PUBLIC UTILITIES COMMISSION

505 VAN NESS AVENUE
SAN FRANCISCO, CA 94102-3298

November 14, 2022

Advice Letter 6678-E, 6678-E-A

Sidney Bob Dietz II
Director, Regulatory Relations
Pacific Gas and Electric Company
77 Beale Street
San Francisco, California 94177
E-mail: PGETariffs@pge.com

SUBJECT: Advice Letter Modifying Electric Rule 21 Pursuant to Resolution E 5172 and PG&E's Request for Extension of Time to Comply with D.20-09-035 Ordering Paragraphs 2 and 11 as Discussed in Resolution E-5172

Dear Mr. Dietz:

Pacific Gas and Electric Company Advice Letter 6678-E, 6678-E-A is effective as of November 4, 2022.

Sincerely,

Leuwam Tesfai

Leuwam Tesfai
Deputy Executive Director for Energy and Climate Policy/
Director, Energy Division
California Public Utilities Commission

Pacific Gas and Electric Company

Sidney Bob Dietz II
Director
Regulatory Relations

Pacific Gas and Electric Company
77 Beale St., Mail Code B13U
P.O. Box 770000
San Francisco, CA 94177

Fax : 415-973-3582

August 12, 2022

Advice 6678-E
(Pacific Gas and Electric Company ID U 39 E)

Public Utilities Commission of the State of California

Subject: **Advice Letter Modifying Electric Rule 21 Pursuant to Resolution E-5172 and PG&E's Request for Extension of Time to Comply with D.20-09-035 Ordering Paragraphs 2 and 11 as Discussed in Resolution E-5172.**

Purpose

Pacific Gas and Electric Company (PG&E) hereby submits this Tier 1 Advice Letter (AL) to modify Electric Rule 21 - *Generating Facility Interconnections* - in compliance with the California Public Utilities Commission (CPUC, Commission) Resolution E-5172,[1] *Approval, with Modifications, of utilities' Advice Letters seeking proposed modifications to Electric Rule 21 Tariff in Compliance with Decision 20-09-035, Ordering Paragraphs 2, 6, 11, 12, and 23 (Resolution E-5172 or Resolution)*, that are effective as of September 26, 2022, and also incorporating guidance the CPUC's granting of PG&E's *Request for Extension of Time to Comply with D.20-09-035 Ordering Paragraphs 2, 6, and 11 as Discussed in Resolution E-5172.*

Specifically, PG&E is modifying language related to Ordering Paragraphs (OP) 2 and 11 of Decision (D.) 20-09-035[2] (Working Group 2 and 3 Decision or Decision) pertaining to Screen M. This advice letter also includes a revision to Screen M recommended by the Interstate Renewable Energy Council (IREC) to align with Resolution E-5172.

Concurrent with this advice letter, PG&E is also submitting AL 6663-E-A with an effective date of August 7, 2022, to address revisions for which the Commission did not grant an extension.

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1 CPUC Resolution E-5172 - Date of Issuance June 23, 2022 – *Approval, with Modifications, of utilities' Advice Letters seeking proposed modifications to Electric Rule 21 Tariff in Compliance with Decision 20-09-035, Ordering Paragraphs 2, 6, 11, 12, and 23*

2 Decision 20-09-035 - Date of Issuance 9/30/2020 - *Decision Adopting Recommendations from Working Groups Two, Three, and Subgroup*

Background

Rulemaking 17-07-007 and Working Groups

On July 13, 2017, The Commission adopted Order Instituting Rulemaking (R.) 17-07-007 to consider refinements to Electric Tariff Rule 21 of PG&E, San Diego Gas & Electric Company (SDG&E), and Southern California Edison Company (SCE) (jointly, Utilities) regarding the interconnection of distributed energy resources.[3]

The October 2, 2017, *Scoping Memo of Assigned Commissioner and Administrative Law Judge* (Scoping Memo) set forth the scope and schedule of the proceeding, including establishment of the working group process, whereby resolution of the technical issues of the proceeding would be proposed by Working Groups One through Six.

CPUC Decision 20-09-035

The CPUC issued CPUC D. 20-09-035 on September 30, 2020, which modified each Utility's Electric Tariff Rule 21. At a high level, the Decision streamlined the interconnection process by incorporating the Integration Capacity Analysis results from R. 14-08-013, the Distribution Resources Plans proceeding, and also improving efficiency, transparency, certainty, and clarity.

AL 6014-E and AL 6014-E-A

On November 30, 2020, PG&E submitted Tier 2 AL 6014-E[4] 60 days after the issuance of D. 20-09-035, as ordered by that decision. That advice letter was protested. Supplemental AL 6014-E-A[5] was submitted June 25, 2021, addressing Ordering Paragraphs (OP) 1, 3, 4, 17 and 18, but OPs 2, 12, and 23 were not addressed there.

AL 5915-E

On January 28, 2021, PG&E submitted the original advice letter AL 5915-E 120 days after the issuance of D. 20-09-035, as ordered by that decision. That advice letter was protested.

AL 5915-E-A and IREC Protest

On September 3, 2021, PG&E submitted supplemental AL 5915-E-A addressing the unresolved OPs in advice letters AL 6014-E-A (the "60 day" supplemental) for OPs

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[3] The Rule 21 tariff describes the interconnection, operating, and metering requirements for certain generating and storage facilities seeking to connect to the electric distribution system. Rule 21 provides customers access to the electric grid to install generating or storage facilities while protecting the safety and reliability of the distribution and transmission systems at the local and system levels. (See R.17-07-007 at p2.)

[4] AL 6014-E *Advice Letter Modifying Electric Rule 21 Pursuant to Decision 20-09-035 for Working Group 2 and 3* (due 60 Days from Issuance)

[5] AL 6014-E-A - *Supplemental: Advice Letter Modifying Electric Rule 21 Pursuant to Decision 20-09-035 for Working Group 2 and 3 (due 60 Days from Issuance*

2,12, and 23 and AL 5915-E (the "120 days" AL) addressing additional change to OPs 5, 6, 8 and 11. This AL was subsequently protested by IREC on September 10, 2021. The joint IOUs submitted a protest response on September 17, 2021. This advice letter incorporated changes the utilities agreed to make in that protest response, based on guidance from Energy Division.

AL 5915-E-B

On November 4, 2021, PG&E submitted supplemental AL 5915-E-B[6], adopting changes PG&E agreed to make in its protest response to IREC's protest of PG&E Advice Letter 5915-E-A.

Resolution E-5172

On June 28, 2022, the CPUC issued Resolution E-5172, approving, with modifications, PG&E's AL 5915-E-B. The CPUC further directed PG&E to file a Tier 1 compliance Advice Letter within 30 days to modify Electric Rule 21 Tariff in accordance with Resolution E-5172.

Advice Letter 6663-E and IREC's Comments

On July 25, 2022, PG&E submitted AL 6663-E,[7] making modifications identified in Resolution E-5172 to the tariffs submitted in AL 5915-E-B.

On August 1, 2022 IREC reached out to PG&E, indicating that they had found inconsistencies between PG&E's AL 6663-E and the language adopted by the Commission in Resolution E-5172 as it related to the flow chart and the Screen M and N language. IREC asked if PG&E would agree to revise the advice letter to match the language found in the Resolution.

PG&E's Request for an Extension and PG&E's Concurrent Advice Letter 6663-E-A

The Commission ordered in Resolution E-5172 that PG&E's AL 5915-E-B shall be in effect 45 days after approval of the Resolution. On July 26, 2022, PG&E submitted its *Request for Extension of Time to Comply with D.20-09-035 Ordering Paragraphs 2, 6, and 11 as Discussed in Resolution E-5172* (Request).

On August 9, 2022, the Commission's Executive Director granted the Request in part and rejected in part, extending the compliance period to September 26, 2022 to comply with Ordering Paragraph 7 of Resolution E-5172 and implement Ordering Paragraphs 2 and 11 of D.20-09-035.

