

Issues, Priorities and Recommendations
for Energy Storage Interconnection

Staff Proposal

July 18, 2014

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I. Summary

This document outlines the issues that need to be addressed in the interconnection process to modify Electric Tariff Rule 21 to reduce barriers to deployment and integration of energy storage facilities in support of the policies of the State of California.¹ The goal of the California Public Utilities Commission (CPUC) Interconnection Proceeding, Rulemaking (R.) 11-09-011, is to promote timely, non-discriminatory, cost-effectively, transparent interconnection of new facilities to the grid.² The purpose of this document is to identify storage-related interconnection issues, to establish a prioritization of these issues and to establish an initial record for consideration within the Rule 21 Rulemaking.

The topics to be addressed may require tariff modification and/or changes to utility interconnection processes. This document will support the development of a record about the following topics: the establishment of a storage safety plan; standardizing the storage interconnection terms and concepts for insertion into the definitions section of Rule 21; identifying the Fast Track threshold and Fast Track study screens applicable to energy storage; and discussing other identified aspects of the interconnection process that require further refinement in order to achieve the goals of the proceeding.

This proposal is not a decision, and it does not speak for the CPUC. Instead, the review of issues and recommendations is intended to elicit comments in order to inform and help the CPUC make its decisions. If there are errors and omissions in various parts of the Staff document, parties' comments will clarify and improve the record.

II. Background

In 2010, California Assembly Bill 2514 (Skinner, 2010) opened the door for energy storage in California, stating that utilizing energy storage systems could help with grid optimization, the integration of distributed generation resources as well as reduction of greenhouse gas emissions.³

The CPUC determined, in R.10-12-007, that it is appropriate to set energy storage procurement targets for each investor owned utility, and identified a lack of appropriate interconnection policies as one of the major barriers toward the deployment of storage.⁴ In 2013, the CPUC adopted an energy storage procurement framework and established a target of 1,325 MW of energy storage to be procured by Pacific Gas and Electric Company (PG&E), Southern California Edison Company (SCE), and San Diego Gas and Electric Company (SDG&E) by 2020, with solicitations starting in December 2014 and installations required no later than the end of 2024.

¹ The recent California Public Utilities Commission Decision 13-10-040, October. 17, 2013, set storage goals for the utilities.

² Order Instituting Rulemaking 11-09-011, September 27, 2011.

³ Bill 2514 (Skinner, 2010)

⁴ Staff Phase 2 report and proposals in R. 10-12-007, p. 25.

Separately, in the Long Term Procurement Plan (LTPP) proceeding, the CPUC directed to SCE and SDG&E to procure a minimum of 50 MW and 25 MW of storage, respectively, for Local Capacity Reliability needs. SDG&E is seeking approval for its storage procurement framework, as required by D. 13-10-040, the CPUC's Decision adopting the energy storage framework and design program.⁵

The interconnection process has been identified as a barrier to integrating storage facilities into the grid despite procurement and policy intentions.⁶ This document addresses a number of the interconnection issues that should be investigated to determine how CPUC jurisdictional Electric Tariff Rule 21 could be updated to streamline interconnection of storage facilities to the distribution grid.

The California Independent System Operator (CAISO) is responsible for Federal Energy Regulatory Commission (FERC) jurisdictional interconnection tariff called the Wholesale Distribution Access Tariff (WDAT).⁷ The WDAT and Rule 21 interconnection are substantially similar to ensure compatibility between federal and state interconnection processes.⁸

The CAISO, in collaboration with the CPUC and the California Energy Commission (CEC), is concurrently developing a Storage Roadmap to assist in formally delineating the proper jurisdiction to resolve a number of cross-jurisdictional storage and interconnection related issues.⁹ CAISO has also opened a Storage Interconnection stakeholder process to ensure that storage-related interconnection issues at the transmission and wholesale level are addressed.¹⁰ Topics such as the lack of an applicable tariff enabling behind the meter storage facilities to directly access a future CAISO market, identification and valuation of storage services, and Rule 21 to WDAT interconnection request changeover issues should be taken into account and harmonized along the way.¹¹

