

PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

ENERGY DIVISION

**RESOLUTION E-5000
July 11, 2019**

R E S O L U T I O N

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.

PROPOSED OUTCOME:

- Approves, with modifications, requests made in the California Solar and Storage Association’s Petition for Modification of Resolution E-4832 and Resolution E-4898
- Clarifies the implementation details of the smart inverter Phase 2 communications requirements and of Phase 3 Functions 1 (Monitor Key Data) and 8 (Scheduling)
- Extends the compliance deadlines (1) for the Phase 2 communications requirements and (2) for Phase 3 Functions 1 (Monitor Key Data), 2 (DER Disconnect and Reconnect), 3 (Limit Maximum Active Power), and 8 (Scheduling)

SAFETY CONSIDERATIONS:

- There is no direct impact on safety, although smart inverters may enhance system reliability in the long-term.

ESTIMATED COST:

- There is no direct cost impact to ratepayers.

By the Petition of the California Solar & Storage Association for Modification of Resolution E-4832 and Resolution E-4898, filed on February 11, 2019.

SUMMARY

In a February 11, 2019 Petition for Modification of Resolution E-4832 and E-4898 (“the Petition”), the California Solar and Storage Association (CALSSA) requests that the Commission clarify and modify the smart inverter Phase 2 and 3 requirements. The Petition makes four primary assertions: (1) IEEE 2030.5¹ should not be required at the inverter level, (2) undefined utility testing should not be required and utilities should rely on attestations for Phase 3 Functions 1 (Monitor Key Data) and 8 (Scheduling), (3) compatibility testing should satisfy compliance with Phase 2 without active aggregator agreements or installed gateway devices, and (4) further extension of the effective date for certain inverter capabilities may be needed.

This Resolution reaffirms that the Phase 2 communications requirements, as specified by the currently approved Rule 21 tariffs, may be met by any of the four options prescribed in Rule 21 Section Hh.5. It further clarifies that the Phase 2 requirements do not require IEEE 2030.5 capabilities at the inverter level. This Resolution orders Pacific Gas and Electric (PG&E), Southern California Edison (SCE), and San Diego Gas & Electric (SDG&E) to adopt the testing pathway laid out by the Petition and restated herein, as the primary method of determining compliance with the Phase 2 requirements. This Resolution mandates that, until the publication of a nationally recognized standard that covers Phase 3 Functions 1 (Monitor Key Data) and 8 (Scheduling), PG&E, SCE, and SDG&E must accept manufacturer attestations as sufficient evidence of compliance with those functions. This Resolution clarifies that the communications capabilities mandated by the Phase 2 requirements are limited to technical capabilities and orders PG&E, SCE, and SDG&E to assess these technical capabilities in conformance with the testing requirements described in the Petition and herein. This Resolution modifies the effective dates of the Phase 2 requirements and of

¹ The Institute of Electrical and Electronic Engineers (IEEE) 2030.5 standard, sometimes referred to as the *Smart Energy Profile (SEP) 2.0*, defines an application profile that provides an interface between the smart grid and users. It specifies the mechanisms for exchanging application messages, the exact messages exchanged, and the required security features while allowing for a variety of possible architectures and usage models. Unlike other common communications protocols, IEEE 2030.5 fully supports the set of smart inverter functionalities recommended by the Smart Inverter Working Group.

the requirement for Phase 3 Functions 1 (Monitor Key Data), 2 (DER Disconnect and Reconnect), 3 (Limit Maximum Active Power Mode), and 8 (Scheduling).²

BACKGROUND

A. Proceeding (R.11-09-011; open September 22, 2011 through June 23, 2016)

The Commission initiated Rulemaking (R.) 11-09-011 on September 22, 2011 to review and, if necessary, revise the rules and regulations governing the interconnection of generation and storage facilities to the electric distribution systems of PG&E, SCE, and SDG&E (collectively, the investor-owned utilities or “IOUs”). The IOUs’ rules and regulations pertaining to the interconnection of generating facilities are set forth in each of the IOUs’ Commission-approved Electric Rule 21 Tariffs. Generating resources interconnecting to the utility grid via Rule 21 that produce direct current (DC) power require an inverter to convert the DC from the generating resource to the voltage and frequency of the alternating current (AC) distribution system; many Distributed Energy Resources (DERs) fall within this category. In early 2013, the Smart Inverter Working Group (SIWG) was formed by parties of R.11-09-011 to develop proposals to take advantage of the rapidly advancing technical capabilities of inverters.³ In February 2015, the SIWG completed its recommendations for Phase 2 communications including specifying the default communication protocol standard as Institute of Electrical and Electronic Engineers (IEEE) 2030.5. In March 2016, the SIWG completed its first set of recommendations for the Phase 3 advanced functions.

On June 23, 2016, the Commission adopted D.16-06-052, which effectively established the Commission’s clear policy direction toward communications-

² The eight Phase 3 functions are listed in Appendix A.

³ The SIWG’s recommendations were developed over five years and were organized into three phases. The Phase 1 recommendations describe a set of autonomous functions that are intended to support grid safety and reliability. The Phase 2 recommendations outline communications requirements for inverter-based generating facilities. The Phase 3 recommendations describe a set of advanced functions that both support grid safety and reliability and form a technical foundation for future grid interactivity. The eight Phase 3 functions are listed in Appendix A. Additional information about the SIWG, including the Phase 1, 2, and 3 recommendations, can be found at <https://www.cpuc.ca.gov/general.aspx?id=4154>.

capable smart inverters. The decision directed the IOUs to file proposed revisions to Rule 21 setting forth any agreed-upon technical requirements, testing and certification processes, and effective dates for the Phase 2 communications requirements and Phase 3 advanced functions in Tier 3 advice letters (ALs) no later than six months from the effective date of D.16-06-052. Ordering Paragraph (OP) 9 requires that, within 6 months of the effective date, the IOUs “shall file proposed revisions to Tariff Rule 21 setting forth any agreed-upon technical requirements, testing and certification processes, and effective dates for Phase 2 communication protocols and Phase 3 additional advanced inverter functions in separate Tier 3 advice letters....”⁴ Attachment E to the Decision notes that, in the absence of consensus among stakeholders, the IOUs, “shall file a status report and work plan on these efforts....”⁵ It likewise stresses that the ALs, “shall solely concern technical inverter requirements and not any regulatory, legal, or compensation issues that are out of scope for the SIWG.”⁶

On November 17, 2016, the Commission’s Energy Division hosted a public workshop for the purpose of discussing the IOUs’ advice letter compliance filings among parties. The workshop demonstrated that there was sufficient consensus for the IOUs to propose revisions to Rule 21 to adopt the Phase 2 recommendations for communication protocols.

B. Resolution E-4832 (April 6, 2017)

On December 20, 2016, the IOUs filed PG&E AL 4982-E, SCE AL 3532-E, and SDG&E AL 3023-E (collectively, the Phase 2 ALs). These ALs set forth proposed tariff changes that incorporated the Phase 2 communications requirements into each Utility’s Rule 21 tariff language. In particular, the IOUs’ ALs all state that, “tariff modifications specify that the communications requirements shall be between (i) the Distribution Provider and the individual generating facility; (ii) the Distribution Provider and the generation facility energy management systems that manage the generating facility within a facility, plant and/or microgrid; or (iii) the Distribution Provider and aggregators, who manage and operate generating facilities at various locations.”⁷ The Phase 2 ALs were not

⁴ D.16-06-052 at 50.

⁵ D.16-06-052 Attachment E at 6.

⁶ *Id.* at 7.

⁷ PG&E 4982-E at 5; SCE 3532-E at 5; SDG&E 3023-E at 5.

protested and were approved on April 6, 2017 by Resolution E-4832. Resolution E-4832 established the Phase 2 compliance deadline as, “the later of (a) March 1, 2018 or (b) nine months after the release of the SunSpec Alliance communication protocol certification test standard or the release of another industry-recognized communication protocol certification test standard.”⁸

C. Resolution E-4898 (April 26, 2018)

On December 20, 2016, the IOUs jointly filed Tier 1 AL 4983-E, which provided a work plan and an outline of next steps for tariff development for the Phase 3 functions.⁹ On March 31, 2017, the Smart Inverter Working Group (SIWG) issued final revisions to the Phase 3 recommendations.¹⁰ In August of 2017, PG&E AL 5129-E, SCE AL 3647-E, and SDG&E AL 3106-E (collectively, the Phase 3 ALs) proposed Rule 21 tariff revisions that set forth agreed-upon technical requirements, testing and certification processes, and effective dates for the Phase 3 functions. In addition, the Phase 3 ALs proposed revisions to the smart inverters Phase 2 communications. In order to discuss issues raised in protests to these ALs, the Energy Division held a public workshop on the Phase 3 As on October 25, 2017.

On April 26, 2018, the Commission in Resolution E-4898 approved, with modifications, the revisions to Rule 21 put forth in the Phase 3 ALs, thereby adopting the SIWG Phase 3 recommendations. Additionally, it rejected the proposed revisions to Rule 21 communications requirements, which would have limited the ability of aggregators to fulfill these requirements. The Resolution language justifying the rejection of these proposed revisions is included in the text box below.

⁸ Resolution E-4832 OP 2.