Accordingly, this advice letter contains changes to PG&E's Rule 21 tariff in compliance with Resolution E-5172 with an effective date of September 26, 2022. Concurrently,

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[6] AL 5915-E-B – Second Supplemental: Advice Letter Modifying Electric Rule 21 Pursuant to Decision 20-09-035 for Working Group 2 and 3 (due 120 Days from Issuance) for Ordering Paragraphs 6 and 11.

[7] AL 6663-E *Advice Letter Modifying Electric Rule 21 Pursuant to Resolution E-5172*

PG&E is submitting Advice Letter 6663-E-A with revisions to PG&E's Rule 21 that are effective on August 7, 2022.

Overview

The ordering paragraphs in Resolution E-5172, as they relate to this Advice Letter, require:

> *"2. Pacific Gas and Electric, Southern California Edison, and San Diego Gas & Electric shall each file a Tier 1 compliance Advice Letter within 30 days to modify Electric Rule 21 Tariff in accordance with Ordering Paragraphs 3 through 6 below.*
>
> *3. Pacific Gas and Electric, Southern California Edison, and San Diego Gas & Electric shall modify Electric Rule 21: 1) to use the term "active power output" instead of the terms "real power production" and "real power output", and 2) use the term "ICA-SG 576 Profile" instead of the term "Generating ICA Profile."*
>
> *4. Pacific Gas and Electric, Southern California Edison, and San Diego Gas & Electric shall modify Electric Rule 21 Screen M and N tariff language using the exact language in Appendices A and B with no omissions, additions, or modifications of any kind.*

Therefore, based on all of the above, PG&E modifies the Rule 21 as discussed below.

Tariff Changes

Consistent with OPs 3 and 4 of Resolution E-5172, the following changes have been made to PG&E's Rule 21.

- Modifications throughout the Electric Rule 21 tariff to change terminology from "real power production" and "real power output" to "active power output";
- Modifications to Electric Rule 21 regarding Screen M to align with language in Resolution E-5172 Appendices A and B;

PG&E made additional revisions to the language as indicated by IREC, to align the language in PG&E's Rule 21 regarding Screen M with the language adopted by the Commission in Resolution E-5172. IREC recommended the following change:

Screen M:

- Change language on PGE AL Sheet 162 from "When ICA information is not available. . . " to "When ICA Values are not available. . ." ;

PG&E's changes from this AL will be denoted in the redlined tariff in pink.

For convenience of the reader, PG&E has included “track-change” or “redline” revisions of Rule 21 in Attachment 2. PG&E implemented the use of the “(P)” symbol for Electric Rule 21 to signify material subject to change under a pending advice letter. The redlines in Attachment 2 are color coded to the specific advice letter. See Attachment 2 cover sheet for more details.

Protests

Anyone wishing to protest this submittal may do so by letter sent electronically via E-mail, no later than September 1, 2022, which is 20 days after the date of this submittal. Protests must be submitted to:

CPUC Energy Division
ED Tariff Unit
E-mail: EDTariffUnit@cpuc.ca.gov

The protest shall also be electronically sent to PG&E via E-mail at the address shown below on the same date it is electronically delivered to the Commission:

Sidney Bob Dietz II
Director, Regulatory Relations
c/o Megan Lawson
E-mail: PGETariffs@pge.com

Any person (including individuals, groups, or organizations) may protest or respond to an advice letter (General Order 96-B, Section 7.4). The protest shall contain the following information: specification of the advice letter protested; grounds for the protest; supporting factual information or legal argument; name and e-mail address of the protestant; and statement that the protest was sent to the utility no later than the day on which the protest was submitted to the reviewing Industry Division (General Order 96-B, Section 3.11).

Effective Date

Pursuant to Resolution E-5172, this advice letter is submitted with a Tier 1 designation. In compliance with OP 7 of Resolution E-5172 and the CPUC’s granting of PG&E’s *Request for Extension of Time to Comply with D.20-09-035 Ordering Paragraphs 2, 6, and 11 as Discussed in Resolution E-5172*, this advice letter is requested to become effective September 26, 2022.

Notice

In accordance with General Order 96-B, Section IV, a copy of this advice letter is being sent electronically to parties shown on the attached list and the parties on the service list for R.17-07-007 (Rule 21). Address changes to the General Order 96-B service list should be directed to PG&E at email address PGETariffs@pge.com. For changes to any other

service list, please contact the Commission's Process Office at (415) 703-2021 or at Process_Office@cpuc.ca.gov. Send all electronic approvals to PGETariffs@pge.com. Advice letter submittals can also be accessed electronically at: http://www.pge.com/tariffs/.

/S/
Sidney Bob Dietz II
Director, Regulatory Relations

cc: Service List R.17-07-007
IREC, c/o Yochi Zakai, yzakai@smwlaw.com

Attachments:
Attachment 1 – Clean version of updated Rule 21 Tariff
Attachment 2 – Redline Tariff Revisions

California Public Utilities Commission

ADVICE LETTER SUMMARY

ENERGY UTILITY

MUST BE COMPLETED BY UTILITY (Attach additional pages as needed)

Company name/CPUC Utility No.: Pacific Gas and Electric Company (ID U39 E)

Utility type:
☑ ELC ☐ GAS ☐ WATER
☐ PLC ☐ HEAT

Contact Person: Kimberly Loo
Phone #: (415)973-4587
E-mail: PGETariffs@pge.com
E-mail Disposition Notice to: KELM@pge.com

EXPLANATION OF UTILITY TYPE
ELC = Electric GAS = Gas WATER = Water
PLC = Pipeline HEAT = Heat

(Date Submitted / Received Stamp by CPUC)

Advice Letter (AL) #: 6678-E

Tier Designation: 1

Subject of AL: Advice Letter Modifying Electric Rule 21 Pursuant to Resolution E 5172 and PG&E's Request for Extension of Time to Comply with D.20-09-035 Ordering Paragraphs 2 and 11 as Discussed in Resolution E-5172

Keywords (choose from CPUC listing): Compliance, Rule 21

AL Type: ☐ Monthly ☐ Quarterly ☐ Annual ☑ One-Time ☐ Other:

If AL submitted in compliance with a Commission order, indicate relevant Decision/Resolution #: Resolution E-5172, D.20-09-035

Does AL replace a withdrawn or rejected AL? If so, identify the prior AL: No

Summarize differences between the AL and the prior withdrawn or rejected AL:

Confidential treatment requested? ☐ Yes ☑ No

If yes, specification of confidential information:
Confidential information will be made available to appropriate parties who execute a nondisclosure agreement. Name and contact information to request nondisclosure agreement/ access to confidential information:

Resolution required? ☐ Yes ☑ No

Requested effective date: 9/26/22

No. of tariff sheets: 14

Estimated system annual revenue effect (%): N/A

Estimated system average rate effect (%): N/A

When rates are affected by AL, include attachment in AL showing average rate effects on customer classes (residential, small commercial, large C/I, agricultural, lighting).

Tariff schedules affected: See Attachment 1

Service affected and changes proposed[1]: N/A

Pending advice letters that revise the same tariff sheets: 5915-E-B

[1]Discuss in AL if more space is needed.