The Interconnection Rulemaking, R. 11-09-011, was launched in September of 2011 to review the rules and regulations governing interconnecting generation and storage resources to the electric distribution systems, embodied in Rule 21.¹²

Four goals of the proceeding were described in the Order Instituting Rulemaking document:

- To review, and, if necessary, revise, Rule 21 to ensure that the interconnection process is timely, non-discriminatory, cost-effective, and transparent;
- To incorporate processes appropriate for new technologies, such as energy storage;

⁵ A. 14-02-006

⁶ R. 10-12-007, p. 7: the Order Instituting Rulemaking pursuant to Assembly Bill 2514 to consider the adoption of procurement targets for viable and cost-effective energy storage systems.

⁷ The three Investor Owned Utilities (IOUs) use different titles for their FERC-jurisdictional tariffs. SCE and SDG&E use "Wholesale Distribution Access Tariff" and PG&E uses "Wholesale Distribution Tariff." This document will refer to these tariffs as "WDAT."

⁸ D. 14-04-003, April 10, 2014, p. 31; D. 12-09-018, Sept. 13, 2012, p. 35-36 & COL #4 p. 59.

⁹ For more information, please see: <https://caiso-hc21.accellion.net/>

¹⁰ For more information, please see:

<http://www.caiso.com/informed/Pages/StakeholderProcesses/EnergyStorageInterconnection.aspx>

¹¹ For more information on the CAISO Roadmap efforts, see:

<http://www.caiso.com/informed/Pages/CleanGrid/EnergyStorageRoadmap.aspx>

¹² Order Instituting Rulemaking (OIR), 11-09-011, September 27, 2011.

- To revise Rule 21 to ensure compliance with certain statutory obligations, such as those contained in Pub. Util. Code § 399.20(e); and
- To provide a procedural forum for then-pending settlement efforts to address matters related to Rule 21. The Revised Rule 21 Settlement was approved by the Commission in 2012.¹³

The CPUC advanced these goals in adopting the Revised Rule 21 Settlement in 2012 in D. 12-09-019, September, 13, 2012, which updated Rule 21 for the modern era. More recently, the CPUC focused on streamlining the application process for interconnection applicants seeking interconnection services in the same electrical area by developing a Distribution Group Study in D. 14-04-003.¹⁴ This process will hopefully allow for more equitably sharing of interconnection costs across multiple projects in the same electrical area.¹⁵

Furthermore, the CPUC has ordered the utilities to commence interconnection process data reporting, quarterly, to improve everyone’s understanding of the interconnection process.¹⁶ This report is still in the development process.

Finally, the CPUC is committed to enabling smart inverters to assist with the integration of distributed generation on the distribution grid. The Smart Inverter Working Group’s Phase I autonomous inverter functionalities recommendations have been integrated into a draft Rule 21.¹⁷ The most recent Scoping Memo provided an initial procedural timeline for consideration of smart inverter communications recommendations.¹⁸

III. Topics for Consideration

Energy Division Staff has identified a number of topics, listed below, that are ready for CPUC consideration based on discussions with stakeholders, including utilities and storage developers.

The Rule 21 interconnection process is a standardized technical process that deals with the nuts and bolts of attaching a new device with various electrical characteristics to the distribution grid. The process initiates when an interconnection application is submitted. To date, Rule 21 has been used to interconnect generators to the grid in a standardized manner. Recently, storage devices have not received the benefits of a standardized interconnection process. Once the new technical issues related to storage are standardized and included in the interconnection tariff, storage projects should be able receive the benefits of a standardized interconnection process. This treatment will greatly facilitate the adoption rate of storage facilities.

¹³ D. 12-09-018, September 13, 2012.

¹⁴ April 10, 2014.

¹⁵ D. 14-04-003, April 10, 2014.