⁹ AL 4983-E was approved January 26, 2017

¹⁰ Copy available at

http://www.energy.ca.gov/electricity_analysis/rule21/documents/phase3/SIWG_Phase_3_Working_Document_March_31_2017.pdf

From Resolution E-4898 at 42:

In the Advice Letters, the IOUs proposed modifications to the communication requirements, which effectively prohibit the ability for aggregators to fulfill the communications requirements of smart inverters for Rule 21 at this time. The Commission already approved the Phase 2 communication requirements in Resolution E-4832 on April 6, 2017. Therefore, we reject the IOU-proposed modifications to the smart inverter communication requirements as they attempt to address a matter the Commission has already ruled upon.

Since the Commission already approved Phase 2 communication requirements that named aggregators as capable of fulfilling Smart Inverter communication functions, we reiterate that aggregators will have a role in fulfilling Rule 21 Smart Inverter functions.

The Phase 3 requirements include a set of communications-based functions, including Function 1 (Monitor Key Data), Function 2 (DER Disconnect and Reconnect), and Function 8 (scheduling power values and modes). The deadline for Functions 1 and 8 was harmonized with that for the Phase 2 communications requirements: nine months after the release of the SunSpec Alliance¹¹ (SunSpec) communication protocol certification test standard. December 2019 was established as the compliance deadline for Functions 2 and 3 (Limit Maximum Active Power Mode).

D. Post-Resolution Activity (May 22, 2018-Present)

SunSpec issued the SunSpec Common Smart Inverter Profile (CSIP) Conformance Test Procedures (SunSpec test procedure) on May 22, 2018. Pursuant to Resolutions E-4832 and E-4898, which established the compliance deadlines for the Phase 2 requirements and for Functions 1 (Monitor Key Data) and 8 (Scheduling) of Phase 3 as nine months after the release of the SunSpec Alliance¹² (SunSpec) communication protocol certification test standard, this

¹¹ The SunSpec Alliance is a trade alliance of developers, manufacturers, operators, and service providers. The SunSpec Alliance develops and supports the development of open information standards for the distributed energy industry. More information is available at sunspec.org.

¹² The SunSpec Alliance is a trade alliance of developers, manufacturers, operators, and service providers. The SunSpec Alliance develops and supports the development of

Footnote continued on next page

issuance set February 22, 2019 as the effective deadline. On November 19, 2018, CALSSA submitted a letter to the Executive Director requesting a six-month extension of this compliance deadline. This request was granted on January 2, 2019, via letter from the Executive Director, setting the compliance deadline as August 22, 2019.

Compliance with the Phase 2 communications requirements, as adopted by Resolution E-4832 and reaffirmed by Resolution E-4898, may be achieved by four possible communications pathways: 1) direct communication between the utility and smart inverter, 2) communication between the utility and an energy management system (EMS) that manages the inverter-based generating asset, 3) communication between the utility and an aggregator that manages the inverter-based generating asset, or 4) another communications pathway by mutual agreement. The SunSpec test procedure establishes that the default communications protocol, IEEE 2030.5, is used between the utility and first point of contact. *For systems opting to utilize an EMS or aggregator, however, this procedure does not test the communications to the inverter itself.*

The SIWG identified this gap in the testing process and, in August 2018, began meeting weekly to discuss the implementation challenge. After significant discussion over 8 meetings, PG&E, SCE, and SDG&E were unable to agree on a shared implementation strategy. At the request of the SIWG and Energy Division staff, each of the three IOUs issued a separate plan on October 26, 2018.¹³ PG&E and SCE's plans are largely similar and proposed to rely on attestation of capabilities in areas where the current testing scheme falls short. SDG&E's plan diverges and introduces two new requirements: First, SDG&E proposes to require commissioning testing¹⁴ of communications capabilities but fails to specify what testing they propose to require or how such testing would be carried out. Second, the SDG&E plan indicates an intention to require IEEE

open information standards for the distributed energy industry. More information is available at sunspec.org.

¹³ The utility implementation plans were shared with Energy Division staff and distributed to stakeholder via the SIWG distribution list but were not filed with the Commission. CALSSA filed all three plans as appendices to the Petition.

¹⁴ Commissioning testing is a term of art that refers to the post-installation testing of a system or facility. In this context, commissioning testing must be carried out once the system is ready for integrated systems testing.

2030.5-compliant communications at every smart inverter, regardless of whether the generating facility has opted to use an EMS or aggregator. Multiple SIWG parties have argued that these elements of SDG&E's plan appear inconsistent with SDG&E's Rule 21 tariff language and with the language of Resolutions E-4832 and E-4898. They have additionally stated that, if enforced, these additional requirements would preclude a large portion of the inverter market from interconnecting in SDG&E's territory.

While stakeholders indicated that SCE's plan was the closest to workability, they argued that lack of specificity therein would still cause damage to the solar market. Given that consensus was not achieved within the SIWG, parties indicated that they would request Commission action on the disputed items.

PETITION FOR MODIFICATION OF RESOLUTIONS E-4832 AND E-4898

CALSSA submitted a Petition for Modification of Resolutions E-4832 and E-4898 ("the Petition") on February 11, 2019, to request that the Commission "include more details and not exceed areas of consensus." The Petition raised five primary issues:

1. "IEEE 2030.5 Should Not be Required at the Inverter Level"¹⁵
2. "Undefined Utility Testing Should Not Be Required"¹⁶
3. "Utilities Should Rely on Attestations for Phase III Function 1 and Function 8"¹⁷
4. "Compatibility Testing Should Satisfy Compliance with Phase II Without Active Aggregator Agreements or Installed Gateway Devices"¹⁸
5. "Further Extension May Be Needed"¹⁹

Energy Division received Responses, Replies to Responses, and Comments on Replies to Responses on the Petition.

¹⁵ Petition at 7.

¹⁶ *Id.* at 11.

¹⁷ *Id.* at 16.

¹⁸ *Id.* at 12.

¹⁹ *Id.* at 21.

NOTICE

Notice of the Petition was made by publication in the Commission's Daily Calendar. CALSSA states that a copy of the Petition was served to the appropriate parties in accordance with Section 8.2 of General Order 96-B.

RESPONSES

Consistent with the Commission's Rules of Practice and Procedure 16.4, responses to petitions for modification must ordinarily be filed within 30 days of the date that the petition was filed. However, in a March 7, 2019 email²⁰, Energy Division extended the deadline by five calendar days. Hence, Energy Division accepted responses to the Petition ("Responses") until close of business on March 18, 2019.

Four parties filed Responses: PG&E, SCE, SDG&E, and Tesla. All responses were timely filed. This Resolution addresses the parties' Responses in the Discussion Section below.

REPLIES TO RESPONSES

In a March 7, 2019 email, Energy Division stated that replies to responses to the Petition ("Replies") would be accepted from all parties. Replies were accepted for 15 days, from March 18, 2019 until close of business on April 2, 2019.

Four parties filed Replies: CALSSA, SCE, SDG&E, and QualityLogic. QualityLogic's Reply was filed on April 3, 2019; this Reply was deemed late but was considered. All other Replies were timely filed. This Resolution addresses the parties' Replies in the Discussion Section below.

COMMENTS ON REPLIES TO RESPONSES

In an April 18, 2019 email, Energy Division stated that comments on replies to responses to the Petition ("Comments") would be accepted and requested that comments be limited to (1) issues already raised (2) discussion of the

²⁰ All Energy Division notices we sent to the service lists for R.11-09-011 and R.17-07-007.

applicability of the SunSpec Alliance's Common Smart Inverter Profile (CSIP) to the disposition of the Petition and (3) discussion of the possible harmonization of the compliance deadlines for smart inverter Phase 3 Functions 2 (DER Disconnect and Reconnect) and 3 (Limit Maximum Active Power) with those for the Phase 2 communications requirements and Functions 1 (Monitor Key Data) and 8 (Scheduling) of Phase 3. Comments were accepted for 11 calendar days, from April 18, 2019 until close of business on April 29, 2019.

Six parties filed Comments: CALSSA, PG&E, SCE, SDG&E, The Public Advocates Office (Cal Advocates), and SunSpec. All responses were timely filed. These Comments are addressed in the Discussion Section below.

DISCUSSION

Each of the issues raised by the Petition and by the Responses, Replies, and Comments, are treated by issue in the section below.

Issue 1: Timing of this Petition

Petition

Rule 8.2 of General Order 96-B requires adherence to Rule 16.4(d) of the Commission's Rules of Practice and Procedure, which require that, if a petition for modification is not filed within one year of the effective date of a decision, it must state why it could not have been filed by that time. CALSSA argues that, in the year following the effective date of Resolution E-4832, parties hoped to achieve consensus on an implementation plan for the Phase 2 communications requirements. The need for the Petition only became clear, argues CALSSA, following the May 22, 2018 release of the CSIP and the October 26, 2018 release of the first drafts of the IOU implementation plans for Phase 2 capabilities. Hence, CALSSA asserts that the Petition should be considered timely.²¹

Responses, Replies, and Comments

Parties did not comment on the timeliness of the Petition.

Comments on the Draft Resolution

Comments on the draft Resolution did not address the timeliness of the Petition.

²¹ Petition at 4.

Discussion

Given the new information that became available in the year preceding the filing of this Petition, its filing should be considered timely.

Conclusion

The Commission concludes that this Petition was timely filed.