Clear Form

Protests and correspondence regarding this AL are to be sent via email and are due no later than 20 days after the date of this submittal, unless otherwise authorized by the Commission, and shall be sent to:

California Public Utilities Commission
Energy Division Tariff Unit Email:
EDTariffUnit@cpuc.ca.gov

Contact Name: Sidney Bob Dietz II, c/o Megan Lawson
Title: Director, Regulatory Relations
Utility/Entity Name: Pacific Gas and Electric Company

Telephone (xxx) xxx-xxxx:
Facsimile (xxx) xxx-xxxx:
Email: PGETariffs@pge.com

Contact Name:
Title:
Utility/Entity Name:

Telephone (xxx) xxx-xxxx:
Facsimile (xxx) xxx-xxxx:
Email:

CPUC
Energy Division Tariff Unit
505 Van Ness Avenue
San Francisco, CA 94102

Clear Form

Cal P.U.C. Sheet No.	Title of Sheet	Cancelling Cal P.U.C. Sheet No.
53938-E	ELECTRIC RULE NO. 21 GENERATING FACILITY INTERCONNECTIONS Sheet 72	50342-E
53939-E	ELECTRIC RULE NO. 21 GENERATING FACILITY INTERCONNECTIONS Sheet 73	50343-E
53940-E	ELECTRIC RULE NO. 21 GENERATING FACILITY INTERCONNECTIONS Sheet 161	51806-E
53941-E	ELECTRIC RULE NO. 21 GENERATING FACILITY INTERCONNECTIONS Sheet 162	51807-E
53942-E	ELECTRIC RULE NO. 21 GENERATING FACILITY INTERCONNECTIONS Sheet 202	51847-E
53943-E	ELECTRIC RULE NO. 21 GENERATING FACILITY INTERCONNECTIONS Sheet 204	51849-E
53944-E	ELECTRIC RULE NO. 21 GENERATING FACILITY INTERCONNECTIONS Sheet 205	51850-E
53945-E	ELECTRIC RULE NO. 21 GENERATING FACILITY INTERCONNECTIONS Sheet 207	51852-E
53946-E	ELECTRIC RULE NO. 21 GENERATING FACILITY INTERCONNECTIONS Sheet 208	51853-E
53947-E	ELECTRIC RULE NO. 21 GENERATING FACILITY INTERCONNECTIONS Sheet 209	51854-E
53948-E	ELECTRIC RULE NO. 21 GENERATING FACILITY INTERCONNECTIONS Sheet 213	51858-E
53949-E	ELECTRIC RULE NO. 21 GENERATING FACILITY INTERCONNECTIONS Sheet 223	51868-E
53950-E	ELECTRIC TABLE OF CONTENTS Sheet 1	53936-E
53951-E	ELECTRIC TABLE OF CONTENTS Sheet 20	53937-E

Ee. MODIFICATION TO INTERCONNECTED GENERATING FACILITIES

1. MODIFICATIONS TO EXISTING EQUIPMENT (D.19-03-013 - Type II)

Certain non-material modifications to existing facilities are permitted as described below in Tables Ee.1, 2 and 3. Modification requests shall incur any incremental fees as noted below. From the date of the proposed modification request is received, the Distribution Provider shall process the request within:

(a) ten (10) Business Days if no re-study is required

(b) twenty (20) Business Days if a re-study is required

Table Ee.1 – Replacing existing equipment

Description of Modification		Notification Required?	Interconnection request is required?	Proceed without PG&E approval?	Fee (See table E.1)
Replace equipment with exact same equipment type		No	No	Yes	n/a
Replace with "like-for-like,"[4] where: 1. system output does not exceed what is listed in the original interconnection agreement and 2. operating mode is not adjusted.		Yes	No	Yes	Modification Fee in E.1[1]
Replacement increases nameplate capacity of the system, but which employ inverter power controls that limit the active power output to the inverter listed size in the original agreement.	Increases nameplate to ≤100kw[2]	Yes	No	Yes	Modification Fee in E.1[1]
	Increases nameplate to >100kw and ≤ 110% of original capacity	Yes	No	Yes	Modification Fee in E.1[1] (T)
	Increase nameplate to > 100kw and > 110% of original capacity	No	Yes	No	E.1[3]
Replacing equipment such that the system capacity increases and no inverter power controls are employed to limit the active power output to the inverter listed size in the original agreement		No	Yes	No	E.1[3] (T)
All other scenarios		No	Yes	No	E.1

[1] See Modification Fees in Table E.1.
[2] For projects increasing capacity to less than or equal to 100 kilowatt (kW), pending the creation of certification schemes for inverter power controls (software/firmware) to limit export (per D. 19-03-013, OP6).
[3] "E.1" refers to applicable charges/fees in Rule 21 Table E.1 for a new application.
[4] Like-for-Like is defined in Section C.

(Continued)

Ee. Modification to Interconnected Generating Facilities (CONT'D.)

1. MODIFICATIONS TO EXISTING EQUIPMENT (D. 19-03-013 - Type II) (CONT'D.)

Table Ee.2 – Upgrading Inverter Firmware /Changing Inverter Characteristics

Description of Modification:	Notification Required?	Interconnection Request Required	Proceed without PG&E approval?	Fee (See table E.1)
Only performing upgrades to inverter firmware that do not affect grid interactions	No	No	Yes	n/a
Changing inverter operating characteristics.	No	Yes	No	E.1
All Other Scenarios	No	Yes	No	E.1

Table Ee.3 -- Adding Storage or Capacity

Description of Modification:		Notification Required?	Interconnection Request Required?	Proceed without PG&E approval?	Fee (See table E.1)
Adding storage capacity to an existing storage facility without changing inverter	Generator's maximum output based on its rated capacity[1]	Yes	No	Yes	$0
	Generator's maximum output based on its operational profiles[2]	Yes	No	Yes	Modification Fees in E.1
Adding storage to an existing generating facility that does not have storage.		No	Yes	No	E.1
Adding such that system capacity increases and no inverter power controls are employed to limit the active power output to the inverter listed size in the original agreement.		No	Yes	No	E.1
All Other Scenarios		No	Yes	No	E.1

(T)

[1] If the Commission determines that a generator's maximum output should be based on its rated capacity (per D. 19-03-013, OP6).
[2] If the Commission determines that operational profiles of systems should be used to determine system impacts D.19-03-013, (per OP6).

(Continued)

G. ENGINEERING REVIEW DETAILS (Cont'd.) (P)

1. INITIAL REVIEW SCREENS (Cont'd.)

m. Screen M: When ICA Values are available at the requested Point of Interconnection, the Distribution Provider shall compare the ICA Values to the Gross Nameplate Rating or typical PV Generation Profile.

For Interconnection Requests based on Gross Nameplate Rating: (P)

a. Is the Generating Facility aggregate Gross Nameplate Rating less than or equal to 90% of the lowest value in the ICA-SG 576 Profile? or (T)/(P) (P)

b. Is the Generating Facility aggregate Gross Nameplate Rating less than or equal to 90% of the lowest value in the ICA-OF 576 Profile? (T)/(P) (P)

If the response is "yes" to both a) and b), the Interconnection Request passes Screen M. (T) (T)

If the response is "no" to either a) or b), the Interconnection Request fails Screen M and must be evaluated under the Supplemental Review to determine mitigation requirements. (T)/(P) (P) (P)

For Interconnection Requests based on typical PV Generation Profile: (P)

a. Is the Generating Facility Generation Profile based on PVWatts® or equivalent less than or equal to 90% of the ICA-SG 576 value in any hour? or (T)/(P) (T)/(P) (P)

b. Is the Generating Facility Generation Profile based on PVWatts® or equivalent less than or equal to 90% of the ICA-OF 576 value in any hour? (T)/(P) (T)/(P) (P)

If the response is "yes" to both a) and b), the Interconnection Request passes Screen M. (T) (T)

If the response is "no" to either a) or b), the Interconnection Request fails Screen M and must be evaluated under the Supplemental Review to determine mitigation requirements. (T)/(P) (P) (P)

(Continued)

G. ENGINEERING REVIEW DETAILS (Cont'd.)

1. INITIAL REVIEW SCREENS (Cont'd.)

m. Screen M (Cont'd):

When ICA Values are not available at the requested Point of Interconnection, Screen M should be evaluated as follows: (T)/(L) (L)

Is the aggregate Generating Facility capacity on the Line Section less than 15% of Line Section peak load for all line sections bounded by automatic sectionalizing devices? (P/L)

- If Yes (pass), Initial Review is complete.
- If No (fail), Supplemental Review is required.