¹⁶ Public versions of the Quarterly Interconnection Data Report can be found at: <http://www.cpub.ca.gov/PUC/energy/Procurement/LTPP/rule21.htm>.

¹⁷ Joint Motion of PG&E, SCE, and SDG&E regarding Implementation of Smart Inverter Functionalities, July 18, 2014.

¹⁸ Assigned Commissioner’s Amended Scoping Memo and Ruling,” R. 11-09-011, May 13, 2014, p. 7. *See also*, a copy of the Smart Inverter Working Group’s Phase I “Recommendations for Updating Technical Requirements for Inverters in Distributed Energy Resources,” January 2014, can be found at: <http://www.cpub.ca.gov/PUC/energy/Procurement/LTPP/rule21.htm>.

The resolution of some of the topics identified in this document presents an opportunity for changes to interconnection rules that would better accommodate deployment of storage and other technologies in the changing distribution grid landscape. The topics identified are expected to necessitate text modifications to the Rule 21 Tariff, changes to utility interconnection processes, or both. Soliciting preliminary comment on them in the Rule 21 proceeding will help the CPUC focus on what items are actionable and ready for consideration.

This document will address the following topics in order of proposed priority:

1. Safety Planning
2. Pre-Interconnection Consultation Process
3. Define Storage Interconnection Terms and Concepts in the Definitions Section of Rule 21
4. Identify the Fast Track Threshold for Storage Projects and the Fast Track Study Screens for Storage Projects
5. Update the Interconnection Application to accommodate storage attributes
6. Update the Interconnection Agreement to account for storage attributes
7. Utility consideration of alternative interconnection metering and protection schemes
8. Electric Vehicle Interconnection Issues

1. Safety Planning

Storage technology is about to become a transformative aspect of the California electrical infrastructure. These new systems have novel safety issues. To ensure that we are ready from a safety perspective, a pinch of prevention is more valuable than a pound of cure, we must make sure that the utilities are engaged with applicants and the CPUC to create and maintain appropriate safety plans.

In a recent Commission decision on Net Energy Metering eligible storage systems, the issue of developing proper safety standards was addressed in a preliminary manner. The Commission ordered Safety Enforcement Division (SED) staff to work with Energy Division Staff and state-wide entities such as the Office of the State Fire Marshall and the Governor's Office of Planning and Research to develop a set of cohesive set of standards and practices to improve permitting and inspection by local authorities.¹⁹

As we move forward to include new storage technologies as permanent parts of the California infrastructure, utilities and regulators must be made aware of any and all safety issues and remediation techniques in advance of interconnection. Applicants, utilities and regulators must be prepared for the deployment and use of storage facilities.

The Interconnection Agreement should contain a requirement for a custom Safety Plan. A safety disclosure clause should be added to Rule 21 as a requirement of the interconnection process in the Interconnection Agreement Phase.

¹⁹ D. 14-05-033, May 15, 2014, pg. 30.

Applicants should submit to utilities a safety plan containing contingency plans and mitigation techniques as necessary. Utilities should coordinate with SED biannually to review such plans and to ensure that regulators are assured of utility preparedness.

- ❖ *Please provide comments on this proposed safety scheme meant to ensure safety for the people and environment of the State of California in a changing electrical environment. What elements should be part of the safety plan?*

2. Pre-Interconnection Consultation Process

New projects and new technologies *will* interconnect to the distribution grid.

In most cases, the interconnection process rules work well. New project configurations, however, call into question multiple areas within the utility: rates, tariffs, contracts, interconnection, metering, telemetry, and legal to name just some. New project configurations introduce novel challenges and projects can get stuck prior to interconnecting when rules cannot contort to fit new scenarios.

Energy Division Staff has recently been involved in multiple transactions where applicants have attempted to escalate problems to Energy Division mid-way through the interconnection process. Sorting out new project problems post interconnection application submission is inefficient, expensive, time consuming, and frustrating for the project in question and potentially applicants of later queued projects impacted by the project applicant's decisions.