Issue 2: Scope of this Resolution

Sub-issue 2.1: Scope of the Petition

Petition

CALSSA requests that the Commission consider five primary issues: (1) “IEEE 2030.5 Should Not be Required at the Inverter Level” (2) “Undefined Utility Testing Should Not Be Required” (3) “Utilities Should Rely on Attestations for Phase III Function 1 and Function 8” (4) “Compatibility Testing Should Satisfy Compliance with Phase II Without Active Aggregator Agreements or Installed Gateway Devices” and (5) “Further Extension May Be Needed”.²²

Responses, Replies, and Comments

In response to the Petition, some parties argue that some or all of CALSSA’s requests are not appropriate to a Petition for Modification. Cal Advocates, for example, states that, “The Commission should reject the PFM and instead direct the Energy Division to convene and lead either a meeting of the SIWG or a workshop to resolve the disagreements raised by the PFM.”²³

Comments on the Draft Resolution

Comments on the draft Resolution did not address the scope of the Petition.

Discussion

Procedurally, this Petition for Modification is the appropriate vehicle by which to request changes to or clarifications of Resolutions E-4832 and E-4898. Any changes to the underlying decision, D.16-06-052, are strictly outside of the scope of this Resolution. As CALSSA notes in Petition, however, D.16-06-052 contained little discussion of the details of the inverter functions, instead deferring to a

²² *Id.* at 7, 11, 16, 12, and 21, respectively.

²³ Cal Advocates comments at 2.

collaborative process and recognizing that additional refinements of the requirements were needed. Hence, the bulk of the technical details were determined within the advice letter process and adopted by Resolutions E-4832 and E-4898. As such, the requests presented by the Petition, if granted, would constitute changes to the Resolutions only, and not to the underlying Decision.

Moreover, we do not find persuasive the argument that the SIWG or an Energy Division-led workshop would be a more appropriate forum in which to resolve the issues raised by the Petition. The SIWG held eight meetings between August and October of 2018 and engaged in lengthy discussions on many of the issues raised in the Petition. As CALSSA notes, serious disagreements remained.²⁴ Given that CALSSA has now raised this matter to the attention of the Commission, we choose to address it via this Resolution.

Conclusion

The issues set forth in the Petition are appropriately raised in a Petition for Modification. Thus, this Resolution addresses them herein.

Sub-issue 2.2: Additional Items within Scope Petition

This sub-issue addresses deadline items that were not raised in the Petition but were raised in Comments on the Petition. Specifically, the consideration of deadline extensions for the smart inverter functions raised in the Petition necessitates the consideration of other function deadlines that were not raised by the Petition.

Responses, Replies, and Comments

In an April 18, 2019 email, Energy Division stated that Comments would be accepted and requested that parties comment on the possible harmonization of the compliance deadlines for Phase 3 Functions 2 (DER Disconnect and Reconnect) and 3 (Limit Maximum Active Power) with those for the Phase 2 communications requirements and Functions 1 (Monitor Key Data) and 8 (Scheduling) of Phase 3.

²⁴ Petition at 5.

SCE opposes addressing this deadline harmonization as a part of the disposition of the Petition and argues that the issues should be subject to additional stakeholder discussion.²⁵ All other parties are supportive of the harmonization or do not comment on the appropriateness of considering such a harmonization in this venue.²⁶

Comments on the Draft Resolution

Comments on the draft Resolution did not address the scope of the Petition.

Discussion

We agree with SCE that additional stakeholder discussion of Functions 2 (DER Disconnect and Reconnect) and 3 (Limit Maximum Active Power) could prove fruitful. As such, we encourage the SIWG to discuss the implementation of these functions. However, we do not find that a determination herein on an extension of the compliance deadline for Functions 2 and 3 precludes additional stakeholder discussion. Moreover, given the interdependencies of the smart inverter functions, we find that the deadline for Functions 2 and 3 is closely linked with the issues raised in the Petition. Hence, we consider the harmonization of the compliance deadlines for smart inverter Phase 3 Functions 2 and 3 with those for Phase 2 communications requirements and Functions 1 (Monitor Key Data) and 8 (Scheduling) of Phase 3 within the scope of this Resolution.

This Resolution is only intended to modify the elements of Resolutions E-4832 and E-4898 that are explicitly noted; this Resolution reaffirms all other elements of the preceding Resolutions.

Conclusion

It is appropriate to consider an extension of the deadline for Phase 3 Functions 2 (DER Disconnect and Reconnect) and 3 (Limit Maximum Active Power) in this Resolution.

Issue 3: The Requirement of IEEE 2030.5 at the Inverter Level Petition

²⁵ SCE comments at 1.

²⁶ PG&E comments at 1; SDG&E comments at 3; CALSSA comments at 7.

CALSSA requests that the Commission modify Resolution E-4832 to order SDG&E not to require IEEE 2030.5 conformance in inverters.²⁷ CALSSA cites the SIWG's Phase 2 communications recommendations, which state that, "Distributed energy resources should have the option of communicating with utilities directly from an inverter or inverter control unit, from an energy management system, or through an aggregator."²⁸

Responses, Replies, and Comments

SDG&E asserts that CALSSA's statement that Distributed Energy Resources (DERs) should have the option of three communications pathways is "a policy-based assertion".²⁹ SDG&E states that such policy-related matters should not be dictated by a technical working group such as the SIWG.³⁰ Moreover, SDG&E argues that, in order to ensure interoperability, it is necessary to require IEEE 2030.5 at every inverter. SDG&E objects in particular to allowing generating facilities that utilize proprietary communications protocols to interconnect based on the expectation that their communications will be mediated by an IEEE 2030.5-compliant gateway. SDG&E argues that, should the contract between gateway and generating facility be terminated, the utility would lose communications and such a generating facility would be out of compliance with interconnection requirements.³¹

CALSSA acknowledges in their Reply that, "The Petition describes the three pathways for customer compliance with communications requirements: direct from the inverter, through an energy management system, or via an aggregator."³² CALSSA argues that, while, "SDG&E called this 'a policy-based assertion'... It is, in fact, the existing language of Rule 21."³³ Moreover, CALSSA argues that SDG&E's stated concerns with respect to stranded assets are unnecessary, stating that, "customer relationships are valuable. If one company goes out of business and there is an economic opportunity for customers to participate in tariffs and programs, there are plenty of other companies that

²⁷ Petition at 10.

²⁸ *Id.* at 7.

²⁹ SDG&E Response at 4.

³⁰ *Id.* at 2.

³¹ *Id.* at 4.

³² CALSSA Petition at 8.

³³ CALSSA Reply at 8.

would pay to acquire those customers and obtain the keys to the communications protocol.”³⁴

Tesla opposes requiring IEEE 2030.5 at every inverter and states that such a requirement would, “run afoul of the expectations and indeed explicit requirements as recognized by Resolution E-4898 and codified in Rule 21 Section Hh.5....”^{35, 36}

Comments on the Draft Resolution

In their Comments on the draft Resolution, PG&E asserts that communications pathways that do not require end-to-end implementation of the IEEE 2030.5 protocol might allow for cybersecurity gaps.³⁷

SDG&E argues that IEEE 2030.5 must be required at the inverter level because, while IEEE 1547-2018³⁸ allows the inverter-level communications requirements to be fulfilled by other protocols, Rule 21 Hh.5.a.3 establishes IEEE 2030.5 as the default communications requirement. SDG&E asserts that these requirements, when taken in combination, will require manufactures to type-test their inverter models to IEEE 2030.5 in order to conform with IEEE 1547-2018.³⁹

³⁴ *Id.* at 9.

³⁵ Tesla Response at 4.

³⁶ From SDG&E Rule 21 Section Hh.5: “The communications requirements herein shall be between (i) the Distribution Provider and the individual Generating Facility’s inverter control or energy management system; (ii) the Distribution Provider and communication to the Generating Facility through an aggregator not co-located or part of the Generating Facility (allowance of aggregator use under section H.h.5 is subject to Commission approval of applicable forms and agreement not currently developed); or (iii) other communication options as mutually agreed to by Applicant and Distribution Provider.” PG&E and SCE share nearly identical Section Hh.5 language, but do not include the parenthetical regarding the allowance of aggregator use.

³⁷ PG&E Comments on Draft Resolution at 1.

³⁸ IEEE 1547-2018 is the IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces. More information is available at <https://standards.ieee.org/standard/1547-2018.html>.

³⁹ SDG&E Comments on Draft Resolution at 4.

QualityLogic requests clarification of the definition of an EMS.⁴⁰

Discussion

Compliance with the communications requirements, as adopted by Resolution E-4832 and reaffirmed by Resolution E-4898, may be achieved by four possible communications pathways: 1) direct communication between the utility and smart inverter, 2) communication between the utility and an energy management system (EMS)⁴¹ that manages the inverter-based generating asset, 3) communication between the utility and an aggregator that manages the inverter-based generating asset, or 4) another communications pathway by mutual agreement. The current Section Hh.5 language in each utility's Rule 21 reflects these requirements. As such, we see no compelling need to adopt CALSSA's proposed clarifying language in order to address this issue.⁴²

We offer the following clarifications. First, we reaffirm that compliance with the Phase 2 communications requirements may be met by four communications pathways: 1) direct communication between the utility and smart inverter, 2) communication between the utility and an EMS that manages the inverter-based generating asset, 3) communication between the utility and an aggregator that manages the inverter-based generating asset, or 4) another communications pathway by mutual agreement.

Second, we reaffirm, as we did in Resolution E-4898, that the default application-level protocol is IEEE 2030.5, and that other application-level protocols may be utilized by mutual agreement of the parties. Hence, IEEE 2030.5 or another mutually-agreed-upon application-level protocol must be embedded in whichever system will communicate with the utility. Thus, for generating facilities opting for communications Option 1, direct communication between the utility and smart inverter, the smart inverter must be IEEE 2030.5 capable, unless another protocol is selected by mutual agreement. For generating facilities opting

⁴⁰ QualityLogic Comments on Draft Resolution at 3.

