PUBLIC UTILITIES COMMISSION

505 VAN NESS AVENUE
SAN FRANCISCO, CA 94102-3298

July 25, 2023

Advice Letter 6635-E-A/E-B/E-C

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: Modifications to Electric Tariff Rule 21 to Incorporate IEEE 1547.1-2020 Test Procedures into Testing Regime for Phase 2 and 3 Requirements in Compliance with Resolutions E-5000 and E 5036

Dear Mr. Dietz:

Pacific Gas and Electric Company Advice Letter 6635-E-A/E-B/E-C is effective as of August 29, 2023.

Sincerely,

Leuwam Tesfai

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

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

February 24, 2023

Advice 6635-E-B
(Pacific Gas and Electric Company ID U 39 E)

Public Utilities Commission of the State of California

Subject: **Second Supplemental - Modifications to Electric Tariff Rule 21 to Incorporate IEEE 1547.1-2020 Test Procedures into Testing Regime for Phase 2 and 3 Requirements in Compliance with Resolutions E-5000 and E-5036**

Purpose

Pacific Gas and Electric Company (PG&E) hereby submits this supplemental Tier 2 advice letter to propose additional modifications to PG&E's Electric Rule 21 (Rule 21) in furtherance of transitioning from UL1741SA to UL1741SB requirements and aligning with IEEE[1] 1547-2018 and IEEE 1547.1-2020 standards for inverter-based Generating Facilities, pursuant to California Public Utilities Commission (CPUC, or Commission) Resolutions E-5000 and E-5036.

This second supplemental advice letter supplements the original and previous supplemental ALs 6635-E-A in part, proposing revisions to Rule 21 to further align with the other IOUs'[2] language and make minor corrections. The revised tariff sheets are listed on Attachment A and are attached hereto.

Background

PG&E submitted AL 6635-E[3] on July 1, 2022 in compliance with CPUC Resolutions E-5000[4] and E-5036[5] to incorporate into Rule 21 a transition plan from UL1741SA

[1] Institute of Electrical and Electronics Engineers (IEEE)
[2] The Investor-Owned Utilities (IOUs) include, Pacific Gas and Electric Company (PG&E), Southern California Edison Company, and San Diego Gas & Electric Company (SDG&E).
[3] PG&E Advice Letter 6635-E, *Modifications to Electric Tariff Rule 21 to Incorporate IEEE 1547.1-2020 Test Procedures into Testing Regime for Phase 2 and 3 Requirements in Compliance with Resolutions E-5000 and E5036*, submitted July 1, 2022
[4] Resolution E-5000 - *Resolution E-5000. Clarifies smart inverter communications requirements in response to the Petition of the California Solar & Storage Association for Modification of Resolution E-4832 and Resolutions E-4898.*
[5] Resolution E-5036 - *Resolution E-5036. Clarifies the testing requirements for smart inverter Phase 2 communications and corrects a typographical error in Resolution E-5000.*

inverter requirements to new the UL1741SB requirements. PG&E later submitted AL 6635-E-A on July 20, 2022 to revise Rule 21 to further align with the other IOUs' language and to make minor corrections.

This Supplemental Advice Letter 6635-E-B

The CPUC Energy Division conducted its reviews of ALs 6635-E- and 6635-E-A, and identified areas for further revision to more closely align with IEEE 1547-2018 and also with the other IOUs' tariffs.

This supplemental includes revisions as noted below to further align with IEEE 1547-2018 and the other IOU's language, and to make minor corrections.

Proposed Tariff Changes

As discussed with the CPUC Energy Division, the following changes have been made to PG&E's Rule 21.

- Updating references from "IEEE 1547" to "IEEE 1547-2018" for clarity, wherever applicable, and also updating specific references to sections of IEEE 1547-2018 to add or correct their proper subsections (i.e. updating Section H.1.c. reference to "IEEE 1547-2018, 4.11" to add "IEEE 1547-2018, 4.11.3" or updating Section L.3.g's reference from "IEEE 1547-2018, 4.11.3" to "IEEE 1547-2018, 4.11.2");

- In Section B.5, "Applicability of IEEE 16547-2018 Requirements," updating references from "34.5 kV" to "50 kV" to align with Southern California Edison Company's and San Diego Gas & Electric Company's tariffs;

- In Section P.1.a, updating frequency ranges from "58.8 Hz" and "61.2 Hz" to "59.0 Hz" and "60.5 Hz," respectively, as discussed during the CPUC's Smart Inverter Working Group (SIWG);

- The following change to Section P.2.a, "Voltage Regulation"

  ~~The Generating Facility shall not~~ If approved by the Distribution Provider, the Smart Inverter may actively regulate the voltage at the PCC while in parallel with Distribution Provider's Distribution System. The ~~Generating Facility~~ Smart Inverter shall not cause the service voltage at other customers to go outside the requirements of ANSI C84.1-1995, Range A. (IEEE 1547-2018, 5.1)

- In Section P.2.t, replacing the word "Conservative" with "Consecutive";

- Minor changes to correct grammar, as applicable.

No cost information is required for this advice letter.

This advice letter will not increase any rate or charge, cause the withdrawal of service, or conflict with any other schedule or rule.

Protests

Pursuant to GO 96-B, General Rule 7.5.1., PG&E request to maintain the original protest and comment period designated in Advice Letter 6635-E and not reopen the protest period.

Effective Date

Pursuant to General Order (GO) 96-B, Rule 5.2, this advice letter is submitted with a Tier 2 designation. PG&E requests that this Tier 2 advice submittal become effective on regular notice on August 1, 2022, which was the proposed start date of the first phase of the proposed transition schedule described in Advice Letters 6635-E and 6635-E-A.

