and 21.):
<http://www.pge.com/tariffs/>.
- PG&E Gas and Electric Service Requirements, “Greenbook”:
https://www.pge.com/en_US/business/services/building-and-renovation/overview/greenbook-manual-online/greenbook-manual-online.page?WT.mc_id=Vanity_greenbook.
- PG&E Distribution Interconnection Handbook:
https://www.pge.com/en_US/business/services/alternatives-to-pge/generate-your-own-power/distributed-generation/distribution-handbook.page.
- Your Projects application portal: <https://yourprojects-pge.com/login>
- PG&E Building and Renovation Service Center:
https://www.pge.com/en_US/residential/customer-service/home-services/renovating-and-building/renovation-and-building.page.

Access to required and other applicable PG&E forms:

- Application for interconnection (required) PG&E Form #79-1174-03 (Sections A-N): <https://www.pge.com/tariffs/index.page>
- Interconnection Agreement (required) PG&E Form # 79-1220, or 79-1069 (as applicable):
https://www.pge.com/tariffs/assets/pdf/tariffbook/ELEC_FORMS_79-1220.pdf or
http://www.pge.com/tariffs/tm2/pdf/ELEC_FORMS_79-1069.pdf.
- Special Facilities Agreement (subject to review and determination if modification to PG&E’s electric system is triggered by the installation of the storage facility). PG&E Form 79-280: http://www.pge.com/tariffs/tm2/pdf/ELEC_FORMS_79-280.pdf.
- Rule 16 contract (subject to review and determination that service upgrade is required as a result of customer upgrading its service panel or if the installation of the storage system is a part of a new service connection). PG&E Form 79-1018: http://www.pge.com/tariffs/tm2/pdf/ELEC_FORMS_79-1018.pdf.

5. Key Terms

- Applicant – Designated representative for the application for interconnection.
- Application for Interconnection – PG&E on-line form completed by all customers who are seeking to operate storage facilities in parallel with PG&E's Electric System. These applications are submitted to PG&E's Generation Interconnection Services group, EGI.
- Application for Service – PG&E on-line form completed by all customers who are modifying their electric service panel, or new load customers connecting to PG&E's Electric System. These applications are submitted through PG&E's BRSC.
- Charging Load Review – The review of charging aspects performed by the PG&E Distribution Planning or Service Planning groups. They will review the impact to the Service Facilities and Distribution System as a result of the charging operations of the storage facility. This will determine what modifications to the Service Facilities or Distribution System are necessary to accommodate the load characteristics of the storage facility. Subsequently, detailed estimating will be performed for any new service or panel upgrade to properly size new Service Facilities, estimate revenue from the additional load, define cost responsibilities, and produce a Rule 16 line extension contract.
- Cursory Review – A provision where storage facilities that meet a certain size threshold will avoid a Load Assessment and Charging Load Review: PG&E distribution system voltage = 4 kV; < 50 kVA, or PG&E distribution system voltage = 12 kV or 21 kV; < 200 KVA. Storage facilities qualifying for this provision still go through a Rule 21 Review.
- Distribution Planning – Local PG&E Engineers who are responsible for the design of the local Distribution System.
- Distribution System – as defined in PG&E Rule 21: All electrical wires, equipment, and other facilities owned or provided by Distribution Provider, other than Interconnection Facilities or the Transmission System, by which Distribution Provider provides Distribution Service to its Customers.
- EGI (PG&E Electric Grid Interconnection Services Department) – The department contains the single point of contact for managing the process to interconnect generators including storage facilities to PG&E's electric grid under Rule 21.