Significance:

1. Low penetration of Generating Facility capacity will have a minimal impact on the operation and load restoration efforts of Distribution Provider's Distribution System.

2. The operating requirements for a high penetration of Generating Facility capacity may be different since the impact on Distribution Provider's Distribution System will no longer be minimal, therefore requiring additional study or controls.

The purpose of this Screen is solely to identify if the Generating Facility needs additional study and is not intended as justification for limiting the penetration of generation on a line section.

2. SUPPLEMENTAL REVIEW SCREENS

The Supplemental Review consists of Screens N through P. If any of the Screens are not passed, a quick review of the failed Screen(s) will determine the requirements to address the failure(s) or that Detailed Studies are required. In certain instances, Distribution Provider may be able to identify the necessary solution and determine that Detailed Studies are unnecessary. Some examples of solutions that may be available to mitigate the impact of a failed Screen are:

1. Replacing a fixed capacitor bank with a switched capacitor bank.
2. Adjustment of line regulation settings.
3. Simple reconfiguration of the distribution circuit. (P/L)

(Continued)

Hh. SMART INVERTER GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS (Cont'd.) (P/L)

2. PREVENTION OF INTERFERENCE (Cont'd.)

f. Frequency

Distribution Provider controls system frequency, and the Generating Facility shall operate in synchronism with Distribution Provider's Distribution or Transmission System. Whenever Distribution Provider's Distribution or Transmission System frequency at the PCC varies from and remains outside normal (nominally 60 Hz) by the predetermined amounts set forth in Table H.2, the Generating Facility's Protective Functions shall cease to energize Distribution Provider's Distribution or Transmission System within the stated maximum trip time.

(i) Frequency Ride-Through Requirements

Smart Inverter based systems shall remain connected to the Distribution Provider's Distribution or Transmission System while the grid is within the frequency-time range indicated in Table Hh-.2, and shall disconnect from the electric grid during a high or low frequency event that is outside that frequency-time range.

The frequency values are shown in Table Hh.2. These values provide default interconnection system response to abnormal frequencies. The inverter shall disconnect by the default clearing times. In the high frequency range between 60.2 Hz and 61.5 Hz, or some other mutually agreed range, the Smart Inverter is (P/L)
permitted to reduce active power output until it ceases to export (T)/(P/L)
power by 61.5 Hz, or other frequency value mutually agreed (P/L)
between the generating facility operator and the Distribution Provider. Islands and microgrids may need different default frequency settings. (P/L)

(Continued)

Hh. SMART INVERTER GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS (Cont'd.) (P/L)

2. PREVENTION OF INTERFERENCE (Cont'd.)

g. Harmonics (Cont'd.)

Table Hh.3

Maximum harmonic current distortion in percent of current (I) [1,2]

Individual harmonic order, h (odd harmonics) [3]	h<11	11≤ h<17	17≤ h<23	23≤ h<35	35≤ h	Total demand distortion
Max Distortion (%)	4.0	2.0	1.5	0.6	0.3	5.0

[1] – IEEE1547-4.3.3

[2] – I = the greater of the maximum Host Load current average demand over 15 or 30 minutes without the GF, or the GF rated current capacity (transformed to the PCC when a transformer exists between the GF and the PCC).

[3] – Even harmonics are limited to 25% of the odd harmonic limits above.

h. Direct Current Injection

Smart Inverter should not inject direct current greater than 0.5% of rated output current into Distribution Provider's Distribution or Transmission System.

i. Fixed Power Factor

Producer shall provide adequate reactive power compensation on site to maintain the Smart Inverter power factor near unity at rated output or a Distribution Provider specified power factor in accordance with the following requirements:

(i) Default Power Factor setting: Absorbing reactive power at 0.95 lagging power factor.

(ii) Aggregate generating facility is greater than 15 kW: 1.0 +/- 0.15 (0.85 Lagging to 0.85 Leading) down to 20% rated power irrespective of active power output. (P/L) (T)

(Continued)

Hh. SMART INVERTER GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS (Cont'd.) (P/L)

2. PREVENTION OF INTERFERENCE (Cont'd.)

i. Fixed Power Factor (Cont'd.)

(iii) Aggregate generating facility is less than or equal to 15 kW: 1.0 +/- 0.10 (0.90 Lagging to 0.90 Leading) down to 20% rated power irrespective of active power output. (P/L)

(T)/(P/L)

(P/L)

j. Dynamic Volt/VAR Operations

The Smart Inverter shall be capable of operating dynamically within a power factor range of +/- 0.85 PF for larger (>15 kW) systems, down to 20% of rated active power, and +/- 0.9 PF for smaller systems (≤15 kW), down to 20% of rated active power, irrespective of active power output. This dynamic Volt/VAR capability shall be able to be activated or deactivated in accordance with Distribution Provider requirements. (P/L)

(T)/(P/L)

(P/L)

The Distribution Provider may permit or require the Smart Inverter systems to operate in larger power factor ranges, including in 4-quadrant operations for storage systems with the implementation of additional anti-islanding protection as determined by the Distribution Provider.

The Smart Inverter shall be capable of providing dynamic reactive power compensation (dynamic Volt/VAR operation) within the following constraints:

- The Smart Inverter shall be able to consume reactive power in response to an increase in line voltage, and produce reactive power in response to a decrease in line voltage.

- The ractive power provided shall be per the range irrespective of active power output, but the maximum reactive power provided to the system shall be as directed by the Distribution Provider. (P/L)

(T)/(P/L)

(P/L)

- Reduction of active power output is allowed to meet the required reactive power ranges. (T)/(P/L)

(P/L)

(Continued)

Hh. SMART INVERTER GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS (Cont'd.) (P/L)

2. PREVENTION OF INTERFERENCE (Cont'd.)

k. Ramp Rate Requirements

The Smart Inverter is required to have the following ramp controls for at least the following four conditions. These functions can be established by multiple control functions or by one general ramp rate control function. Ramp rates are contingent upon sufficient energy available from the Smart Inverter.

- Normal ramp-up rate: For transitions between energy output levels over the normal course of operation. The default value is 100% of maximum current output per second with a range of adjustment between 1% to 100%, with specific settings as mutually agreed by the Distributor Provider and the Producer.

- Connect/Reconnect Ramp-up rate: Upon starting to inject power into the grid, following a period of inactivity or a disconnection, the inverter shall be able to control its rate of increase of power from 1 to 100% maximum current per second. The default value is 2% of maximum current output per second, with specific settings as mutually agreed upon by the Distribution Provider and the Producer.

l. Frequency-Watt Requirements

This requirement will become mandatory for Generating Facilities utilizing inverter-based technologies for which an Interconnection Request is submitted on or after February 22, 2019, nine (9) months following the approval of the SunSpec Alliance Communication Protocol Certification Test Standard.