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, R. 11-09-011. 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

Attachments:
Attachment A: Tariff Sheets
Attachment B: Redline Tariff Revisions

cc: Service List R.17-07-007, R.11-09-011

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) #: 6635-E-B

Tier Designation: 2

Subject of AL: Second Supplemental: Modifications to Electric Tariff Rule 21 to Incorporate IEEE 1547.1-2020 Test Procedures into Testing Regime for Phase 2 and 3 Requirements in Compliance with Resolutions E-5000 and E 5036

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 #: Resolutions E-5000 and E-5036

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: 8/1/22

No. of tariff sheets: 13

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: 6682-E-A, 6757-E-A

[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.
55545-E	ELECTRIC RULE NO. 21 GENERATING FACILITY INTERCONNECTIONS Sheet 16	42313-E
55546-E	ELECTRIC RULE NO. 21 GENERATING FACILITY INTERCONNECTIONS Sheet 178	50841-E
55547-E	ELECTRIC RULE NO. 21 GENERATING FACILITY INTERCONNECTIONS Sheet 185	50848-E
55548-E	ELECTRIC RULE NO. 21 GENERATING FACILITY INTERCONNECTIONS Sheet 189	50852-E
55549-E	ELECTRIC RULE NO. 21 GENERATING FACILITY INTERCONNECTIONS Sheet 248	44414-E
55550-E	ELECTRIC RULE NO. 21 GENERATING FACILITY INTERCONNECTIONS Sheet 249	53022-E
55551-E	ELECTRIC RULE NO. 21 GENERATING FACILITY INTERCONNECTIONS Sheet 286	
55552-E	ELECTRIC RULE NO. 21 GENERATING FACILITY INTERCONNECTIONS Sheet 288	
55553-E	ELECTRIC RULE NO. 21 GENERATING FACILITY INTERCONNECTIONS Sheet 291	
55554-E	ELECTRIC RULE NO. 21 GENERATING FACILITY INTERCONNECTIONS Sheet 294	
55555-E	ELECTRIC RULE NO. 21 GENERATING FACILITY INTERCONNECTIONS Sheet 304	
55556-E	ELECTRIC TABLE OF CONTENTS Sheet 1	54809-E
55557-E	ELECTRIC TABLE OF CONTENTS Sheet 20	54834-E

B. APPLICABILITY (Cont'd.)

3. APPLICABLE CODES AND STANDARDS

This Rule has been harmonized with the requirements of Institute of Electrical and Electronic Engineers (IEEE) 1547-2018 Standards for Interconnecting Distributed Resources with Electric Power Systems. In some sections, IEEE 1547-2018 language has been adopted directly or by reference. In others, IEEE 1547-2018 requirements were interpreted and this Rule's language was changed to maintain the spirit of both documents. (T) (T) (T) (T)

(D)
(D)

The language from IEEE 1547-2018 that has been adopted directly or by reference (as opposed to paraphrased language or previous language that was determined to be consistent with IEEE 1547-2018) is followed by a citation that lists the clause from which the language derived. For example, IEEE 1547-2018, 4.1.1 is a reference to Clause 4.1.1. (T) (T) (T)

In the event of any conflict between this Rule, any of the standards listed herein, or any other applicable standards or codes, the requirements of this Rule shall take precedence.

4. RETAIL CUSTOMER ENERGY STORAGE DEVICES

For retail customers interconnecting energy storage devices pursuant to this Rule, the load aspects of the storage devices will be treated pursuant to Rules 2, 3, 15, and 16 just like other load, using the incremental net load for non-residential customers, if any, of the storage devices.

5. APPLICABILITY OF IEEE 1547-2018 REQUIREMENTS (N)

The system's voltage at Point of Interconnection (POI) will determine the required Generating Facility operating requirements. Where voltage at the Point of Interconnection is less than 50 kV, for applicable generation technology, IEEE 1547-2018 and related certification requirements are required. Where POI voltage is greater than or equal to 50 kV, the Distribution Provider's Interconnection Handbook will outline operating and performance requirements consistent with North American Electric Reliability Corporation (NERC) and CAISO operating requirements. (N)

(L)

(Continued)

H. GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS (Cont'd.)

1. GENERAL INTERCONNECTION AND PROTECTIVE FUNCTION REQUIREMENTS (Cont'd.)

c. Suitable Equipment Required (T)

Circuit breakers or other interrupting equipment located at the Point of Common Coupling (PCC) must be Certified or "Listed" (as defined in Article 100, the Definitions Section of the National Electrical Code) as suitable for their intended application. This includes being capable of interrupting the maximum available fault current expected at their location. Producer's Generating Facility and Interconnection Facilities shall be designed so that the failure of any single device or component shall not potentially compromise the safety and reliability of Distribution Provider's Distribution and Transmission System. The Generating Facility paralleling-device shall be capable of withstanding 220% of the Interconnection Facility rated voltage (IEEE 1547-2018, 4.11.3). The Interconnection Facility shall have the capability to withstand voltage and current surges in accordance with the environments defined in IEEE Std C62.41.2-2002 or IEEE Std C37.90.1-2002 as applicable and as described in L.3.e (IEEE 1547-2018, 4.11.2). (L) (L) (T) (T)

d. Visible Disconnect Required

When required by Distribution Provider's operating practices, Producer shall furnish and install a ganged, manually-operated isolating switch (or a comparable device mutually agreed upon by Distribution Provider and Producer) near the Point of Interconnection to isolate the Generating Facility from Distribution Provider's Distribution or Transmission System. The device does not have to be rated for load break nor provide over-current protection.

The device must:

i) allow visible verification that separation has been accomplished. (This requirement may be met by opening the enclosure to observe contact separation.)

ii) include markings or signage that clearly indicates open and closed positions.

iii) be capable of being reached:

a) for Emergency purposes quickly and conveniently 24 hours a day by Distribution Provider personnel for construction,

(Continued)

H. GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS (Cont'd.)

2. PREVENTION OF INTERFERENCE (Cont'd.)

e. Integration with Distribution Provider's Distribution System Grounding

The grounding scheme of the Generating Facility shall not cause over-voltages that exceed the rating of the equipment connected to Distribution Provider's Distribution System and shall not disrupt the coordination of the ground fault protection on Distribution Provider's Distribution System (IEEE 1547-2018, 4.12) (See Section G.1.i, line configuration). (T)

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.