⁴¹ The term "Energy Management System" or "EMS" is used in this Resolution in conformance with its usage in the SIWG Phase 2 recommendations and CSIP.

⁴² However, we do find Rule 21 tariff changes necessary to address other issues, as elaborated in the discussion section for Issue 6.

for communications Option 2, communication between the utility and an EMS that manages the inverter-based generating asset, the EMS must be capable of communicating with the utility via IEEE 2030.5, unless another protocol is selected by mutual agreement. For generating facilities opting for communications Option 3, communication between the utility and an aggregator that manages the inverter-based generating asset, the aggregator must be capable of communicating with the utility via IEEE 2030.5, unless another protocol is selected by mutual agreement.

For generating facilities utilizing communications Options 2 and 3, the inverter must be able to communicate with the EMS (in the case of Option 2) or aggregator (in the case of Option 3). However, IEEE 2030.5 is not required at the inverter level or between the inverter and EMS (in the case of Option 2) or aggregator (in the case of Option 3).

In response to SDG&E's assertion that the above clarifications are policy-based and hence outside of the scope of a technical working group, we note that Decisions and Resolutions are policy-making vehicles of the Commission. The above policy-based determinations were made by D.16-06-052 and Resolution E-4832 and reaffirmed by Resolution E-4898. They are additionally reaffirmed herein.

D.16-06-052 adopted the Phase 2 communications requirements. We note that these requirements were designed to ensure that, as DER penetrations continue to increase, capabilities exist for managing these resources in a way that maintains grid stability while supporting the achievement of California's clean energy goals. The Commission determined that the requirements should allow for multiple communications pathways in order to allow generating facilities flexibility while preserving the benefits to reliability and operational control that communications can provide. Restructuring or reinterpreting the Phase 2 requirements, as SDG&E seems to propose in their October 2018 implementation plan, would compromise the flexibility that the Commission deemed necessary to advancing the goals of the Commission and State of California.

Moreover, we do not find SDG&E's argument that IEEE 1547-2018 in combination with Rule 21 will require IEEE 2030.5 at the inverter level

compelling.⁴³ While IEEE 2030.5 is the default application-level protocol under Rule 21, this neither establishes a requirement for any specific protocol at the inverter level nor impacts the requirements under IEEE 1547-2018.

We acknowledge that there are outstanding questions with regards to the cybersecurity of the communications pathways put forth in the Rule 21 Section Hh. These are addressed in the discussion of Issue 4.

Finally, we address SDG&E's concern that generating facilities that employ proprietary communications protocols to communicate with aggregators could be left out of compliance with the Phase 2 requirements if the aggregator were to terminate their service. Should this situation arise, and should the generating facility fail to reestablish compliant communications, the IOU could pursue recourse through established dispute resolution processes or, in an extreme situation, revoke the facility's Permission to Operate.

Conclusion

This Resolution reaffirms that the Phase 2 communications requirements may be met by any of the four options prescribed in Section Hh.5 of each IOU's Rule 21. Additionally, this Resolution explicitly states that the smart inverter Phase 2 requirements do not require IEEE 2030.5 capabilities at inverters that communicate with the utility via EMS or aggregator and that the IOUs shall not require it.

Issue 4: Phase 2 Communications Testing

Petition

CALSSA states in the Petition that, "SDG&E's plan requires undefined, utility-led testing that is inconsistent with agreements to rely on testing developed by the SunSpec Alliance. PG&E's plan states that the utility may later decide to require such testing."⁴⁴ CALSSA recommends that, "The Commission should modify Resolution E-4832 to make clear that utilities cannot require their own brand of testing beyond the commissioning testing for large systems that is already specified in Rule 21 Section L.5. For product type testing, CALSSA recommends the compatibility testing described in the following section."^{45, 46}

⁴³ SDG&E Comments on Draft Resolution at 4.

⁴⁴ Petition at 2.

⁴⁵ Petition at 11.

In the subsequent section of the Petition, CALSSA describes the testing pathway it recommends that the Commission adopt. CALSSA's proposed plan would rely on type testing⁴⁷ to allow inverter manufacturers to demonstrate that their products meet the Phase 2 communications requirements via Nationally Recognized Testing Lab (NRTL) testing only. For inverters that will meet the IEEE 2030.5 requirement through a gateway, the NRTL would test each model with each compatible gateway and then produce two types of reports: one test report stating that the gateway meets CSIP requirements and one letter that states which inverter models successfully connected to the gateway during testing. CALSSA's description of the plan is included in Appendix B.

Responses, Replies, and Comments

The Responses, Replies, and Comments raise several concerns with regards to CALSSA's proposed test plan.

First, the IOUs question CALSSA's qualifications to recommend a testing and implementation process and argue that technical experts or the SIWG are best suited to develop testing procedures.⁴⁸ In these assertions, CALSSA asserts that they, "did not propose new testing standards...Our recommendation was simply to specify which inverter is connected to a gateway during a test."⁴⁹

Second, parties address CALSSA's proposed testing pathway. The IOUs provide little specific feedback on the technical elements of the plan. However, SCE argues that the Commission should allow them to pursue the pathway they outlined in their October implementation plan rather than mandating the use of CALSSA's plan. SCE notes that some parties have argued for attestation-only while others have argued for full end-to-end testing and states, "SCE believes that its implementation plan – which requires testing between the gateway and utility in accordance with the SunSpec Common Smart Inverter Profile (CSIP)

⁴⁶ Rule 21 Section L covers Certification and Testing Criteria. Section L.5 covers Commissioning Testing.

⁴⁷ "Type testing" is a term of art that refers to a process wherein a representative sample of a product is tested to a specific standard and level of interoperability with other products, typically by a testing laboratory.

⁴⁸ PG&E Response at 2; SCE Response at 3; SDG&E Reply at 2.

⁴⁹ CALSSA Reply at 7.

Conformance Test Procedures until the necessary standards are developed by IEEE 1547.1⁵⁰ – to be the midpoint between these two extremes.”⁵¹ SCE additionally asserts that, “once operational testing standards down to the inverter-level are established by IEEE 1547.1...testing standards currently included in SCE’s implementation plan may no longer be necessary.”⁵²

QualityLogic addresses CALSSA’s proposed testing pathway in detail in their Reply. QualityLogic states that, “we think that the CALSSA approach to ‘gateway’ testing could be improved but would not substitute for an end-end testing process to validate interoperability, security and performance of the DERMS-Gateway-Inverter combinations.”⁵³ Specifically, QualityLogic notes that CALSSA’s proposed testing pathway does not include a validation of inverter performance in response to commands, does not include end-to-end security testing, tests only a limited range of functions, and is less comprehensive than the interoperability tests within IEEE 1547.1. QualityLogic proposes that the interoperability testing within IEEE 1547.1 could be leveraged ahead of the adoption of the standard in order to expand testing coverage.⁵⁴

In their Comments, SunSpec both addresses CALSSA’s proposed testing pathway and argues that any adopted testing pathway should demonstrate a variety of characteristics. First, SunSpec asserts that any communication testing requirements should only be mandated at interfaces.⁵⁵ SunSpec cautions against mandating type testing combinations of products: “Going beyond CSIP, testing of combinations of products becomes an intractable problem as the number of products in each category grows...Integration testing of products by utilities and others is desirable but should not be a condition of interconnection.”⁵⁶ SunSpec recommends utilizing, until the release of IEEE 1547.1, “manufacturer attestation

⁵⁰ IEEE 1547.1 will serve as the conformance test procedures for equipment interconnecting DERs with electric power systems and associated interfaces and is currently in the process of final review. More information is available at http://grouper.ieee.org/groups/scc21/1547.1_revision/1547.1revision_logistics.html

⁵¹ SCE Response at 3.

⁵² *Id.* at 4.

⁵³ QualityLogic Reply at 7.

⁵⁴ *Ibid.*

⁵⁵ SunSpec Comments at 2.

⁵⁶ *Id.* at 3.

of compliance to the requirement that equipment must be capable of communicating the required Rule 21 functionality.”⁵⁷ Thereafter, SunSpec argues that the Commission should, “utilize IEEE 1547.1 when it becomes available to increase the functional testing coverage.”⁵⁸

CALSSA addresses some party concerns in their Reply and Comments. CALSSA acknowledges that SCE’s implementation plan is close to feasibility but identifies outstanding issues. CALSSA notes that SCE agrees in their response that an affidavit may be used as an interim solution for the certification of communications between a gateway and generating facility and for inverter performance of Phase 3 Functions 1 (Monitor Key Data) and 8 (Scheduling).⁵⁹ CALSSA argues that, “This is a point of agreement that should be foundational if the Commission does not defer compliance to IEEE 1547.1 implementation.”⁶⁰ Additionally, CALSSA requests that the Commission, “reject [QualityLogic’s] recommendations for mandatory utility testing and advanced use of tests currently under development for IEEE 1547.1.”⁶¹

Third, the IOUs oppose limitations on utility-led testing. “It is imperative that the utility reserve the right to perform end-to-end testing... To restrict this right of testing serves to put customer interests, system reliability, and ultimately safety at risk.”⁶² Furthermore, in response to CALSSA’s recommendation that commissioning testing be limited to large systems as specified in Rule 21 Section L.5, SCE argues that L.5 does not cover communications testing and hence is not sufficient.⁶³ SDG&E agrees that that the testing outlines in section L.5 is insufficient.⁶⁴

In their Reply, QualityLogic agrees with the IOUs: “Prohibiting utilities from conducting their own testing for totally new technology deployments seems at

⁵⁷ *Id.* at 6.