The utilization of this function is permissible under mutual agreement between the utility and the generating facility before the effective date. (P/L)

Smart Inverters shall reduce their active power output as a function of system frequency, in accordance with the following: (T)/(P/L)

- When system frequency exceeds 60.036 Hz, the active power output produced by the Smart Inverter shall be reduced by 50% of real power nameplate rating per hertz (5% of real power nameplate rating reduction per 0.1 hertz) (P/L)

(Continued)

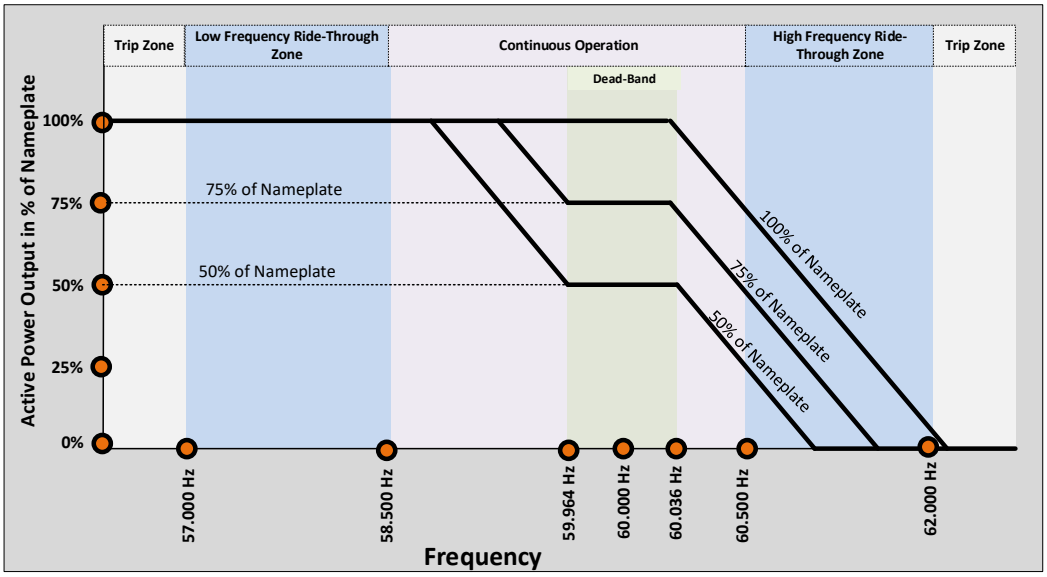
Hh. SMART INVERTER GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS (Cont'd.) (P/L)

2. PREVENTION OF INTERFERENCE (Cont'd.)

l. Frequency-Watt Requirements (Cont'd.)

- When system frequency moves under 59.964 Hz, the active power output produced by the Smart Inverter shall be increased by 50% of real power nameplate rating per hertz (5% of real power nameplate rating increase per 0.1 hertz) when inverter is capable of increasing active power output. (P/L)
- The default dead-band should be +/- 0.036 Hz from 60 Hertz (59.964 Hz to 60.036 Hz). When the system frequency is in range of 59.964 Hz and 60.036 Hz, the Smart Inverter is not required to decrease power as a function of system frequency. (T)/(P/L)
- Open loop response time for Frequency –Watt shall be 5 seconds. (P/L)
- Figure Hh-2 illustrated this requirement for three levels of output power. Figure Hh-2 is for illustration purposes only.

Figure Hh-2: Active Power as a Function of System Frequency



Note: the frequency markers on the horizontal axis are not drawn to scale. (P/L)

(Continued)

Hh. SMART INVERTER GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS (Cont'd.) (P/L)

2. PREVENTION OF INTERFERENCE (Cont'd.)

m. Voltage-Watt Default Settings Requirements

This requirement will become mandatory for Generating Facilities utilizing inverter-based technologies for which an Interconnection Request is submitted on or after February 22, 2019, nine (9) months following the approval of the SunSpec Alliance Communication Protocol Certification Test Standard.

The utilization of this function is permissible under mutual agreement between the utility and the generating facility before the effective date. (P/L)

Smart Inverters shall reduce their active power output as a function of measured voltage at the inverter terminals or at the Generating Facility Point of Common Coupling (PCC) in accordance with the following: (T)/(P/L)

- When the measured voltage is greater than 106% of nominal voltage (for example: 127.2 volts on a 120 volts nominal), the export of active power at the PCC or the production of active power by the Smart Inverter shall be reduced at a rate of 25% of active power nameplate rating per one percent of nominal voltage. Figure Hh-3 – Volt-Watt Requirements – illustrates the required rate of reduction. When export of active power is controlled, a certified inverter and control system shall be used. (P/L)

(Continued)

Hh. SMART INVERTER GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS (Cont'd.) (P/L)

2. PREVENTION OF INTERFERENCE (Cont'd.)

q. Load Shedding or Transfer

The voltage and frequency ride-through requirements of Hh.2.b.(ii) and Hh.2.f.(i) shall not apply if either: a) The real power across the Point of Common Coupling is continuously maintained at a value less than 10% of the aggregate rating of the Smart Inverters connected to the Generation Facility prior to any voltage disturbance, and the Generation Facility disconnects from the Distribution Provider's T&D system, along with Generation Facility load, such that the net change in real power flow from or to the Distribution Provider is less than 10% of the aggregate Smart Inverter capacity; or b) Generation Facility load real power demand equal to 90% to 120% of the pre-disturbance aggregate Smart Inverter active power output is shed within 0.1 seconds of Smart Inverter disconnection. (P/L) (T)/(P/L) (P/L)

3. TECHNOLOGY SPECIFIC REQUIREMENTS

Grid-interactive inverters do not require separate synchronizing equipment. Non grid-interactive or "stand-alone" inverters shall not be used for Parallel Operation with Distribution Provider's Distribution or Transmission System. (P/L)

(Continued)

Hh. SMART INVERTER GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS (Cont'd.) (P/L)

8. CONTROL THROUGH COMMUNICATION CAPABILITIES

a. The capability for these requirements will be mandatory for Generating Facilities utilizing inverter-based technologies for which an Interconnection Request is submitted on or after the earlier of the dates shown in the "Table of Phase 3 Effective Dates Pursuant to Resolution E-4898" in Section Hh.2.p.

The utilization of these functions is permissible under mutual agreement between the utility and the generating facility before the effective date.

Smart Inverters shall have the capabilities of accepting an operational controls through communications in accordance to the following:

(i) Cease to energize control command. When the Smart Inverter receives a cease-to-energize command through communication it must enter into a cease-to-energize state of operation or shall initiate the opening of the DER switch referenced in the ECP in order to galvanically isolate the DER system from the Distribution System

(ii) Return to service control command. When the Smart Inverter receives a return-to-service control command, the Smart Inverter may return to service operation as required by Generating Facility operator or as required by the scheduling control system as required by section H.6

(iii) Limit Active Power command. When the Smart Inverter receives a command to limit its production of real power, the Smart Inverter shall reduce its active power output to the specified percent of real power capacity of the Smart Inverter or to a specified real power value. (P/L) (T)/(P/L) (P/L)

(iv) Set Active Power Level Mode Function. The capability for this requirement will become mandatory for Generating Facilities utilizing inverter-based technologies for which an Interconnection Request is submitted twelve (12) months after approval of a nationally recognized standard that includes the function.

(v) Suspension of Active Power restriction. When the Smart Inverter receives a command to suspend the command for active power reduction, the Smart Inverter may return to normal operation as required by Generating Facility operator or as required by the scheduling control system as required by section H.6. (P/L)

(Continued)

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(Continued)

Advice 6678-E
August 12, 2022

Attachment 2

Redline Tariff Revisions

For convenience of the reader, PG&E has included redline revisions in Attachment 2. **These redline revisions only include redlined sheets that have been modified in this advice letter (AL 6678-E)**. Where Electric Rule 21 has been revised, the affected sheets are included in Attachment 1.

In this advice letter and accordance to CPUC General Order 96B, Section 9.5.3, PG&E has implemented the use of the "(P)" symbol to signify material subject to change under a pending advice letter. The redlines in Attachment 2 are color coded to the specific advice letter. The color coding is as follows:

Redline Text Color	Advice Letter	Subject	Comments
	5915-E-B	Second Supplemental: Advice Letter Modifying Electric Rule 21 Pursuant to Decision 20-09-035 for Working Group 2 and 3 (due 120 Days from Issuance) for Ordering Paragraphs 6 and 11	Approved with modifications by Resolution E-5172. This advice letter includes pending language that is not effective until September 26, 2022, as written in the CPUC'S granting PG&E's *Request for Extension of Time to Comply with D.20-09-035 Ordering Paragraphs 2, 6, and 11 as Discussed in Resolution E-5172*.
	6678-E	Advice Letter Modifying Electric Rule 21 Pursuant to Resolution E 5172 and PG&E's Request for Extension of Time to Comply with D.20-09-035 Ordering Paragraphs 2 and 11 as Discussed in Resolution E-5172	In this advice letter, revisions are made pursuant to Resolution E-5172 following the CPUC'S granting PG&E's *Request for Extension of Time to Comply with D.20-09-035 Ordering Paragraphs 2, 6, and 11 as Discussed in Resolution E-5172*. Revisions are also made as recommended by IREC.