- Electric System or Electric Grid – All PG&E-owned and operated electrical facilities that make up customers' Service Facilities and PG&E's Distribution System (as defined in Rule 21).
- Interconnection Facilities (as defined in PG&E Rule 21) – The electrical wires, switches, and related equipment that is required in addition to the facilities required to provide electric Distribution Service to a Customer to allow Interconnection. Interconnection Facilities may be located on either side of the Point of Common Coupling as appropriate to their purpose and design. Interconnection Facilities may be integral to a Generating Facility or provided separately. Interconnection Facilities may be owned by either Producer or Distribution Provider.
- Interconnection Manager (IM) – Designated PG&E employee to act as single point of contact for the Rule 21 generator interconnection process.
- Operating Mode – One of three modes of operating of a storage facility: No Grid Charging, Peak Shaving and Unrestricted Charging.
- Rule 16 Contract ("Line Extension Contract") – Standard Form approved by the CPUC to be signed by Applicants when there is a new Service Facility installation or when the Applicant upgrades their electric service panel.
- Electric Rule 21 or "Rule 21" – Tariffed PG&E Rule describing interconnection requirements for generators including storage systems.
- Rule 21 Review – PG&E review of the protective functions and storage electric characteristics to determine impact of its operation on the Distribution System. This review includes Initial Review, and more detailed reviews as prescribed in Rule 21. These studies analyze the operation of generating facilities, including storage facilities, for voltage, flicker, short circuit duty, etc., as prescribed in Rule 21.
- Service Facilities – Wires, transformers, etc., used to deliver electric service from PG&E's Distribution System to the customers electric service panel.
- Service Planning – Local PG&E group consisting of Project Coordinators and Estimators who work with Applicants who are seeking gas and electric service connections.
- System Protection – PG&E Protection Engineers responsible for the operating characteristics of the Distribution System.

6. Guide Revision Process

This portion of the Guide describes the process PG&E follows to update the contents of this Guide.

The objectives of the Guide Revision Process are:

1. Create a forum for PG&E and stakeholders to provide input and foster understanding of the respective viewpoints regarding the Guide.
2. Communicate participants' proposals, positions and options in a transparent manner.
3. Document PG&E's revisions to the Guide, including feedback from stakeholder comments.
4. Describe the communication protocol among all parties participating in revisions of the Guide, including the use of tools like e-mail, meetings, conference calls, and the exchange of written documents.
5. Describe the steps of the Guide Revision Process.

A list of interested parties with e-mail contact information will be maintained by PG&E for purposes of notices pertaining to this Guide. Initially, this list will be composed of the parties on the Rulemaking 11-09-011 Service List.

Any party may add themselves to the Guide Mailing List by e-mailing their contact information to the designated inbox (see next section).

a. Submittal of a Proposed Revision Request (PRR)

A request to make any change to the Guide, including any addition, edit, deletion, revision, or clarification, must be initiated by submittal of a Proposed Revision Request (PRR) to PG&E at Rule21Gen@pge.com.

The PRR shall include the following information:

1. Description of requested revision;
2. Reason for the suggested change (including a statement of why the change/revision is important);
3. Impacts and benefits of the suggested change on the Rule 21 customers to which this Guide applies;
4. List of section(s) and subsection(s) of the Guide affected by the PRR;
5. General administrative information regarding the requester (organization, contact name, etc.); and

6. Suggested language for the requested revision.

b. PRR Review and Comment

Once a PRR is submitted, PG&E reviews the PRR for accuracy, completeness and applicability. PG&E may contact the Guide Change Requester to clarify the PRR or to request any additional supporting documentation.

Based on the scope of the PRR, and the reasons or documentation supporting it, the PG&E can either: (a) accept the PRR for review; or (b) reject the PRR. If the PRR is rejected, PG&E will communicate to the Guide Change Requester the reasons why the PRR has been rejected.

c. Guide Change Stakeholder Review Meeting to Discuss PRR

PG&E will convene a Guide Change Stakeholder Review Meeting on an as-needed basis, and up to two per year, to discuss pending PRRs with all interested stakeholders. Notice of this meeting will be given to the Guide Mailing List 1 business days prior. PG&E may also schedule special meetings if circumstances require expedited consideration or additional discussion time. For purposes of efficiency for all parties, stakeholder involvement with this Guide may be scheduled concurrently with stakeholder involvement activities for other aspects of Rule 21.