(Continued)

H. GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS (Cont'd.)

3. TECHNOLOGY SPECIFIC REQUIREMENTS

a. Technology Specific Requirements

Three-Phase Synchronous Generators: For three phase Generators, the Generating Facility circuit breakers shall be three-phase devices with electronic or electromechanical control. Producer shall be responsible for properly synchronizing its Generating Facility with Distribution Provider's Distribution or Transmission System by means of either manual or automatic synchronous equipment. Automatic synchronizing is required for all synchronous Generators that have a Short Circuit Contribution Ratio (SCCR) exceeding 0.05. Loss of synchronism protection is not required except as may be necessary to meet Section H.2.d (Flicker) (IEEE 1547-2018, 7.2.3). Unless otherwise agreed upon by Producer and Distribution Provider, synchronous Generators shall automatically regulate power factor, not voltage, while operating in parallel with Distribution Provider's Distribution System. A power system stabilization Function is specifically not required for Generating Facilities under 10 MW Net Rating. (T)

b. Induction Generators

Induction Generators (except self-excited Induction Generators) do not require a synchronizing Function. Starting or rapid load fluctuations on induction Generators can adversely impact Distribution Provider's Distribution or Transmission System voltage. Corrective step-switched capacitors or other techniques may be necessary and may cause undesirable ferro-resonance. When these counter measures (e.g. additional capacitors) are installed on Producer's side of the PCC, Distribution Provider must review these measures. Additional equipment may be required as determined in a Supplemental Review or an Interconnection Study.

(Continued)

L. CERTIFICATION AND TESTING CRITERIA (Cont'd.)

3. TYPE TESTING (Cont'd.)

f. Synchronization Test

This test is applied to synchronous Generators, self-excited induction generators, and inverters capable of operating as voltage-source while connected to Distribution Provider's Distribution or Transmission System. The test is also applied to the resynchronization Function (transition from stand-alone to parallel operation) on equipment that provides such functionality. This test may not need to be performed on both the synchronization and re-synchronization functions if the manufacturers can verify to the satisfaction of the testing organization that monitoring and controls hardware and software are common to both functions. This test is not necessary for induction generators or current-source inverters. Instead, the ln-rush Current test Section L.3.d shall be applied to those generators.

This test shall demonstrate that at the moment of the paralleling-device closure, all three synchronization parameters in Table L.3 are within the stated limits. This test shall also demonstrate that if any of the parameters are outside of the limits stated in the table, the paralleling-device shall not close (IEEE 1547-2018, 4.10.4). The test will start with only one of the three parameters: (1) voltage difference between Generating Facility and Distribution Provider's Distribution or Transmission System; (2) frequency difference; or (3) phase angle outside of the synchronization specification. Verify that the Generating Facility is brought within specification prior to synchronization. Repeat the test five times for each of the three parameters. For manual synchronization with synch check or manual control with auto synchronization, the test must verify that paralleling does not occur until the parameters are brought within specifications. (T)

(Continued)

L. CERTIFICATION AND TESTING CRITERIA (Cont'd.)

3. TYPE TESTING (Cont'd.)

f. Synchronization Test (Cont'd.)

Table L.3
***Synchronization Parameter Limits* [1]**

Aggregate Rating of Generator Units (kVA)	Frequency Difference (Δf, Hz)	Voltage Difference Phase Angle (ΔV, %)	Difference (ΔΦ,°)
0-500	0.3	10	20
> 500-1,500	0.2	5	15
> 1,500-10,000	0.1	3	10

[1] – IEEE 1547-2018, 4.10.4 (T)

g. Paralleling Device Withstand Test

The di-electric voltage withstand test specified in Section L.1 shall be performed on the paralleling device to ensure compliance with those requirements specified in Section H.1.c (IEEE 1547-2018, 4.11.2). (T)

h. Backfeed Test

Non-Export AC/DC Converters must satisfy the requirements in its definition in Section C.

4. PRODUCTION TESTING

At a minimum, each interconnection system shall be subjected to Distribution Provider Voltage and Frequency Variation Test procedure described in UL1741 under Manufacturing and Production Tests, Section 68 and the Synchronization test specified in Section L.3.f. Interconnection systems with adjustable set points shall be tested at a single set of set points as specified by the manufacturer. This test may be performed in the factory or as part of a Commissioning Test (Section L.5).

(Continued)

P. SMART INVERTER GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS FOR UL1741SB INVERTERS (Cont'd) (N)

1. General Interconnection and Protective Function Requirements (Cont'd)

a. Protective Functions Required

Smart Inverters operating in parallel with Distribution Provider's Distribution or Transmission System shall be equipped with the following Protective Functions to sense abnormal conditions on Distribution Provider's Distribution or Transmission System and cause the Smart Inverter to be automatically disconnected from Distribution Provider's Distribution or Transmission System or to prevent the Smart Inverter from being connected to Distribution Provider's Distribution or Transmission System inappropriately:

(i) Over and under voltage trip functions and over and under frequency trip functions;

(ii) A voltage and frequency sensing and time-delay function to prevent the Smart Inverter from energizing a de-energized Distribution or Transmission System circuit and to prevent the Smart Inverter from reconnecting with Distribution Provider's Distribution or Transmission System unless Distribution Provider's Distribution System service voltage and frequency is within the ANSI C84.1-1995 Table 1 Range B voltage Range of 106 volts to 127 volts (on a 120 volt basis), inclusive, and a frequency range of 59.0 Hz to 60.5 Hz, inclusive, and are stable for at least 15 seconds; and

(iii) A function to prevent the Smart Inverter from contributing to the formation of an Unintended Island, and cease to energize Distribution Provider's Distribution System within two seconds of the formation of an Unintended Island.