⁵⁸ *Ibid.*

⁵⁹ CALSSA Reply at 5.

⁶⁰ *Ibid.*

⁶¹ *Id.* at 7.

⁶² PG&E Response at 2; SDG&E Response at 5.

⁶³ SCE Response at 3.

⁶⁴ SDG&E Reply at 3.

odds with both utility requirements and California's leadership in R&D for smart inverter management."⁶⁵

In their Reply and Comments, CALSSA addresses the IOUs' concerns with respect to limiting utility-led testing. CALSSA agrees that some "simple commissioning tests for large systems" may be reasonable but asserts that, "the utilities must propose specific test protocols before a compliance regimen is approved that includes utility field testing."⁶⁶ CALSSA argues that, "the utilities must also demonstrate that they are prepared to do the increased testing without additional delays."⁶⁷

Comments on the Draft Resolution

In their Comments on the draft Resolution, PG&E, SDG&E, and QualityLogic raise concerns that the testing pathway approved herein is not exhaustive and that interoperability issues might arise once performance is needed.⁶⁸ More specifically, QualityLogic notes that there is no requirement for independent validation of inverter performance of communicated commands under the mandated test plan and states a preference that NRTL witness of conduct the validation testing.⁶⁹

SDG&E asserts that, contrary to Ordering Paragraph 3 of the draft Resolution, SDG&E will be required to carry out performance testing in order, "to satisfy SDG&E's Commission-approved Technology Neutral Proforma Contract for Distribution Services...."⁷⁰

Both SCE and QualityLogic raise concerns about coordination and execution of the testing pathway. SCE argues that the Commission should require that CSIP testing of gateways must be certified by the SunSpec Alliance.⁷¹ SunSpec also

⁶⁵ QualityLogic Reply at 6.

⁶⁶ CALSSA Reply at 7.

⁶⁷ *Id.* at 6.

⁶⁸ PG&E Comments on Draft Resolution at 2; SDG&E Comments on Draft Resolution at 5; QualityLogic Comments on Draft Resolution at 5.

⁶⁹ *Id.* at 7.

⁷⁰ SDG&E Comments on Draft Resolution at 7

⁷¹ SCE Comments on Draft Resolution at 5.

notes that a “certification” process requires a certifying authority.⁷² Similarly, QualityLogic argues that, in order to fill in logistical gaps in the test plan and identify a certifying body, a program owner must be identified.⁷³ QualityLogic also identifies concerns about the readiness of the CEC and SunSpec to track approval of gateway/inverter combinations.⁷⁴ Both SCE and QualityLogic identify unanswered questions about the coordination of the entities involved in the testing pathway.⁷⁵

SCE requests clarification of, “Whether the Approved Testing Pathway for Smart Inverters is required to be done concurrent with the IEEE 2030.5 certification of a gateway....”⁷⁶ In order to address these issues and others that might arise in the implementation of the testing pathway, SCE requests that the Commission require the utilities to work with stakeholders to create implementation plans addressing four items: testing pathway clarifications, outreach to industry, development of lists of approved inverters and gateways, and interconnection portal preparation (as necessary).⁷⁷

QualityLogic also requests clarification in a variety of areas. First, they argue that the Resolution is ambiguous as to the specific limitations on utility testing of communications capabilities.⁷⁸ Second, they request that the Commission specify a deadline for the completion of the mandated testing pathway.⁷⁹ Finally, they request clarity on which systems require testing and certification, especially with respect to those systems that will be used for non-export facilities.⁸⁰

SunSpec focuses their Comments on the draft Resolution on Appendix C, which describes the testing pathway mandated herein. SunSpec argues that the test scenario described in Appendix C need not involve a NRTL, since there is, “no

⁷² SunSpec Comments on Draft Resolution at 2.

⁷³ QualityLogic Comments on Draft Resolution at 8.

⁷⁴ *Id.* at 9.

⁷⁵ SCE Comments on Draft Resolution at 4; QualityLogic Comments on Draft Resolution at 9.

⁷⁶ SCE Comments on Draft Resolution at 4.

⁷⁷ *Ibid.*

⁷⁸ QualityLogic Comments on Draft Resolution at 4.

⁷⁹ *Id.* at 8.

⁸⁰ *Id.* at 10.

relationship between what is being tested and what is being attested to....”⁸¹ Additionally, SunSpec argues that not all NRTLs are qualified to carry out IEEE 2030.5 testing and that not all qualified labs are NRTLs.⁸² Finally, SunSpec notes that non-SunSpec certified entities will not have access to SunSpec’s public key infrastructure⁸³, which could raise cost and system trust concerns.⁸⁴

The Interstate Renewable Energy Council (IREC) notes that full conformance with IEEE 1547-2018 likely will not be required until 18 months after the publication on IEEE 1547.1, nine months after the draft Resolution requires the IOUs to submit their ALs incorporating IEEE 1547.1 into the testing requirements for the Phase 2 and 3 requirements. IREC suggests that, “the Advice Letters would be contingent on the future date of 1547-2018/UL 1741⁸⁵ implementation for any type testing, but may possibly make use of the evaluation and commissioning test aspects of IEEE Std 1547.1 before that time, if deemed appropriate by the IOUs and SIWG.”⁸⁶ IREC requests clarification that it is the intent of the Commission that, “implementation timelines for type testing, evaluation and commissioning are discussed by the IOUs and SIWG, and contained in the Advice Letters, possibly allowing for staggered implementation timelines dependent on the timeline for type testing of general IEEE Std 1547-2018 requirements.”⁸⁷ In addition, IREC requests that the Commission clarify that, by the “approval” of the IEEE 1547.1 test procedures, the intent is to refer to the publication of IEEE 1547.1.⁸⁸

Discussion

⁸¹ SunSpec Comments on Draft Resolution at 3.

⁸² *Ibid.*

⁸³ A public key infrastructure (PKI) is a collection of hardware, software, policies, and processes need to support public key encryption.

⁸⁴ SunSpec Comments on Draft Resolution at 3.

⁸⁵ Underwriters Laboratory (UL) 1741 is the UL standard for inverters, converters, controllers, and interconnection system equipment for use with DERs. It supplements IEEE 1547 and IEEE 1547.1. More information is available at https://standardscatalog.ul.com/standards/en/standard_1741_2.

⁸⁶ IREC Comments on Draft Resolution at 2.

⁸⁷ *Ibid.*

⁸⁸ *Id.* at 3.

First, we consider the utility concerns with respect to CALSSA's qualifications to propose a testing pathway. CALSSA argues in their Reply that they do not, in the Petition, put forward new testing standards.⁸⁹ We agree with this assertion and find that CALSSA's testing pathway does not define any new test procedures; it merely explains a possible utilization of existing test standards. Moreover, we reject the utilities' arguments that CALSSA's plan should be rejected in favor of a new plan developed by technical experts or by the SIWG. The SIWG, in which many technical experts participate, held eight meetings between August and October of 2018 and engaged in lengthy discussions of possible testing pathways. Consensus was not achieved within these meetings and we find no compelling reason to believe that additional meetings would resolve the areas of disagreement.

Second, we consider CALSSA's proposed testing pathway and the concerns raised by parties about its efficacy. We acknowledge party concerns that the testing pathway proposed in the Petition is not exhaustive. We are cognizant that gaps in testing could result in some impediment to future interoperability. Furthermore, we recognize that adjustments to the implementation of the Phase 2 communications requirements will likely be needed as communications capabilities are operationalized and stakeholders gain more experience with these technologies. However, we find that the plan proposed by CALSSA provides a clear and workable path forward, which will allow the continued implementation of advanced smart inverter functionalities. Moreover, in the absence of concrete evidence, we do not find SunSpec's concern that the testing of combinations of products will become an intractable problem compelling. Should this issue materialize in the future, we encourage parties to raise it to the attention of the Commission through the appropriate procedural pathways.

In order to make the direction of the Commission explicit, we detail the mandated testing pathway in Appendix C. The utilities shall implement the smart inverter Phase 2 communications requirements as described by CALSSA in the Petition⁹⁰ and as interpreted in Appendix C. In the instance that the testing pathway described in the Petition and outlined in Appendix C are in conflict, Appendix C governs.

⁸⁹ CALSSA Reply at 7.

⁹⁰ CALSSA's description of the testing pathway is reproduced in Appendix B.

We acknowledge that unanswered questions remain around the logistical elements of the approved testing pathway. In order to provide for a smooth implementation, we order the IOUs to work with the SIWG to address the implementation issues identified by parties, both in Comments on the draft Resolution and in the course of implementation. These discussions should cover, but not be limited to,

- the implementation pathway for Phase 3 Functions 2 (DER Disconnect and Reconnect) and 3 (Limit Maximum Active Power);
- the requirements for and identification of a program owner and/or certifying body, unless it is determined that such an entity is unnecessary;
- the division of roles and responsibilities in the execution of the testing pathway; outreach to industry;
- development of lists of approved inverters and gateways; interconnection portal preparation (as necessary);
- other testing pathway clarifications, as identified throughout the process.

The IOUs shall begin meeting with the SIWG on these issues within 20 days of the issuance of this Resolution and shall reflect the results of said discussions in implementation plans. The utilities shall share these implementation plans with the members of the SIWG and other interested parties.