The utilities should develop and promote an optional Advanced Interconnection Consultation Process to assist Applicants to determine the project details to be submitted to the interconnection process. Two types of analysis are expected: a determination of the rules as they stand today as well as a brainstorming exercise that proposes better process possibilities for the future. The utilities should proactively assist Applicants to determine and submit thoughtful interconnection requests for projects that will enhance the functionality of the distribution grid. The possibilities for this interaction should be examined in comments.

- ❖ *In comments, please delineate the expected services to be provided by this consultation process, the timeframe and format for the delivery of results, and any other recommendations on this collaborative process.*

3. Define Storage Interconnection Terms and Concepts in the Definitions Section of Rule 21

The Commission endorses the goal of harmonizing the interconnection processes defined by CPUC jurisdictional Electric Tariff Rule 21 and the FERC jurisdictional WDAT thus enabling the utilities to utilize a standardized process to interconnect facilities to the grid.²⁰ In order to do so, however, utility

²⁰ D. 14-04-003, April 10, 2014, p. 31; D. 12-09-018, Sept. 13, 2012, p. 35-36 & COL #4 p. 59.

interconnection staff and applicants need to rely upon the common language housed within the tariffs to communicate.

Terminology related to energy storage and interconnection must be determined, defined and added to the definitions section of Rule 21.²¹ Since the interconnection process must be standardized across all utilities²², the utilities should develop a storage-specific vocabulary in order to properly communicate with the CPUC, CAISO, stakeholders, and applicants.

It may be possible to reference the outcome of A.14-02-006, et.al, where clarification of the definition of storage is being considered in the context of procurement. Otherwise, parties should work cooperative to develop a common lexicon of useful terms. At a minimum, Rule 21 should recognize that aspects of storage devices are different from generators so that the tariff may require the interconnection study process to consider such characteristics.

- ❖ *In comments, please list the terms or concepts that require definition to be added to the Rule 21 Definitions section. Please also attempt to provide a working definition of the term or concept.*

4. Identify the Fast Track Threshold for Storage Projects and the Fast Track Study Screens for Storage Projects

A Fast Track Process threshold and appropriate Fast Track study screens for storage facilities should be determined and defined in Electric Tariff Rule 21 for increased process transparency. The threshold for generation devices to qualify for the Fast Track interconnection process varies by utility due to differences in grid conditions. The eligibility threshold for generators is 3 MW in PG&E and SCE territory and 1.5 MW in SDG&E territory.²³

In the absence of any Fast Track process for storage, Fast Track eligibility is unclear, leading to the frustration of many project applicants. The parameters (system size, configuration, load and discharge duration times) under which a storage facility may access the Fast Track process should be added to Rule 21 tariff in Section E.2.b.i: Interconnection Request Submission Process, Interconnection Request Process, Applicant Selects a Study Process, Fast Track Eligibility. The Fast Track threshold for storage facilities should be determined since it will simplify project screening and reduce workload for utilities. It will make the interconnection process more predictable for applicants.

The existing Rule 21 Fast Track process for generators requires that generating devices pass standardized study screens. There are no specified study screens identified, however, for the load-side/charging function a storage device. Therefore, in addition to system parameters, Fast Track study screens must be identified and delineated in the tariff in Rule 21 Section G. 1. Engineering Review

²¹ Rule 21, Section C

²² D. 12-09-18, September 13, 2012, p. 10, fn. 19.

²³ Rule 21 Sec. E.2.b.i: Interconnection Request Submission Process, Fast Track Eligibility.

Details, Initial Review Screens, and, if necessary, Rule 21 Section G. 2. Supplemental Review Screens. Defining study screens in an understandable manner is important for process transparency.