The Smart Inverter shall cease to energize Distribution Provider's Distribution System for faults on Distribution Provider's Distribution System circuit to which it is connected (IEEE 1547-2018, 6.2.1). The Smart Inverter shall cease to energize Distribution Provider's Distribution circuit prior to re-closure by Distribution Provider's Distribution System equipment (IEEE 1547-2018, 6.3). (N)

(Continued)

P. SMART INVERTER GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS FOR UL1741SB INVERTERS (Cont'd) (N)

1. General Interconnection and Protective Function Requirements (Cont'd)

c. Suitable Equipment Required

Circuit breakers or other interrupting equipment located at the Point of Common Coupling (PCC) must be Certified or "Listed" (as defined in Article 100, the Definitions Section of the National Electrical Code) as suitable for their intended application. This includes being capable of interrupting the maximum available fault current expected at their location. Producer's Smart Inverter and Interconnection Facilities shall be designed so that the failure of any single device or component shall not potentially compromise the safety and reliability of Distribution Provider's Distribution and Transmission System. The Smart Inverter paralleling-device shall be capable of withstanding 220% of the Interconnection Facility rated voltage (IEEE 1547-2018, 4.11.3). The Interconnection Facility shall have the capability to withstand voltage and current surges in accordance with the environments defined in IEEE Std C62.41.2-2002 or IEEE Std C37.90.1-2002 as applicable and as described in L.3.e (IEEE 1547-2018, 4.11.2).

d. Visible Disconnect Required

When required by Distribution Provider's operating practices, Producer shall furnish and install a ganged, manually-operated isolating switch (or a comparable device mutually agreed upon by Distribution Provider and Producer) near the Point of Interconnection to isolate the Smart Inverter from Distribution Provider's Distribution or Transmission System. The device does not have to be rated for load break nor provide over-current protection.

The device must:

(i) allow visible verification that separation has been accomplished. (This requirement may be met by opening the enclosure to observe contact separation.)
(ii) Include markings or signage that clearly indicates open and closed positions.
(iii) be capable of being reached: (N)

(Continued)

P. SMART INVERTER GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS FOR UL1741SB INVERTERS (Cont'd) (N)

2. Prevention of Interference (Cont'd)

a. Voltage Regulation

If approved by the Distribution Provider, the Smart Inverter may actively regulate the voltage at the PCC while in parallel with Distribution Provider's Distribution System. Smart Inverter shall not cause the service voltage at other customers to go outside the requirements of ANSI C84.1-1995, Range A. (IEEE 1547-2018, 5.1)

b. Voltage Trip and Ride-Through Setting

The voltage ranges in Table P-1 define protective trip limits for the Protective Function and are not intended to define or imply a voltage regulation Function. Generating Facilities shall cease to energize Distribution Provider's Distribution System within the prescribed trip time whenever the voltage at the PCC deviates from the allowable voltage operating range. The Protection Function shall detect and respond to voltage on all phases to which the Generating Facility is connected.

i) Smart Inverters

Smart Inverters shall be capable of operating within the voltage range normally experienced on Distribution Provider's Distribution System from plus to minus 5% of the nominal voltage (e.g. 114 volts to 126 volts, on a 120 volt base), at the service panel or PCC. The trip settings at the generator terminals may be selected in a manner that minimizes nuisance tripping in accordance with Table P-1 to compensate for voltage drop between the generator terminals and the PCC. Voltage may be detected at either the PCC or the Point of Interconnection. However, the voltage range at the PCC, with the generator on-line, shall stay within +/-5% of nominal. (N)

(Continued)

P. SMART INVERTER GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS FOR UL1741SB INVERTERS (Cont'd) (N)

2. Prevention of Interference (Cont'd)

c. Paralleling

The Smart Inverter shall parallel with Distribution Provider's Distribution or Transmission System without causing a voltage fluctuation at the PCC greater than plus/minus 5% of the prevailing voltage level of Distribution Provider's Distribution or Transmission System at the PCC, and meet the flicker requirements of Section H.2.d. Section L, Certification and Testing Criteria, provides technology-specific tests for evaluating the paralleling Function. (IEEE 1547-2018, 4.10.4)

d. Flicker

The Generating Facility shall not create objectionable flicker for other Customers on Distribution Provider's Distribution or Transmission System. To minimize the adverse voltage effects experienced by other Customers, flicker at the P caused by the Generating Facility should not exceed the limits of IEEE 1547-2018, 7.2.3. This requirement is necessary to minimize the adverse voltage affects experienced by other Customers on Distribution Provider's Distribution or Transmission System. Generators may be connected and brought up to synchronous speed (as an induction motor) provided these flicker limits are not exceeded.

e. Integration with Distribution Provider's Distribution System Grounding

The grounding scheme of the Smart Inverter shall not cause over-voltages that exceed the rating of the equipment connected to Distribution Provider's Distribution System and shall not disrupt the coordination of the ground fault protection on Distribution Provider's Distribution System (IEEE 1547-2018, 4.12) (See Section G.1.i, line configuration). (N)

(Continued)

P. SMART INVERTER GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS FOR UL1741SB INVERTERS (Cont'd) (N)

2. Prevention of Interference (Cont'd)

s. Storage Inverter Normal Operation Ramp Control Requirements

Smart Inverters used for energy storage applications shall include ramp-up rate control. The default value shall be 100% of maximum current output per second or slower if required by Applicant. Other ramp-up control settings can be used, when required, as mutually agreed by the Distribution Provider and the Applicant.

t. Ride-through of Consecutive Voltage Disturbances

Ride-through of consecutive voltage disturbances shall be in accordance with IEEE 1547-2018, 6.4.2.5.

u. Restore output without dynamic voltage support

Restore output without dynamic voltage support shall be in accordance with IEEE 1547-2018, 6.4.2.7.1.

v. Transition between performance operating regions:

Transition between performance operating regions should be in accordance with IEEE 1547-2018, 6.4.2.7.3.

w. Constant Reactive Power Mode

When in this mode, the Smart Inverter shall maintain a constant reactive power. The target reactive power level and mode (injection or absorption) shall be specified by the Distribution Provider and shall be within the same range specified in IEEE 1547-2018 section 5.3.5. The reactive power settings are allowed to be adjusted locally and/or remotely as specified by the Distribution Provider. The maximum Smart Inverter response time to maintain constant reactive power shall be 10 seconds or less. (N)

(Continued)

ELECTRIC TABLE OF CONTENTS Sheet 1

TABLE OF CONTENTS

(Continued)

ELECTRIC TABLE OF CONTENTS Sheet 20

RULE	TITLE OF SHEET	CAL P.U.C. SHEET NO.	
	Rules (Cont'd)		
Rule 21	Generating Facility Interconnections..... 53729,49771,50319,50320,50321,50812,50813,50814, 50815,50816,50817,52998,53730,53731,42312,**55545**,53733,53734,53735,53736,53737,53001, 42320, 50821,42322,53738,53739,53740,53741,53742,53743,42329,42330,42331,42332,42333, 42334,50334, 42336,42337,42338,42339,42340,46374,42342,42343,42344,42345,42346,42347, 42348,50335, 50336, 50337,50338,49785,49786,49787,49788,49789,49790,49791,49792,50339, 49794,49795,49796,49797, 50340,49799,50341,53938,53939,50344,50345,50346,53002,50348, 50349,50350,50351,50352,50353, 50354,50355,50356,50357,50358,50359,50360,50361,50362, 50363,50364,50365,50366,50367,50368, 50369,50370,50371,50372,50373,50374,50375,50376, 50377,50378,50379,50380,50381,54826,50383, 50384,50385,50386,50387,50388,50389,50390, 50391,50392,50393,50394,50395,50396,50397,50398, 50399,50400,50401,50402,50403,50404, 50405,50406,50407,50408,50409,50410,50411,50412,50413, 50414,53930,53931,54494,50418, 50419,50420,51652,51653*,51654,51980*,50425,50823,50824,50825,51655,51656,53940,53941, 54491,53933,53934,53935,50834,50835,50836,50837,53746, 53747, 53748,53749,50842,53750, 50844,**55546**,50846,53751,53752,50849,53753,50851,**55547**,50853,50854,50855, **55548**,50857, 50858,50859,50860,50861,50862,50863,50864,50865,50866,50867,50868,53942,50870,53943, 53944,50873,53945,53946,53947,50877,50878,50879,53948,50881,50882,50883,50884,50885, 50886,50887,50888,50889,53949,50891,50892,50893,50894,50895,53003,53004,53005,53006, 53007,53008,53009,53010,53011,53012,53755,53756,53015,53757,53017,53758,53759,53760, 53021,**55549**,**55550**,53024,53025,53026,53027,53028,53029,53030,53031,53032,53033,53034, 53035,53036,53037,53038,53039,53040,53041,53762,53043,53044,53045,53046,53047,53048, 53049,53050,53051,53052,53053,53054,53055,53056,53763,53764,53765,**55551**,53767,**55552**, 53769,53770,**55553**,53772,53773,**55554**,53775,53776,53777,53778,53779,53780,53781,53782, 53783,**55555**,53785,53786,53787,53788,53789,53790,53791,53792,53793,53794,53795,53796, ...53797,53798,53799,53800,53801-E	(T) (T) (T) (T) | (T) (P)
Rule 22	Direct Access Service ..... 33491,29165,29166,29167,29168,29169,29170,29171,14896, ...30872,30873,32758,32992,32993,32994,32995,30879,30880,30881,30882,30883, ...30884,30885,30886,30887,30888,30889,30890,30891,30892,30893,30894,30895, ...43002,30897,30898,30899,30900,30901,30902,30903,30904,30905,30906,30907, ...30908,30910,30911,30912,30913,30914,30915,51173,30493,30494,30495,30496, ... 30497,30498,30923,30924,30925,30926,33499,33500,33501,33502,33503-E		
Rule 22.1	Direct Access Service Switching Exemption Rules..... 44759,32404,44760,44761, ... 44762,44763,44764,44765,44766,44767, ...44768,44769,44770,44771,44772,44773,44774-E		
Rule 23	Standby Service..... ..... 48308,48309,32810,25530*,25531*25532*,25533*,25534*, ... 30933,29202,25537*,48310,48311,48312,48313,48314,48315,48316, ...48317,48318,48319,48320,48321,48322,48323,48324,48325,48326,48327, ...48328,48329,48330,48331,48332,48333,48334,48335,48336,48337,48338, ...48339,48340,48341,48342,48343,48344,51174,51478,48347,48348,48349, ...48350,48351,483452,48353,48354,48355,48356,48357,48358,48359,48360, ...48361,48362,48363,48364,48365,48366,48367-E		
Rule 23.2	Community Choice Aggregation Open Season 25575,25576,25577,27270,27271-E		

(Continued)

Attachment B

Redline Tariff Revisions

These redline revisions only include modified sheets that have language changes in this advice letter (AL 6635-E-B). Where Electric Rule 21 has been revised, the affected sheets are included in Attachment A.

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
	6635-E	Modifications to Electric Tariff Rule 21 to Incorporate IEEE 1547.1-2020 Test Procedures into Testing Regime for Phase 2 and 3 Requirements in Compliance with Resolutions E-5000 and E 5036	This advice letter is superseded by Advice 6635-E-A and Advice 6635-E-B. The redline changes remain in blue, so the additional supplemental changes can be identified compared to Advice 6635-E revisions.
	6635-E-A	Supplemental: Modifications to Electric Tariff Rule 21 to Incorporate IEEE 1547.1-2020 Test Procedures into Testing Regime for Phase 2 and 3 Requirements in Compliance with Resolutions E-5000 and E 5036	In this advice letter, revisions are made pursuant to Resolutions E-5000 and E-5036.
	6635-E-B	Second Supplemental: Modifications to Electric Tariff Rule 21 to Incorporate IEEE 1547.1-2020 Test Procedures into Testing Regime for Phase 2 and 3 Requirements in Compliance with Resolutions E-5000 and E 5036	In this advice letter, revisions are made pursuant to Resolutions E-5000 and E-5036. This supplemental further aligns with the other IOUs and makes minor corrections.