Additionally, we are cognizant that the timeline for the implementation of the Phase 2 communications requirements is unlikely to allow sufficient time for cybersecurity issues to be comprehensively addressed. In order to provide a proper venue in which to address the cybersecurity concerns raised in the responses to the Petition and Comments on the draft Resolution,⁹¹ we order the IOUs to begin meeting with the SIWG and other interested parties within 90 days of the publication of IEEE 1547.1, if not earlier, in order to address cybersecurity concerns raised by the Phase 2 communications requirements and develop a pathway forward.

⁹¹ SCE Response at 5; SDG&E Reply at 4; PG&E Comments on Draft Resolution at 1.

We acknowledge that parties are largely in agreement that IEEE 1547.1 test procedures, which have yet to be published, will prescribe interoperability test procedures that should be leveraged in order to best implement the Phase 2 and 3 requirements. We wish to leverage these procedures once they become available. To this end, following the publication of the IEEE 1547.1 test procedures, the IOUs shall work with the SIWG to incorporate the new procedures into the testing regime for the Phase 2 and 3 requirements. The IOUs and SIWG should determine implementation timelines for type testing, evaluation, and commissioning and consider staggered implementation timelines dependent on the timeline for type testing of general IEEE 1547-2018 requirements. Within 9 months of the publication of IEEE 1547.1, the IOUs shall submit separate Tier 1 ALs proposing the new testing regime and reporting on the elements thereof that are supported by the consensus of the SIWG. The IOUs shall additionally report on non-consensus items. This testing regime shall augment the testing regime that is mandated herein.

Third, we consider the issue of utility-led testing and CALSSA's proposed limitations thereof. We do not see merit in limiting utility testing that is necessary in order to maintain the safety and reliability of the grid. Furthermore, we recognize that utility-led testing can help utility engineers build comfort with new technologies and ensure the safety and reliability of the grid. As such, we encourage the IOUs to carry out some limited testing. Such testing should be demonstrably in the interest of grid safety and reliability, should provide increased understanding of advanced inverter capabilities, and should not lead to undue delays in the interconnection process.

The above encouragement, however, does not constitute authorization to carry out utility-led testing on all systems. We reject any assertion that commissioning testing should be required prior to the interconnection of any significant portion of systems. Commissioning testing should only be utilized in cases where the benefit of such testing can be expressly demonstrated. Moreover, we explicitly reject SDG&E's argument that Ordering Paragraph 3 limits testing in a manner that conflicts with the terms of the Technology Neutral Proforma Contract for Distribution Services.⁹² The terms of the Technology Neutral Proforma Contract for Distribution Services apply only to those services that have been procured

⁹² SDG&E Comments on Draft Resolution at 7.

through the Competitive Solicitation Framework. In addition, we are convinced by CALSSA's argument with respect to project delays: no testing should be required that leads to undue delays of the interconnection process.

We decline to burden the tariff with prescriptive rules at this time that would limit, constrain, or require reporting of the frequency of IOU use of their testing authority. We remind parties to utilize informal and formal dispute resolution processes to resolve specific incidents and invite parties to propose more detailed testing rules based on experience not yet available.

Finally, we offer the following clarifications in response to the Comments on the draft Resolution. First, we clarify that inverter-based non-export generating facilities, like exporting facilities, are subject to Rule 21 Section Hh. Second, we clarify that there is no explicit deadline for completion of the approved testing pathways; interconnecting facilities must demonstrate compliance with Rule 21 prior to interconnection. Third, we address SunSpec's assertion that there is no need to involve a NRTL in the execution of the approved testing pathway.⁹³ The inverter manufacturer is required to attest that the inverter communicates with the NRTL server and executes the commands. Hence, it is essential that the commands originate from the NRTL server.

Conclusion

This Resolution finds that CALSSA's proposed testing pathway for the Phase 2 communications requirements provides an appropriate path to implementation. This Resolution order that the IOUs move forward with the implementation of this pathway, as described in the Petition and in the discussion section, above.

This Resolution orders that, within 20 days of its issuance, the IOUs shall begin meeting with the SIWG in order to discuss the implementation issues identified by parties, both herein and in the course of implementation. The IOUs shall reflect the results of said discussions in implementation plans, which they shall share with the SIWG and with other interested parties.

This Resolution orders that, within 90 days of the publication of IEEE 1547.1, the IOUs begin meeting with the SIWG and other interested parties, in order to

⁹³ SunSpec Comments on Draft Resolution at 3

address cybersecurity concerns raised by the Phase 2 communications requirements and develop a pathway forward.

This Resolution orders that, following the publication of the IEEE 1547.1 test procedures, the IOUs shall work with the SIWG to incorporate interoperability testing included in the updated standard, as appropriate, into the testing regime for the Phase 2 and 3 requirements. Within 9 months of the publication of IEEE 1547.1, the IOUs shall submit separate Tier 1 ALs proposing the updated testing regime.

This Resolution finds that some utility-led testing of the Phase 2 communications requirements is necessary for the maintenance of the safety and reliability of the grid. However, this Resolution orders that utility-led testing of these capabilities, including commissioning testing, may only be utilized in cases where the benefit of such testing can be expressly demonstrated. This Resolution expressly forbids the requirement of commissioning testing of the Phase 2 requirements for any significant portion of systems absent additional new factual development and/or due process of law.

Issue 5: Attestations for Phase 3 Function 1 and Function 8

Petition

CALSSA asserts that no tests exist, at present, for Phase 3 Functions 1 (Monitor Key Data) and 8 (Scheduling). CALSSA requests that, “The Commission should clarify in Resolution E-4898 that a manufacturer affidavit is sufficient to demonstrate compliance with the inverter functionality aspects of Function 1 and Function 8. This is a temporary solution until other standards are completed.”⁹⁴

Responses, Replies, and Comments

SDG&E opposes CALSSA’s request that attestations be considered sufficient to demonstrate compliance with Phase 3 Functions 1 (Monitor Key Data) and 8 (Scheduling), stating that, “a manufacturer attestation is not sufficient to demonstrate compliance with Phase III Functions 1 and 8.”⁹⁵ SCE and QualityLogic both agree that attestations of Functions 1 and 8 should be used as a temporary measure and that certification should be required at the inverter

⁹⁴ Petition at 17.

⁹⁵ SDG&E Reply at 4.

level within 12 months of the approval of IEEE 1547.1.⁹⁶ SunSpec likewise argues in favor of allowing manufacturer attestations but suggests that additional testing requirements should be developed and updated on an annual basis.⁹⁷

CALSSA clarifies that they do not support attestations as a long-term solution for demonstrating compliance with Functions 1 and 8.⁹⁸

Comments on the Draft Resolution

In their Comments on the draft Resolution, PG&E states their understanding that inverters that use attestation to comply with Functions 1 (Monitor Key Data) and 8 (Scheduling) will be required to provide evidence that the inverter function has been tested to IEEE 1547.1 within 12 months of the standard being released.⁹⁹ IREC notes that the draft Resolution requires testing of Function 1, for which there is a test in the upcoming IEEE 1547.1 standard, twelve months after the publication of a nationally recognized test procedure containing Phase 3 Function 1. IREC argues that, since full conformance with IEEE 1547-2018 likely will not be required until 18 months after the publication on IEEE 1547.1, this Function 1 testing would be unnecessarily onerous for manufacturers. Consequently, IREC recommends that the language of this Resolution be updated to reflect the timeline for full conformance with IEEE 1547-2018 in order to allow for a streamlined certification process.¹⁰⁰ Additionally, IREC requests that the test procedures for Function 8 be treated into two parts: the scheduling element of Function 8 and the set-point modifications element of Function 8.¹⁰¹

Discussion

In the absence of a test procedure, we find that manufacturer attestations are the appropriate vehicle by which compliance with Phase 3 Functions 1 (Monitor Key Data) and 8 (Scheduling) should be demonstrated. As such, we order that, in the near-term, the IOUs shall accept manufacturer attestations as sufficient evidence of compliance with Phase 3 Functions 1 and 8.

⁹⁶ SCE Response at 8; QualityLogic Reply at 10.

⁹⁷ SunSpec Comments at 8.

⁹⁸ CALSSA Reply at 1.

⁹⁹ PG&E Comments on Draft Resolution at 2.

¹⁰⁰ IREC Comments on Draft Resolution at 3.

¹⁰¹ *Id.* at 4.

We are cognizant, however, of the value of nationally recognized standards, test procedures, and certifications and wish to leverage them wherever possible. Hence, 18 months after the publication of a nationally recognized test procedure containing any of the Phase 3 functions, the IOUs shall require that the included function(s) be tested according to the procedures. Additionally, the IOUs shall notice the service list of R.17-07-007 of the upcoming changes to the testing requirements within 6 months of the publication of such a standard.

In response to PG&E's stated understanding that inverters that use attestation to comply with Functions 1 and 8 will be required to provide evidence that the inverter function has been tested to IEEE 1547.1 within 12 months of the standard being released¹⁰², we clarify that, in order to continue interconnecting, manufacturers will be required to provide evidence that the relevant functions have been tested to IEEE 1547.1 within 18 months of the standard being published. However, this Resolution does not establish retroactive testing for generating facilities that have already been issued permission to operate.

Conclusion

The IOUs shall, until twelve months after the publication of a nationally recognized test procedure containing Phase 3 Function 1 (Monitor Key Data), accept manufacturer attestations as sufficient evidence of compliance with Function 1. Twelve months after the publication of a nationally recognized test procedure containing Function 1, the IOUs shall require that the function be tested according to the prescribed procedures.

The IOUs shall, until twelve months after the publication of a nationally recognized test procedure containing Phase 3 Function 8 (Scheduling), accept manufacturer attestations as sufficient evidence of compliance with Function 8. Twelve months after the publication of nationally recognized a test procedure containing Function 8, the IOUs shall require that the function be tested according to the prescribed procedures.