- ❖ *Please comment on the threshold parameters for a storage facility to access the Fast Track Process. Please also discuss the aspects of the storage facility that should be studied in a standardized way for Fast Track Study Screen development.*

Applicants wanting to interconnect storage facilities located behind the meter contend that these types of facilities should not be subject to the interconnection process at all since they modify load and do not export power onto the grid.²⁴

- ❖ *Please comment on the special case of “non-exporting” storage: What parameters and requirements should be considered to determine whether or not a storage device is “non-exporting”? What type of proof should be available to prove “non-exporting”? Should non-exporting storage devices be allowed to bypass the interconnection process entirely? Should some other process be required? If so, what?*

The Independent Study Process for larger and more complicated systems (i.e. Non-Fast Track Eligible) also requires scrutiny: utilities harbor distribution grid data in multiple databases and data channels. This data is collected and analyzed in order to determine how a new device will affect the energy flows on various distribution circuits. The tariff permits the utility to take 90 days to complete this load flow analysis. Technology exists today that can standardize various data streams and enable the same or more robust analyses for the same facilities, including smart inverter functionalities and voltage and frequency mitigation techniques, to be performed in a few minutes.

- ❖ *Please comment on the practicalities of reducing interconnection study times by standardizing study data and system characteristic into algorithms made accessible through a visual platform. Please describe the potential benefits and expected costs of instituting such technology advancement in utility interconnection departments.*

5. Update the Interconnection Agreement to Account for Storage Attributes

Currently, the Generator Interconnection Agreement²⁵ defines the interconnection agreement for an Applicant and the Utility. This document will likely be used to define the interconnection agreement for storage facilities. The tariff and the document should be technology neutral and should therefore be re-titled simply the “Interconnection Agreement.”

The Interconnection Agreement needs to be constructed to define agreement around, and accommodate, the unique attributes of storage facilities. While generators can export energy up to a maximum output, storage facilities have two functionalities: the charge and discharge mode. Discharge mode resembles the export of a traditional generator. Charging mode offers a different behavior and its

²⁴ Utilities engineers and testing teams use the Rule 21 Section L.7.a. Non-Exporting Test Procedures to bring generators online.

²⁵ Rule 21 Sec. 3.e.

parameters are not yet captured in an agreement. Both the charge and discharge functions can be programmed to behave at levels besides their maximum capacity.

These storage functions (or uses) can be permitted or restricted via settings. These settings can be created based on advice and guidance from utility experts who must analyze grid conditions at the point of common coupling. These setting could optimize the storage facility on the grid. Determining and developing these settings will need to be discussed and then become points of agreement that need to be captured in Interconnection Agreement. It may be beneficial to revisit the settings over time.

Storage developers will be financially responsible for distribution grid upgrades triggered by their facilities just as generator developers are. Generators trigger distribution grid upgrades based on their maximum potential export. A storage facility may be set so that the facility cannot perform a maximum export. This setting could be agreed to in contract. There are many possible options. Accordingly, if a storage facility utilizes setting and modifies its functional characteristics, for example in response to a consultation with a utility engineer's description of local grid conditions at the point of common coupling, the operationally restricted storage facility could therefore trigger a different (potentially lesser) set of interconnection upgrades.

No form currently describes the cost responsibility / use restriction balance potential or contains a way to contract utilizing use restrictions. This process requires discussion and needs to be captured in the Interconnection Agreement document.

- ❖ *Please comment on how might the utility and applicant best consult to determine the optimal storage facility settings and prevent an extended Interconnection Agreement negotiation phase when a variety of distribution grid upgrades and storage facility working parameters are discussed as possibilities.²⁶*
- ❖ *How best can the utility provide information to the applicant, and what type of information would be required at the conclusion of the study phase that would be most helpful to all parties in order to move smoothly into the Interconnection Agreement signing phase? Should study results reflect the possible high, mid and low level distribution upgrade costs and corresponding storage use restrictions or some other method?*
- ❖ *What type of penalties might accrue for operations outside of agreed-to use restrictions?*

6. Update the Interconnection Application to Accommodate Storage Attributes

²⁶ Utilities can provide information to a developer to enable full usage of the storage device, which could require extensive and expensive upgrades. Utilities can also provide information to a developer to utilize portions of the storage device without triggering any or minimal upgrades. Utilities can also provide information to developers that would balance limited storage operation with upgrade expenses landing somewhere in between.