B. APPLICABILITY (Cont'd.)

3. APPLICABLE CODES AND STANDARDS

This Rule has been harmonized with the requirements of ~~American National Standards Institute/~~Institute of Electrical and Electronic Engineers (~~ANSI/~~IEEE) 1547-~~2003 Standards for Interconnecting Distributed Resources with Electric Power Systems~~2018 In some sections, IEEE 1547-2018 language has been adopted directly or by reference.~~,~~ ~~I~~in others, IEEE 1547-2018 requirements were interpreted and this Rule's language was changed to maintain the spirit of both documents. (P)

~~UL1741- Supplement SA has been utilized for certification of phase I Smart Inverters (Phase 1 Smart Inverter Functions) as outlined in section Hh.~~ (P)

The language from IEEE 1547-2018 that has been adopted directly or by reference (as opposed to paraphrased language or previous language that was determined to be consistent with IEEE 1547-2018) is followed by a citation that lists the clause from which the language derived. For example, IEEE 1547-2018, 4.1.1 is a reference to Clause 4.1.1. (P)

In the event of any conflict between this Rule, any of the standards listed herein, or any other applicable standards or codes, the requirements of this Rule shall take precedence.

4. RETAIL CUSTOMER ENERGY STORAGE DEVICES

For retail customers interconnecting stationary or mobile energy storage devices pursuant to this Rule, the load aspects of the storage devices will be treated pursuant to Rules 2, 3, 15, and 16 just like other load, using the incremental net load for non-residential customers, if any, of the storage devices.

5. APPLICABILITY OF IEEE 1547-2018 REQUIREMENTS

The system's voltage at Point of Interconnection (POI) will determine the required Generating Facility operating requirements. Where voltage at the Point of Interconnection is less than ~~34.5~~50 kV, for applicable generation technology, IEEE 1547-2018 and related certification requirements are required. Where POI voltage is greater than or equal to ~~34.5~~50 kV, the Distribution Provider's Interconnection Handbook will outline operating and performance requirements consistent with North American Electric Reliability Corporation (NERC) and CAISO operating requirements. (P/L) (P/L)

(Continued)

H. GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS (Cont'd.)

1. GENERAL INTERCONNECTION AND PROTECTIVE FUNCTION REQUIREMENTS (Cont'd.)

c. Suitable Equipment Required ~~(Cont'd.)~~ (P)

Circuit breakers or other interrupting equipment located at the Point of Common Coupling (PCC) must be Certified or "Listed" (as defined in Article 100, the Definitions Section of the National Electrical Code) as suitable for their intended application. This includes being capable of (P/L)
interrupting the maximum available fault current expected at their location. (P/L)
Producer's Generating Facility and Interconnection Facilities shall be designed so that the failure of any single device or component shall not potentially compromise the safety and reliability of Distribution Provider's Distribution and Transmission System. The Generating Facility paralleling-device shall be capable of withstanding 220% of the Interconnection Facility rated voltage (IEEE 1547-~~4.1.8.3~~2018, 4.11.3). (P)
The Interconnection Facility shall have the capability to withstand voltage and current surges in accordance with the environments defined in IEEE Std C62.41.2-2002 or IEEE Std C37.90.1-2002 as applicable and as described in L.3.e (IEEE 1547-~~4.1.8.2~~2018, 4.11.2). (P)

d. Visible Disconnect Required

When required by Distribution Provider's operating practices, Producer shall furnish and install a ganged, manually-operated isolating switch (or a comparable device mutually agreed upon by Distribution Provider and Producer) near the Point of Interconnection to isolate the Generating Facility from Distribution Provider's Distribution or Transmission System. The device does not have to be rated for load break nor provide over-current protection.

The device must:

i) allow visible verification that separation has been accomplished. (This requirement may be met by opening the enclosure to observe contact separation.)

ii) include markings or signage that clearly indicates open and closed positions.

iii) be capable of being reached:

a) for Emergency purposes quickly and conveniently 24 hours a day by Distribution Provider personnel for construction,

(Continued)

H. GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS (Cont'd.)

2. PREVENTION OF INTERFERENCE (Cont'd.)

e. Integration with Distribution Provider's Distribution System Grounding

The grounding scheme of the Generating Facility shall not cause over-voltages that exceed the rating of the equipment connected to Distribution Provider's Distribution System and shall not disrupt the coordination of the ground fault protection on Distribution Provider's Distribution System (IEEE 1547-~~4.1.2~~2018, 4.1~~0~~2) (See Section G.1.i, line configuration). (P)

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.

(Continued)

H. GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS (Cont'd.)

3. TECHNOLOGY SPECIFIC REQUIREMENTS
   a. Technology Specific Requirements

      Three-Phase Synchronous Generators: For three phase Generators, the Generating Facility circuit breakers shall be three-phase devices with electronic or electromechanical control. Producer shall be responsible for properly synchronizing its Generating Facility with Distribution Provider's Distribution or Transmission System by means of either manual or automatic synchronous equipment. Automatic synchronizing is required for all synchronous Generators that have a Short Circuit Contribution Ratio (SCCR) exceeding 0.05. Loss of synchronism protection is not required except as may be necessary to meet Section H.2.d (Flicker) (IEEE 1547-~~4.2.5~~2018, 7.2.3~~, 7.3~~). Unless otherwise agreed upon by Producer and Distribution Provider, synchronous Generators shall automatically regulate power factor, not voltage, while operating in parallel with Distribution Provider's Distribution System. A power system stabilization Function is specifically not required for Generating Facilities under 10 MW Net Rating. (P)

   b. Induction Generators

      Induction Generators (except self-excited Induction Generators) do not require a synchronizing Function. Starting or rapid load fluctuations on induction Generators can adversely impact Distribution Provider's Distribution or Transmission System voltage. Corrective step-switched capacitors or other techniques may be necessary and may cause undesirable ferro-resonance. When these counter measures (e.g. additional capacitors) are installed on Producer's side of the PCC, Distribution Provider must review these measures. Additional equipment may be required as determined in a Supplemental Review or an Interconnection Study.