ELECTRIC RULE NO. 21 Sheet 71
GENERATING FACILITY INTERCONNECTIONS

Ee. MODIFICATION TO INTERCONNECTED GENERATING FACILITIES

1. MODIFICATIONS TO EXISTING EQUIPMENT (D. 19-03-013 - Type II)
Certain non-material modifications to existing facilities are permitted as described below in Tables Ee.1, 2 and 3. Modification requests shall incur any incremental fees as noted below. From the date of the proposed modification request is received, the Distribution Provider shall process the request within:

   (a) ten (10) Business Days if no re-study is required

   (b) twenty (20) Business Days if a re-study is required

Table Ee.1 – Replacing existing equipment

Description of Modification		Notification Required?	Interconnection request is required?	Proceed without PG&E approval?	Fee (See table E.1)
Replace equipment with exact same equipment type		No	No	Yes	n/a
Replace with "like-for-like,"[4] where: 1. system output does not exceed what is listed in the original interconnection agreement and 2. operating mode is not adjusted.		Yes	No	Yes	Modification Fee in E.1[1]
Replacement increases nameplate capacity of the system, but which employ inverter power controls that limit the ~~real~~ active power output to the inverter listed size in the original agreement.	Increases nameplate to <100kw[2]	Yes	No	Yes	Modification Fee in E.1[1]
	Increases nameplate to >100kw and < 110% of original capacity	Yes	No	Yes	Modification Fee in E.1[1] (T)
	Increase nameplate to > 100kw and > 110% of original capacity	No	Yes	No	E.1[3]
Replacing equipment such that the system capacity increases and no inverter power controls are employed to limit the ~~real~~ active power output to the inverter listed size in the original agreement		No	Yes	No	E.1[3] (T)
All other scenarios		No	Yes	No	E.1

[1] See Modification Fees in Table E.1.
[2] For projects increasing capacity to less than or equal to 100 kilowatt (kW), pending the creation of certification schemes for inverter power controls (software/firmware) to limit export (per D. 19-03-013, OP6)
[3] "E.1" refers to applicable charges/fees in Rule 21 Table E.1 for a new application.
[4] Like-for-Like is defined in Section C.

(Continued)

Ee. Modification to Interconnected Generating Facilities (CONT'D.)

1. MODIFICATIONS TO EXISTING EQUIPMENT (D. 19-03-013 - Type II) (CONT'D.)

Table Ee.2 – Upgrading Inverter Firmware /Changing Inverter Characteristics

Description of Modification:	Notification Required?	Interconnection Request Required	Proceed without PG&E approval?	Fee (See table E.1)
Only performing upgrades to inverter firmware that do not affect grid interactions	No	No	Yes	n/a
Changing inverter operating characteristics.	No	Yes	No	E.1
All Other Scenarios	No	Yes	No	E.1

Table Ee.3 -- Adding Storage or Capacity

Description of Modification:		Notification Required?	Interconnection Request Required?	Proceed without PG&E approval?	Fee (See table E.1)
Adding storage capacity to an existing storage facility without changing inverter	generator's maximum output based on its rated capacity[1]	Yes	No	Yes	$0
	Generator's maximum output based on its operational profiles[2]	Yes	No	Yes	Modification Fees in E.1
Adding storage to an existing generating facility that does not have storage.		No	Yes	No	E.1
Adding such that system capacity increases and no inverter power controls are employed to limit the ~~real~~ active power output to the inverter listed size in the original agreement.		No	Yes	No	E.1 (T)
All Other Scenarios		No	Yes	No	E.1

[1] If the Commission determines that a generator's maximum output should be based on its rated capacity (per D. 19-03-013, OP6).
[2] If the Commission determines that operational profiles of systems should be used to determine system impacts D. 19-03-013, (per OP6).

(Continued)

G. ENGINEERING REVIEW DETAILS (Cont'd.) (P)

1. INITIAL REVIEW SCREENS (Cont'd.)

m. Screen M: When ICA Values are available at the requested Point of Interconnection, the Distribution Provider shall compare the ICA Values to the Gross Nameplate Rating or typical PV Generation Profile.

For Interconnection Requests based on Gross Nameplate Rating:

a. Is the Generating Facility aggregate Gross Nameplate Rating less than or equal to 90% of the lowest value in the ICA-SG 576 Profile? (P) (T)/(P)
or (P)

b. Is the Generating Facility aggregate Gross Nameplate Rating ~~greater than~~less than or equal to 90% of the lowest value in the ICA-OF 576 Profile? (P) (T) (P)

If the response is "yes" to both a) and b), the Interconnection Request passes Screen M. (T)/(P) (T)

If the response is "no" to either a) or b), the Interconnection Request fails Screen M and must be evaluated under the Supplemental Review to determine mitigation requirements. (T)/(P) (P)

For Interconnection Requests based on typical PV Generation Profile: (P

a. Is the Generating Facility Generation Profile based on PVWatts® or equivalent ~~greater than~~less than or equal to 90% of the ICA-SG 576 value in any hour? or (T)/(P) (T)/(P) (P)

b. Is the Generating Facility Generation Profile based on PVWatts® or equivalent ~~greater than~~less than or equal to 90% of the ICA-OF 576 value in any hour? (T)/(P) (T)/(P) (P)

If the response is "yes" to both a) and b), the Interconnection Request passes Screen M. (T)/(P) (T)

If the response is "no" to either a) or b), the Interconnection Request fails Screen M and must be evaluated under the Supplemental Review to determine mitigation requirements. (T)/(P) (P) (P)

(Continued)

G. ENGINEERING REVIEW DETAILS (Cont'd.)

1. INITIAL REVIEW SCREENS (Cont'd.)

m. Screen M (Cont'd):

When ICA Values are not available at the requested Point of Interconnection, Screen M should be evaluated as follows: (T)/(L) (L)

Is the aggregate Generating Facility capacity on the Line Section less than 15% of Line Section peak load for all line sections bounded by automatic sectionalizing devices? [ii] ~~(Cont'd.)~~

(P/L)
- If Yes (pass), Initial Review is complete.
- If No (fail), Supplemental Review is required.
(P/L)

~~When ICA information is not available at the requested Point of Interconnection, Screen M should be evaluated as follows:~~

Significance:

(P/L)
1. Low penetration of Generating Facility capacity will have a minimal impact on the operation and load restoration efforts of Distribution Provider's Distribution System.
(P/L)

2. The operating requirements for a high penetration of Generating Facility capacity may be different since the impact on Distribution Provider's Distribution System will no longer be minimal, therefore requiring additional study or controls.

The purpose of this Screen is solely to identify if the Generating Facility needs additional study and is not intended as justification for limiting the penetration of generation on a line section.

2. SUPPLEMENTAL REVIEW SCREENS

The Supplemental Review consists of Screens N through P. If any of the Screens are not passed, a quick review of the failed Screen(s) will determine the requirements to address the failure(s) or that Detailed Studies are required. In certain instances, Distribution Provider may be able to identify the necessary solution and determine that Detailed Studies are unnecessary. Some examples of solutions that may be available to mitigate the impact of a failed Screen are:

1. Replacing a fixed capacitor bank with a switched capacitor bank.

(Continued)

2. Adjustment of line regulation settings.

3. Simple reconfiguration of the distribution circuit.

[ii] ~~Inadvertent Export systems that meet the requirements specified in Section Mm are processed under Screen M as described in Section Mm.~~

(Continued)

Hh. SMART INVERTER GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS (Cont'd.)