Interconnection Applications must be updated to include a request to know storage system attributes. Standardized storage facility attributes and information should be collected via the Interconnection application Instead of a supplemental document.

Interconnection Applications for all facilities as modified to allow for storage should be standardized across the three IOUs since the data requested by each utility and used in each utility's interconnection process is substantially similar.²⁷

To maintain the integrity of the interconnection process, the utilities must ensure that all data required to interconnect a storage project is requested upfront, on the interconnection application, and not via iterative requests for preliminary information delaying the interconnection process.

All interconnection related documentation and forms should be received via an internet-based submission channel. All application materials should be received digitally to ensure the integrity of data and maximum interconnection process efficiency. All interconnection status information should be able to be checked by applicants electronically. The Interconnection Application and a corresponding process diagram should be posted prominently on the interconnection websites of the three utilities. The internet portal should be easily accessible and intuitive.

- ❖ *Please comment on the potential for utilizing the internet as the only submission channel for interconnection information, detail what information should be delivered to a utility on an interconnection request for a storage facility, provide any other recommendations for utilizing the interconnection application to maximizing the efficiency of the interconnection process. Should there be a single standard application?*

7. Utility Consideration of Alternative Interconnection Metering and Protection Schemes

Utilities rely on best practices and industry standards to ensure safety and reliability on the distribution grid. There can be disagreements among the utilities and between the utility and applicant regarding needs and requirements for interconnecting facilities to the grid in the areas of metering, disconnect requirements, and protection schemes. Safety may not be compromised.

Applicants are exploring novel ways of fitting generation and storage together in advanced technology systems. Applicants continually approach regulators requesting that we create new protocols to standardize protection schemes for the utilities and reduce the need to install additional safety components, thereby reducing overall project costs.

Recognizing that maintaining system reliability of service is a core function of the distribution utilities, the CPUC nonetheless also recognizes that policies can and should adapt to meet changing policy needs and accommodate new technologies. As technologies advance, so too must the utility's ability to evaluate the effectiveness and usability of new metering and protection schemes. Utilities

²⁷ D. 12-09-018, Sept. 13, 2012, p. 35-36 & COL #4 p. 59.

should determine a process for testing the capabilities of alternative protection schemas brought forth by Applicants.

The utilities should create an internal process and add this process as another option for Applicants.

- ❖ *Please discuss how an Applicant might trigger a “New Technology/ New Schema” Testing Process, what that process should be, the information that should be submitted to it, and how we might involve standard writing bodies to respond to changing needs in the energy industry. How can utility test labs be leveraged? Discuss how Applicants should present proof-of-concept evidence, including what type of evidence is necessary, when making a request that any party consider altering best practices.*

8. Electric Vehicle Interconnection Issues

Currently, Electric Vehicles (EVs) enjoy a waiver from the interconnection process under D. 13-06-014. The joint IOUs are currently performing EV load research to help parties and the CPUC understand the distribution grid upgrade costs associated with EVs and EV charging. This research process and waiver of distribution grid related upgrade costs for electric vehicles remains until 2016.

Since EVs behave similarly to storage, they might one day participate in demand response programs or other markets at some point. We should be cognizant that ideas that solidify in relation to storage could impact EVs after the current interconnection process waivers lift.

IV. Conclusion

The Commission has already determined in several forums that energy storage is expected to play an important role in helping meet state policies for greenhouse gas reduction, renewable energy integration and optimization of the grid.

Parties should use a numbering (outline) system when filing comments and reply comments in this proceeding. Although occasionally explicitly stated, the idea that “Parties should comment on the issues mentioned herein.” is implicit throughout the entire document. Additional or omitted issues may be added to the end of each related section, so long as they are within the scope of the question. Please provide tariff language where applicable and appropriate.