(Continued)

L. CERTIFICATION AND TESTING CRITERIA (Cont'd.)

3. TYPE TESTING (Cont'd.)

f. Synchronization Test

This test is applied to synchronous Generators, self-excited induction generators, and inverters capable of operating as voltage-source while connected to Distribution Provider's Distribution or Transmission System. The test is also applied to the resynchronization Function (transition from stand-alone to parallel operation) on equipment that provides such functionality. This test may not need to be performed on both the synchronization and re-synchronization functions if the manufacturers can verify to the satisfaction of the testing organization that monitoring and controls hardware and software are common to both functions. This test is not necessary for induction generators or current-source inverters. Instead, the In-rush Current test Section L.3.d shall be applied to those generators.

This test shall demonstrate that at the moment of the paralleling-device closure, all three synchronization parameters in Table L.3 are within the stated limits. This test shall also demonstrate that if any of the parameters are outside of the limits stated in the table, the paralleling-device shall not close (IEEE 1547-~~5.1.2A~~2018, 4.10.4). The test will start with only one of the three parameters: (1) voltage difference between Generating Facility and Distribution Provider's Distribution or Transmission System; (2) frequency difference; or (3) phase angle outside of the synchronization specification. Verify that the Generating Facility is brought within specification prior to synchronization. Repeat the test five times for each of the three parameters. For manual synchronization with synch check or manual control with auto synchronization, the test must verify that paralleling does not occur until the parameters are brought within specifications.

(Continued)

L. CERTIFICATION AND TESTING CRITERIA (Cont'd.)

3. TYPE TESTING (Cont'd.)

f. Synchronization Test (Cont'd.)

Table L.3
***Synchronization Parameter Limits* [1]**

Aggregate Rating of Generator Units (kVA)	Frequency Difference (Δf, Hz)	Voltage Difference Phase Angle (ΔV, %)	Difference (ΔΦ,°)
0-500	0.3	10	20
> 500-1,500	0.2	5	15
> 1,500-10,000	0.1	3	10

[1] – IEEE 1547-~~5.1.1B~~2018, 4.10.4 (P)

g. Paralleling Device Withstand Test

The di-electric voltage withstand test specified in Section L.1 shall be performed on the paralleling device to ensure compliance with those requirements specified in Section H.1.c (IEEE 1547-~~5.1.3.3~~2018, 4.11.~~3~~2). (P) (P)

h. Backfeed Test
Non-Export AC/DC Converters must satisfy the requirements in its definition in Section C.

4. PRODUCTION TESTING

At a minimum, each interconnection system shall be subjected to Distribution Provider Voltage and Frequency Variation Test procedure described in UL1741 under Manufacturing and Production Tests, Section 68 and the Synchronization test specified in Section L.3.f. Interconnection systems with adjustable set points shall be tested at a single set of set points as specified by the manufacturer. This test may be performed in the factory or as part of a Commissioning Test (Section L.5).

(Continued)

P. SMART INVERTER GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS FOR UL1741SB INVERTERS (Cont'd) (P)

1. General Interconnection and Protective Function Requirements (Cont'd)

a. Protective Functions Required

Smart Inverters operating in parallel with Distribution Provider's Distribution or Transmission System shall be equipped with the following Protective Functions to sense abnormal conditions on Distribution Provider's Distribution or Transmission System and cause the Smart Inverter to be automatically disconnected from Distribution Provider's Distribution or Transmission System or to prevent the Smart Inverter from being connected to Distribution Provider's Distribution or Transmission System inappropriately:

(i) Over and under voltage trip functions and over and under frequency trip functions;

(ii) A voltage and frequency sensing and time-delay function to prevent the Smart Inverter from energizing a de-energized Distribution or Transmission System circuit and to prevent the Smart Inverter from reconnecting with Distribution Provider's Distribution or Transmission System unless Distribution Provider's Distribution System service voltage and frequency is within the ANSI C84.1-1995 Table 1 Range B voltage Range of 106 volts to 127 volts (on a 120 volt basis), inclusive, and a frequency range of ~~58.8~~59.0 Hz to ~~61.2~~60.5 Hz, inclusive, and are stable for at least 15 seconds; and

(iii) A function to prevent the Smart Inverter from contributing to the formation of an Unintended Island, and cease to energize Distribution Provider's Distribution System within two seconds of the formation of an Unintended Island.

The Smart Inverter shall cease to energize Distribution Provider's Distribution System for faults on Distribution Provider's Distribution System circuit to which it is connected (IEEE 1547-2018, 6.2.1). The Smart Inverter shall cease to energize Distribution Provider's Distribution circuit prior to re-closure by Distribution Provider's Distribution System equipment (IEEE 1547-2018, 6.3). (P)

(Continued)