Issue 6: Demonstration of Phase 2 Communications Capability

Petition

CALSSA requests that the Commission clarify that an interconnecting facility need not be under contract with an aggregator or have an installed EMS in order

¹⁰² PG&E Comments on Draft Resolution at 2.

to demonstrate communications capability in compliance with the smart inverter Phase 2 communications requirements.¹⁰³ In support of this request, CALSSA asserts that requiring all generating facilities to maintain communications contracts is unduly burdensome, given that many small installations will likely never be required to use their communications capabilities. Additionally, CALSSA asserts that the IOU plans require active contracts or installed equipment that are beyond the level of stakeholder agreement.¹⁰⁴

CALSSA specifically requests that the Commission order SDG&E to remove the language, “allowance of aggregator use under section H.h.5 is subject to Commission approval of applicable forms and agreement not currently developed”¹⁰⁵, from their Rule 21 tariff language.¹⁰⁶

Responses, Replies, and Comments

The IOUs oppose CALSSA’s request. They argue that, without a contract, they will have no recourse if aggregators fail to perform when called upon. SCE and PG&E state that, in order to be considered “capable” of communications, an inverter that is not IEEE 2030.5 compliant should be required to include an IEEE 2030.5 certified gateway (inverter control unit, energy management system, aggregator) as part of the installation.¹⁰⁷ SCE argues that an Aggregator agreement must be developed and approved in order to “verify that an Aggregator is actually capable of meeting the requirements of Rule 21 Section Hh” and “ensure adequate cybersecurity”.¹⁰⁸ SDG&E agrees.¹⁰⁹

In response to the utility arguments regarding recourse in the absence of a contract, CALSSA asserts that, “the absence of an active aggregator contract does not pose any risk if there are no communications.”¹¹⁰

¹⁰³ Petition at 22.

¹⁰⁴ *Id.* at 12.

¹⁰⁵ SDG&E Rule 21 Section Hh.5

¹⁰⁶ Petition at 15.

¹⁰⁷ PG&E Response at 3; SCE Response at 7.

¹⁰⁸ SCE Response at 5.

¹⁰⁹ SDG&E Reply at 4.

¹¹⁰ CALSSA Reply at 5.

Comments on the Draft Resolution

In their Comments on the draft Resolution, PG&E notes that, if generating facilities employing an energy management system or aggregator are not required to have installed gateways or active contracts, then there will be generating facilities that are “capable of communications” that will be unable to communicate with Distribution Provider without additional onsite work of installing a gateway or establishing an aggregator agreement.¹¹¹

SCE points out that, in the absence of an aggregator agreement, the approved testing pathway, “does not include any cybersecurity requirements and has no mechanism to ensure that the aggregator will continue to comply with communications requirements....”¹¹² SCE further requests that, given the ongoing development of an aggregator agreement in R.17-07-007 Working Group 2, either, “aggregators not be permitted to provide these communication capabilities until after the Commission issues a decision on the Working Group Two Report...” or, “the Draft Resolution be modified to allow the Utilities to require aggregators that begin to provide these communications capabilities without an agreement in place, as allowed under the Draft Resolution, retroactively sign an aggregator agreement if one is later approved.”¹¹³

Discussion

D.16-06-052 orders the IOUs to file proposed revisions to Tariff Rule 21 setting forth any agreed-upon technical requirements, testing and certification processes, and effective dates for Phase 2 communications protocols.¹¹⁴ Additionally, Attachment E of D.16-06-052 stresses that the tariff revisions that incorporate the Phase 2 and 3 recommendations must “solely concern technical inverter issues and not any regulatory, legal, or compensation issues that are out of scope for the SIWG.”¹¹⁵ Based on this language, we find it compelling that the communications capabilities mandated by the Phase 2 communications requirements must be limited to technical capabilities. The establishment of contracts clearly constitutes a legal issue. Hence, the

¹¹¹ PG&E Comments on Draft Resolution at 2.

¹¹² SCE Comments on Draft Resolution at 3.

¹¹³ *Id.* at 4.

¹¹⁴ D.16-06-052, OP9.

¹¹⁵ *Id.* at 7.

establishment of contracts may not be considered a prerequisite for the adoption of the SIWG Phase 2 recommendations. The IOUs are free to seek Commission-directed contracting requirements in another procedural venue.

As such, we find that the language in SDG&E's Rule 21 Section Hh.5 which states that "allowance of aggregator use under section H.h.5 is subject to Commission approval of applicable forms and agreement not currently developed" is inconsistent with the Commission's intended implementation of the Phase 2 communications requirements. Consequently, we order that SDG&E file a Tier 1 advice letter amending its Rule 21 Section Hh.5 to remove this language.

Moreover, we clarify that "technical capabilities" must be determined in conformance with the testing requirements described in the discussion and conclusion of Issue 4, above. Systems that demonstrate compliance with the Phase 2 requirements in the manner prescribed by this Resolution must be considered "capable of communications." As such, the requirement of active contracts or installed gateways would go above and beyond the communications requirements.

Hence, we clarify that generating facilities that opt to meet the communications requirements via Option 2 (communications with the utility are mediated by an EMS that manages the inverter-based generating asset) or Option 3 (communications with the utility are mediated by an aggregator that manages the inverter-based generating asset) are not required to have installed gateways (for Option 2) or active contracts (Option 3).¹¹⁶

Finally, while we recognize that the Decision on the R.17-07-007 Working Group Two Report will address the issue of aggregator agreements, we reject the argument that the lack of a standard aggregator agreement at this time should preclude aggregators from providing communications capabilities. Following the consideration of additional information within R.17-07-007, the Commission may adjust the requirements for aggregator agreements. However, the Commission declines to change its determination on this Resolution's Issue 6 at this time.

¹¹⁶ See the discussion of Issue 3 herein for a more complete description of the allowed communications options.

Conclusion

This Resolution clarifies that the communications capabilities mandated by the Phase 2 communications requirements must be limited to technical capabilities and orders that these technical capabilities must be assessed in conformance with the testing requirements described in the Petition and in the discussion and conclusion of Issue 4 herein.

Moreover, this Resolution orders that SDG&E file a Tier 1 advice letter amending Rule 21 Section Hh.5 to remove the phrase, “allowance of aggregator use under section H.h.5 is subject to Commission approval of applicable forms and agreement not currently developed”.

Issue 7: Deadline Extension

Sub-issue 7.1: Compliance Deadline for Phase 2 and Functions 1 and 8 of Phase 3

Petition

In the Petition, CALSSA asserts that, “if it is difficult and time-consuming for the Commission to work through disagreements, the Commission may need to consider another extension to allow market participants enough time to demonstrate compliance.”¹¹⁷

Responses, Replies, and Comments

All parties that provided Responses supported an extension of the compliance deadline for Phase 2 and Functions 1 (Monitor Key Data) and 8 (Scheduling) of Phase 3. PG&E and SCE request that the deadline be extended until 12 months after the approval of IEEE 1547.1.¹¹⁸ SDG&E argues that the Commission should grant an additional extension of 18 months, until February 22, 2021.¹¹⁹ Tesla requests a shorter extension and suggests that an additional four to six months would provide sufficient time for the implementation of a new testing plan.¹²⁰

In justifying their lengthy extension requests, SCE and SDG&E assert that the certification challenges posed by the Phase 2 communications requirements and Functions 1 (Monitor Key Data) and 8 (Scheduling) of Phase 3 will be resolved by

¹¹⁷ Petition at 20.

¹¹⁸ PG&E Response at 1; SCE Response at 9.

¹¹⁹ SDG&E Response at 7.

¹²⁰ Tesla Response at 5.

the release of IEEE 1547.1.¹²¹ In their Reply, however, QualityLogic states that the “hope that IEEE 1547.1 will address the end-end testing issue is misplaced.”¹²² More specifically, QualityLogic asserts the following: “There is no “end-end” testing in IEEE 1547.1. The certification only validates that a correct message in one of the protocols from a simulated aggregator, utility, cloud-based adapter, EMS, etc., will result in the desired performance. There is no testing with a specific EMS, aggregator system, utility DERMS, or any other source that may be sending real instructions to the inverter.”¹²³ Furthermore, QualityLogic argues that IEEE 1547.1 should not be seen as a replacement for a communications protocol test. “While [IEEE 1547.1] ensures that the IEEE 1547 functions can be managed via a specific protocol (including monitoring and scheduling), it does not validate that the rest of the protocol is functioning correctly. That is what is done in a protocol test such as the SunSpec IEEE 2030.5 CSIP test. This means that an inverter can pass a 1547.1 interoperability test but still not communicate correctly with a production server for that protocol.”¹²⁴

QualityLogic further argues that a delay in the compliance deadline for Phase 2 and Functions 1 (Monitor Key Data) and 8 (Scheduling) of Phase 3 would be counter to California’s renewable energy targets¹²⁵. QualityLogic states that, in order to avoid hindering the State’s climate goals and avoid undermining faith in the CPUC’s Rule 21 process, the August 22, 2019 deadline should not be delayed.¹²⁶

In their Reply, CALSSA notes that the Commission and parties considered delaying requirements until a national standard had been developed during the November 17, 2016 Energy Division workshop on smart inverter requirements

¹²¹ SDG&E Response at 5; SCE Response at 2.

¹²² QualityLogic Reply at 5.