2. PREVENTION OF INTERFERENCE (Cont'd.)

f. Frequency

Distribution Provider controls system frequency, and the Generating Facility shall operate in synchronism with Distribution Provider's Distribution or Transmission System. Whenever Distribution Provider's Distribution or Transmission System frequency at the PCC varies from and remains outside normal (nominally 60 Hz) by the predetermined amounts set forth in Table H.2, the Generating Facility's Protective Functions shall cease to energize Distribution Provider's Distribution or Transmission System within the stated maximum trip time.

(i) Frequency Ride-Through Requirements

Smart Inverter based systems shall remain connected to the Distribution Provider's Distribution or Transmission System while the grid is within the frequency-time range indicated in Table Hh-.2, and shall disconnect from the electric grid during a high or low frequency event that is outside that frequency-time range.

The frequency values are shown in Table Hh.2. These values provide default interconnection system response to abnormal frequencies. The inverter shall disconnect by the default clearing times. In the high frequency range between 60.2 Hz and 61.5 Hz, or some other mutually agreed range, the Smart Inverter is permitted to reduce ~~real~~ active power output until it ceases to export power by 61.5 Hz, or other frequency value mutually agreed between the generating facility operator and the Distribution Provider. Islands and microgrids may need different default frequency settings. (T)

(Continued)

Hh. SMART INVERTER GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS (Cont'd.)

2. PREVENTION OF INTERFERENCE (Cont'd.)

g. Harmonics (Cont'd.)

Table Hh.3

Maximum harmonic current distortion in percent of current (I) [1,2]

Individual harmonic order, h (odd harmonics) [3]	h<11	11≤ h<17	17≤ h<23	23≤ h<35	35≤ h	Total demand distortion
Max Distortion (%)	4.0	2.0	1.5	0.6	0.3	5.0

[1] – IEEE1547-4.3.3
[2] – I = the greater of the maximum Host Load current average demand over 15 or 30 minutes without the GF, or the GF rated current capacity (transformed to the PCC when a transformer exists between the GF and the PCC).
[3] – Even harmonics are limited to 25% of the odd harmonic limits above.

h. Direct Current Injection

Smart Inverter should not inject direct current greater than 0.5% of rated output current into Distribution Provider's Distribution or Transmission System.

i. Fixed Power Factor

Producer shall provide adequate reactive power compensation on site to maintain the Smart Inverter power factor near unity at rated output or a Distribution Provider specified power factor in accordance with the following requirements:

(i) Default Power Factor setting: Absorbing reactive power at 0.95 lagging power factor.

(ii) Aggregate generating facility is greater than 15 kW: 1.0 +/- 0.15 (0.85 Lagging to 0.85 Leading) down to 20% rated power irrespective of ~~Real Power Production~~active power output. (T)

(Continued)

Hh. SMART INVERTER GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS (Cont'd.)

2. PREVENTION OF INTERFERENCE (Cont'd.)

i. Fixed Power Factor (Cont'd.)

(iii) Aggregate generating facility is less than or equal to 15 kW: 1.0 +/- 0.10 (0.90 Lagging to 0.90 Leading) down to 20% rated power irrespective of ~~Real Power Production~~active power output. (T)

j. Dynamic Volt/VAR Operations

The Smart Inverter shall be capable of operating dynamically within a power factor range of +/- 0.85 PF for larger (>15 kW) systems, down to 20% of rated active power, and +/- 0.9 PF for smaller systems (≤15 kW), down to 20% of rated active power, irrespective of ~~Real Power Production~~active power output. This dynamic Volt/VAR capability shall be able to be activated or deactivated in accordance with Distribution Provider requirements. (T) (T)

The Distribution Provider may permit or require the Smart Inverter systems to operate in larger power factor ranges, including in 4-quadrant operations for storage systems with the implementation of additional anti-islanding protection as determined by the Distribution Provider.

The Smart Inverter shall be capable of providing dynamic reactive power compensation (dynamic Volt/VAR operation) within the following constraints:

- The Smart Inverter shall be able to consume reactive power in response to an increase in line voltage, and produce reactive power in response to a decrease in line voltage.
- The reactive power provided shall be per the range irrespective of ~~real power production~~active power output, but the maximum reactive power provided to the system shall be as directed by the Distribution Provide (T)
- Reduction of ~~real power production~~active power output is allowed to meet the required reactive power ranges. (T)

(Continued)

Hh. SMART INVERTER GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS (Cont'd.)

2. PREVENTION OF INTERFERENCE (Cont'd.)

k. Ramp Rate Requirements

The Smart Inverter is required to have the following ramp controls for at least the following four conditions. These functions can be established by multiple control functions or by one general ramp rate control function. Ramp rates are contingent upon sufficient energy available from the Smart Inverter.

- Normal ramp-up rate: For transitions between energy output levels over the normal course of operation. The default value is 100% of maximum current output per second with a range of adjustment between 1% to 100%, with specific settings as mutually agreed by the Distributor Provider and the Producer.

- Connect/Reconnect Ramp-up rate: Upon starting to inject power into the grid, following a period of inactivity or a disconnection, the inverter shall be able to control its rate of increase of power from 1 to 100% maximum current per second. The default value is 2% of maximum current output per second, with specific settings as mutually agreed upon by the Distribution Provider and the Producer.

l. Frequency-Watt Requirements

This requirement will become mandatory for Generating Facilities utilizing inverter-based technologies for which an Interconnection Request is submitted on or after February 22, 2019, nine (9) months following the approval of the SunSpec Alliance Communication Protocol Certification Test Standard.

The utilization of this function is permissible under mutual agreement between the utility and the generating facility before the effective date.

Smart Inverters shall reduce their ~~real power production~~active power output (T) as a function of system frequency, in accordance with the following: (T)

- When system frequency exceeds 60.036 Hz, the active power output produced by the Smart Inverter shall be reduced by 50% of real power nameplate rating per hertz (5% of real power nameplate rating reduction per 0.1 hertz)

(Continued)

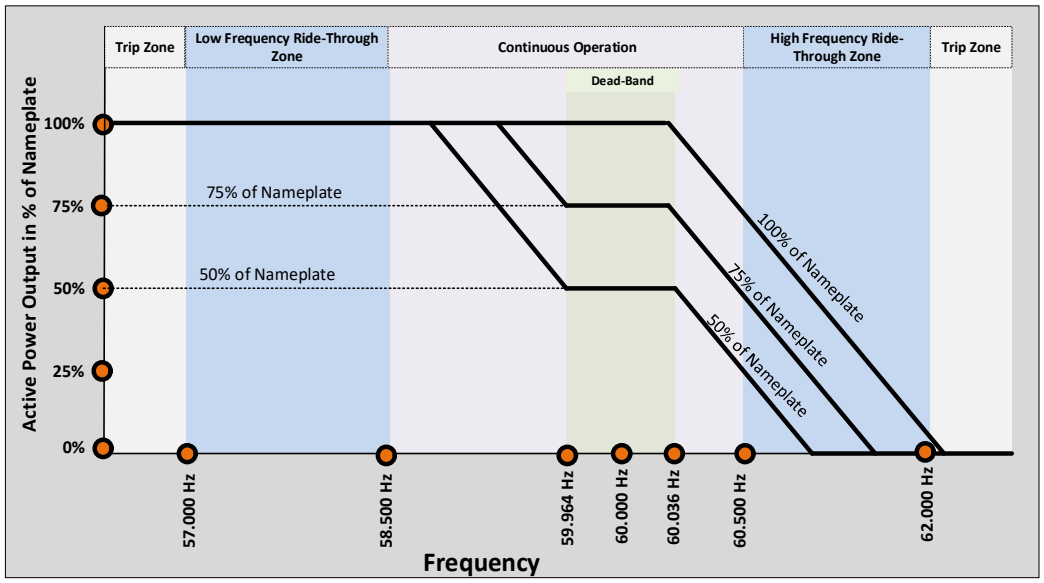
Hh. SMART INVERTER GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS (Cont'd.)