P. SMART INVERTER GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS FOR UL1741SB INVERTERS (Cont'd) (P)

1. General Interconnection and Protective Function Requirements (Cont'd)

c. Suitable Equipment Required

Circuit breakers or other interrupting equipment located at the Point of Common Coupling (PCC) must be Certified or "Listed" (as defined in Article 100, the Definitions Section of the National Electrical Code) as suitable for their intended application. This includes being capable of interrupting the maximum available fault current expected at their location. Producer's Smart Inverter and Interconnection Facilities shall be designed so that the failure of any single device or component shall not potentially compromise the safety and reliability of Distribution Provider's Distribution and Transmission System. The Smart Inverter paralleling-device shall be capable of withstanding 220% of the Interconnection Facility rated voltage (IEEE 1547-2018, 4.11.3). The Interconnection Facility shall have the capability to withstand voltage and current surges in accordance with the environments defined in IEEE Std C62.41.2-2002 or IEEE Std C37.90.1-2002 as applicable and as described in L.3.e (IEEE 1547-2018, 4.11.42).

d. Visible Disconnect Required

When required by Distribution Provider's operating practices, Producer shall furnish and install a ganged, manually-operated isolating switch (or a comparable device mutually agreed upon by Distribution Provider and Producer) near the Point of Interconnection to isolate the Smart Inverter from Distribution Provider's Distribution or Transmission System. The device does not have to be rated for load break nor provide over-current protection.

The device must:

(i) allow visible verification that separation has been accomplished. (This requirement may be met by opening the enclosure to observe contact separation.)
(ii) Include markings or signage that clearly indicates open and closed positions.
(iii) be capable of being reached: (P)

(Continued)

P. SMART INVERTER GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS FOR UL1741SB INVERTERS (Cont'd) (P)

2. Prevention of Interference (Cont'd)

a. Voltage Regulation

~~The Generating Facility shall not~~ If approved by the Distribution Provider, the Smart Inverter may actively regulate the voltage at the PCC while in parallel with Distribution Provider's Distribution System. ~~The Generating Facility~~Smart Inverter shall not cause the service voltage at other customers to go outside the requirements of ANSI C84.1-1995, Range A. (IEEE 1547-2018, 5.1)

b. Voltage Trip and Ride-Through Setting

The voltage ranges in Table P-1 define protective trip limits for the Protective Function and are not intended to define or imply a voltage regulation Function. Generating Facilities shall cease to energize Distribution Provider's Distribution System within the prescribed trip time whenever the voltage at the PCC deviates from the allowable voltage operating range. The Protection Function shall detect and respond to voltage on all phases to which the Generating Facility is connected.

i) Smart Inverters

Smart Inverters shall be capable of operating within the voltage range normally experienced on Distribution Provider's Distribution System from plus to minus 5% of the nominal voltage (e.g. 114 volts to 126 volts, on a 120 volt base), at the service panel or PCC. The trip settings at the generator terminals may be selected in a manner that minimizes nuisance tripping in accordance with Table P-1 to compensate for voltage drop between the generator terminals and the PCC. Voltage may be detected at either the PCC or the Point of Interconnection. However, the voltage range at the PCC, with the generator on-line, shall stay within +/-5% of nominal.

(P)

(Continued)

P. SMART INVERTER GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS FOR UL1741SB INVERTERS (Cont'd) (P)

2. Prevention of Interference (Cont'd)

c. Paralleling

The Smart Inverter shall parallel with Distribution Provider's Distribution or Transmission System without causing a voltage fluctuation at the PCC greater than plus/minus 5% of the prevailing voltage level of Distribution Provider's Distribution or Transmission System at the PCC, and meet the flicker requirements of Section H.2.d. Section L, Certification and Testing Criteria, provides technology-specific tests for evaluating the paralleling Function. (IEEE 1547-2018, 4.10.4)

d. Flicker

The Generating Facility shall not create objectionable flicker for other Customers on Distribution Provider's Distribution or Transmission System. To minimize the adverse voltage effects experienced by other Customers, flicker at the P caused by the Generating Facility should not exceed the limits of IEEE 1547-2018, 7.2.3. This requirement is necessary to minimize the adverse voltage affects experienced by other Customers on Distribution Provider's Distribution or Transmission System. Generators may be connected and brought up to synchronous speed (as an induction motor) provided these flicker limits are not exceeded.

e. Integration with Distribution Provider's Distribution System Grounding

The grounding scheme of the Smart Inverter shall not cause over-voltages that exceed the rating of the equipment connected to Distribution Provider's Distribution System and shall not disrupt the coordination of the ground fault protection on Distribution Provider's Distribution System (IEEE 1547-2018, 4.~~10.4~~12) (See Section G.1.i, line configuration).

(P)

(Continued)

P. SMART INVERTER GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS FOR UL1741SB INVERTERS (Cont'd) (P)

2. Prevention of Interference (Cont'd)

s. Storage Inverter Normal Operation Ramp Control Requirements

Smart Inverters used for energy storage applications shall include ramp-up rate control. The default value shall be 100% of maximum current output per second or slower if required by Applicant. Other ramp-up control settings can be used, when required, as mutually agreed by the Distribution Provider and the Applicant.

t. Ride-through of Consecutive~~Conservative~~ Voltage Disturbances

Ride-through of consecutive voltage disturbances shall be in accordance with IEEE 1547-2018, 6.4.2.5.

u. Restore output without dynamic voltage support

Restore output without dynamic voltage support shall be in accordance with IEEE 1547-2018, 6.4.2.~~5~~7.1.

v. Transition between performance operating regions:

Transition between performance operating regions should be in accordance with IEEE 1547-2018, 6.4.2.7.3.

w. Constant Reactive Power Mode

When in this mode, the Smart Inverter shall maintain a constant reactive power. The target reactive power level and mode (injection or absorption) shall be specified by the Distribution Provider and shall be within the same range specified in IEEE 1547-2018 section 5.3.5. The reactive power settings are allowed to be adjusted locally and/or remotely as specified by the Distribution Provider. The maximum Smart Inverter response time to maintain constant reactive power shall be 10 seconds or less.

(P)

(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
Downey Brand LLP
Dish Wireless L.L.C.

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

GenOn Energy, Inc.
Green Power Institute
Hanna & Morton
ICF
iCommLaw
International Power Technology
Intertie

Intestate Gas Services, Inc.

Johnston, Kevin
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.

Resource Innovations

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