2. PREVENTION OF INTERFERENCE (Cont'd.)

I. Frequency-Watt Requirements (Cont'd.)

- When system frequency moves under 59.964 Hz, the active power output produced by the Smart Inverter shall be increased by 50% of real power nameplate rating per hertz (5% of real power nameplate rating increase per 0.1 hertz) when inverter is capable of increasing ~~real power production~~active power output. (T)
- The default dead-band should be +/- 0.036 Hz from 60 Hertz (59.964 Hz to 60.036 Hz). When the system frequency is in range of 59.964 Hz and 60.036 Hz, the Smart Inverter is not required to decrease power as a function of system frequency.
- Open loop response time for Frequency –Watt shall be 5 seconds.
- Figure Hh-2 illustrated this requirement for three levels of output power. Figure Hh-2 is for illustration purposes only.

Figure Hh-2: Active Power as a Function of System Frequency



Note: the frequency markers on the horizontal axis are not drawn to scale.

(Continued)

Hh. SMART INVERTER GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS (Cont'd.)

2. PREVENTION OF INTERFERENCE (Cont'd.)

m. Voltage-Watt Default Settings Requirements

This requirement will become mandatory for Generating Facilities utilizing inverter-based technologies for which an Interconnection Request is submitted on or after February 22, 2019, nine (9) months following the approval of the SunSpec Alliance Communication Protocol Certification Test Standard.

The utilization of this function is permissible under mutual agreement between the utility and the generating facility before the effective date.

Smart Inverters shall reduce their ~~real power production~~active power output (T) as a function of measured voltage at the inverter terminals or at the Generating Facility Point of Common Coupling (PCC) in accordance with the following: (T)

- When the measured voltage is greater than 106% of nominal voltage (for example: 127.2 volts on a 120 volts nominal), the export of active power at the PCC or the production of active power by the Smart Inverter shall be reduced at a rate of 25% of active power nameplate rating per one percent of nominal voltage. Figure Hh-3 – Volt-Watt Requirements – illustrates the required rate of reduction. When export of active power is controlled, a certified inverter and control system shall be used.

(Continued)

Hh. SMART INVERTER GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS (Cont'd.)

2. PREVENTION OF INTERFERENCE (Cont'd.)

q. Load Shedding or Transfer

The voltage and frequency ride-through requirements of Hh.2.b.(ii) and Hh.2.f.(i) shall not apply if either: a) The real power across the Point of Common Coupling is continuously maintained at a value less than 10% of the aggregate rating of the Smart Inverters connected to the Generation Facility prior to any voltage disturbance, and the Generation Facility disconnects from the Distribution Provider's T&D system, along with Generation Facility load, such that the net change in real power flow from or to the Distribution Provider is less than 10% of the aggregate Smart Inverter capacity; or b) Generation Facility load real power demand equal to 90% to 120% of the pre-disturbance aggregate Smart Inverter ~~real~~ active power output is shed within 0.1 seconds of Smart Inverter disconnection. (T)

3. TECHNOLOGY SPECIFIC REQUIREMENTS

Grid-interactive inverters do not require separate synchronizing equipment. Non grid-interactive or "stand-alone" inverters shall not be used for Parallel Operation with Distribution Provider's Distribution or Transmission System.

(Continued)

Hh. SMART INVERTER GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS (Cont'd.)

8. CONTROL THROUGH COMMUNICATION CAPABILITIES

a. The capability for these requirements will be mandatory for Generating Facilities utilizing inverter-based technologies for which an Interconnection Request is submitted on or after the earlier of the dates shown in the "Table of Phase 3 Effective Dates Pursuant to Resolution E-4898" in Section Hh.2.p.

The utilization of these functions is permissible under mutual agreement between the utility and the generating facility before the effective date.

Smart Inverters shall have the capabilities of accepting an operational controls through communications in accordance to the following:

(i) Cease to energize control command. When the Smart Inverter receives a cease-to-energize command through communication it must enter into a cease-to-energize state of operation or shall initiate the opening of the DER switch referenced in the ECP in order to galvanically isolate the DER system from the Distribution System

(ii) Return to service control command. When the Smart Inverter receives a return-to-service control command, the Smart Inverter may return to service operation as required by Generating Facility operator or as required by the scheduling control system as required by section H.6

(iii) Limit Active Power command. When the Smart Inverter receives a command to limit its production of real power, the Smart Inverter shall reduce its ~~real power production~~active power output to the specified percent of real power capacity of the Smart Inverter or to a specified real power value. (T)

(iv) Set Active Power Level Mode Function. The capability for this requirement will become mandatory for Generating Facilities utilizing inverter-based technologies for which an Interconnection Request is submitted twelve (12) months after approval of a nationally recognized standard that includes the function.

(v) Suspension of Active Power restriction. When the Smart Inverter receives a command to suspend the command for active power reduction, the Smart Inverter may return to normal operation as required by Generating Facility operator or as required by the scheduling control system as required by section H.6.

(Continued)

PG&E Gas and Electric
Advice Submittal List
General Order 96-B, Section IV

AT&T
Albion Power Company

Alta Power Group, LLC
Anderson & Poole

Atlas ReFuel
BART

Barkovich & Yap, Inc.
Braun Blaising Smith Wynne, P.C.
California Cotton Ginners & Growers Assn
California Energy Commission

California Hub for Energy Efficiency Financing

California Alternative Energy and Advanced Transportation Financing Authority
California Public Utilities Commission
Calpine

Cameron-Daniel, P.C.
Casner, Steve
Center for Biological Diversity

Chevron Pipeline and Power
City of Palo Alto

City of San Jose
Clean Power Research
Coast Economic Consulting
Commercial Energy
Crossborder Energy
Crown Road Energy, LLC
Davis Wright Tremaine LLP
Day Carter Murphy

Dept of General Services
Don Pickett & Associates, Inc.
Douglass & Liddell

East Bay Community Energy Ellison Schneider & Harris LLP
Engineers and Scientists of California

GenOn Energy, Inc.
Goodin, MacBride, Squeri, Schlotz & Ritchie
Green Power Institute
Hanna & Morton
ICF
International Power Technology

Intertie

Intestate Gas Services, Inc.
Kelly Group
Ken Bohn Consulting
Keyes & Fox LLP
Leviton Manufacturing Co., Inc.

Los Angeles County Integrated Waste Management Task Force
MRW & Associates
Manatt Phelps Phillips
Marin Energy Authority
McClintock IP
McKenzie & Associates

Modesto Irrigation District
NLine Energy, Inc.
NRG Solar

OnGrid Solar
Pacific Gas and Electric Company
Peninsula Clean Energy

Pioneer Community Energy

Public Advocates Office

Redwood Coast Energy Authority
Regulatory & Cogeneration Service, Inc.
SCD Energy Solutions
San Diego Gas & Electric Company

SPURR
San Francisco Water Power and Sewer
Sempra Utilities

Sierra Telephone Company, Inc.
Southern California Edison Company
Southern California Gas Company
Spark Energy
Sun Light & Power
Sunshine Design
Stoel Rives LLP

Tecogen, Inc.
TerraVerde Renewable Partners
Tiger Natural Gas, Inc.

TransCanada
Utility Cost Management
Utility Power Solutions
Water and Energy Consulting Wellhead Electric Company
Western Manufactured Housing Communities Association (WMA)
Yep Energy