¹²³ *Ibid.*

¹²⁴ *Ibid.*

¹²⁵ QualityLogic suggests five possible consequences of an implementation delay in their Reply, including the installation of, “an estimated 200,000 or more non-communicating (not utility managed) solar PV installations,” which could force the state to either miss its SB 350 de-carbonization goals or face significant grid disruptions from increasing penetrations of non-communicating solar installations. (QualityLogic Reply at 3)

¹²⁶ *Id.* at 3.

and that, “The Commission ultimately decided to establish communications requirements as a condition of interconnection in advance of the national standard.”¹²⁷ However, CALSSA also states that, “If the communications requirement is not deferred to IEEE 1547-2018 implementation, another deadline extension is necessary as suggested in the Petition and reinforced in the response of Tesla.”¹²⁸

In their Comments, SunSpec supports QualityLogic’s characterization of the limitations of IEEE 1547.1.¹²⁹ Additionally, SunSpec argues that, “no delay to the implementation date is preferable but a delay of a few months may be warranted.”¹³⁰

Discussion

First, we consider the IOUs’ request for an extension of 18 months or until 12 months after the approval of IEEE 1547.1. Based on the information presented in the Petition and in the Responses, Replies, and Comments, we are not convinced that the approval of the IEEE 1547.1 standard would resolve the testing and certification issues identified by the Petition. Moreover, as CALSSA indicated in their Reply, the Commission previously considered deferring advanced inverter requirements until the release of a nationally recognized standard and rejected the option. We acknowledge that additional time might allow for the development of more thorough testing standards. We do not find, however, that the benefits would outweigh the costs, which can be measured in terms of non-communicating systems installed and resulting losses in future grid flexibility. Hence, we believe that a deadline extension of 18 months or until 12 months after the approval of IEEE 1547.1 at this time would be excessive and counter to the goals of the Commission.

While we consider the extensions requested by the IOUs to be excessively long, we acknowledge that some additional time is needed for manufacturers and installers to pursue the testing pathways mandated by this Resolution. We find that an additional extension of five months will allow sufficient time for testing

¹²⁷ CALSSA Reply at 2.

¹²⁸ *Id.* at 3.

¹²⁹ SunSpec Comments at 4.

¹³⁰ *Id.* at 7.

and certification without unduly slowing the penetration of communications-capable DERs.

Conclusion

This Resolution finds that a five-month extension of the compliance deadline for the Phase 2 communications requirements and for Functions 1 (Monitor Key Data) and 8 (Scheduling) of Phase 3 is warranted. As such, the compliance deadline for Phase 2 and for Phase 3 Functions 1 and 8 is extended until January 22, 2020. The IOUs shall keep Energy Division staff regularly apprised of implementation progress.

Sub-issue 7.2: Compliance Deadline for Phase 3 Functions 2 and 3

Petition

The Petition does not address the compliance deadline for Phase 3 Functions 2 (DER Disconnect and Reconnect) and 3 (Limit Maximum Active Power).

Responses, Replies, and Comments

In an April 18, 2019 email, Energy Division requested party comments on the possible harmonization of the compliance deadline for Phase 3 Functions 2 (DER Disconnect and Reconnect) and 3 (Limit Maximum Active Power) with that for Phase 2 and Functions 1 (Monitor Key Data) and 8 (Scheduling) of Phase 3.

PG&E and SDG&E both support the proposed deadline harmonization if and only if such a harmonization is carried out in conjunction with a significant deadline extension.^{131, 132} SCE supports deadline harmonization.¹³³ CALSSA supports harmonizing all of the deadlines in question, those for the Phase 2 communications requirements and for Functions 1 (Monitor Key DER Data), 2 (DER Disconnect and Reconnect), 3 (Limit Maximum Active Power), and 8 (Scheduling) of Phase 3, to December 31, 2019 but acknowledges that further delay might be necessary.¹³⁴

¹³¹ PG&E requests that the compliance deadline for the Phase 2 communications requirements and for Functions 1 and 8 of Phase 3 be extended by either 18 months or until 12 months after the approval of IEEE 1547.1 (PG&E comments at 1). SDG&E requests an 18-month extension of the same (SDG&E comments at 3).

¹³² PG&E Comments at 1; SDG&E Comments at 3.

¹³³ SCE Comments at 2.

¹³⁴ CALSSA Comments at 7.

Comments on the Draft Resolution

In their Comments on the draft Resolution, SCE and SDG&E argue that, because no certification currently exists for Phase 3 Functions 2 and 3 and because the IOUs have not been ordered to accept manufacturer attestations as evidence of these capabilities, the compliance deadline for these functions should be extended until 12 months after the approval of IEEE 1547.1. SCE and SDG&E further argue that, in order to provide a single deadline, the compliance deadlines for the Phase 2 requirements and for Phase 3 Functions 1 and 8 should likewise be extended until 12 months after the approval of IEEE 1547.1.¹³⁵

Discussion

The harmonization of the compliance deadlines for smart inverter Phase 3 Functions 2 (DER Disconnect and Reconnect) and 3 (Limit Maximum Active Power) with those for Phase 2 and Functions 1 (Monitor Key Data) and 8 (Scheduling) of Phase 3 would decrease regulatory complexity. We do not see any compelling reason that this harmonization would only be beneficial in the case of a significant delay of the compliance deadline for Phase 2 and Functions 1 and 8 of Phase 3. First, given that Function 2 is intended as a communications-based function, little utility would be provided by requiring Function 2 capability in advance of Phase 2 communications. Second, an extension of the deadline for Functions 2 and 3 does not prevent generating facilities from installing inverters with these capabilities in the months preceding the delayed deadline. Hence, we find that the benefits of establishing a single deadline for the Phase 2 requirements and Functions 1, 2, 3, and 8 of Phase 3 outweigh any negative consequences of delaying the deadline for Phase 3 Functions 2 and 3.

We do not find that the argument regarding certification of Functions 2 and 3, as raised by SCE and SDG&E in their Comments on the draft Resolution¹³⁶, is sufficiently different from the arguments raised in the IOU Responses, Replies, and Comments to merit reconsideration.

¹³⁵ SCE Comments on Draft Resolution at 2; SDG&E Comments on Draft Resolution at 2.

¹³⁶ SCE Comments on Draft Resolution at 2; SDG&E Comments on Draft Resolution at 2.

Conclusion

This Resolution finds that the harmonization of the compliance deadline for Phase 3 Functions 2 (DER Disconnect and Reconnect) and 3 (Limit Maximum Active Power) with that for Phase 2 and Functions 1 (Monitor Key Data) and 8 (Scheduling) of Phase 3 is reasonable and approved. As such, the compliance deadline for Phase 3 Functions 2 and 3 is extended until January 22, 2020.

COMMENTS

Pursuant to Public Utilities Code section 311(g)(1), a resolution must be served on all parties and subject to at least 30 days public review. Section 311(g)(2) provides that this 30-day review period and 20-day comment period may be reduced or waived upon the stipulation of all parties in the proceeding.

The 30-day review and 20-day comment period for the draft of this Resolution was neither waived nor reduced. Accordingly, this draft Resolution was mailed to parties for comments on June 6, 2019.

Comments on the draft Resolution were timely filed on or before June 27, 2019 by Pacific Gas and Electric (PG&E), Southern California Edison (SCE), San Diego Gas & Electric (SDG&E), the Interstate Renewable Energy Council (IREC), the SunSpec Alliance, and QualityLogic.

Summaries of the Comments on the draft Resolution that are within the scope of the Resolution and raise an issue not already discussed are provided, by issue, in the Discussion section above. Comments on the draft Resolution that make a specific request within the scope of the Resolution and have not already been considered are addressed in the bodies of the Discussion sections.

FINDINGS

1. Resolution E-4832 established the Phase 2 compliance deadline as the later of (a) March 1, 2018 or (b) nine months after the release of the SunSpec Alliance communication protocol certification test standard or the release of another industry-recognized communication protocol certification test standard.
2. Resolution E-4898 established the compliance deadline for Functions 1 (Monitor Key Data) and 8 (Scheduling) of Phase 3 as the later of (a) March 1, 2018 or (b) nine months after the release of the SunSpec Alliance

- communication protocol certification test standard or the release of another industry-recognized communication protocol certification test standard.
3. The SunSpec Alliance released the SunSpec Common Smart Inverter Profile (CSIP) Conformance Test Procedures on May 22, 2018.
 4. The release of the CSIP Conformance Test Procedures established the compliance deadline for Phase 2 communications requirements and for Functions 1 (Monitor Key Data) and 8 (Scheduling) of Phase 3 as February 22, 2019.
 5. On October 26, 2018, at the request of the SIWG and Energy Division staff, PG&E, SCE, and SDG&E each issued a document outlining their implementation plan for the Phase 2 communications requirements and for Functions 1 (Monitor Key Data) and 8 (Scheduling) of Phase 3.
 6. On January 2, 2019, the Executive Director of the Commission granted a six-month extension of the compliance deadline for Phase 2 communications requirements and for Functions 1 (Monitor Key Data) and 8 (Scheduling) of Phase 3, setting the compliance deadline as August 22, 2019.
 7. The California Solar and Storage Association (CALSSA) filed a Petition for Modification of Resolutions E-4832 and E-4898 (“the Petition”) on February 11, 2019.
 8. The Petition was timely filed.
 9. The issues raised by the Petition are appropriate to a Petition for Modification of Resolutions E-4832 and E-4898.
 10. It is appropriate to consider an extension of the deadline for Phase 3 Functions 2 (DER Disconnect and Reconnect) and 3 (Limit Maximum Active Power) in this Resolution.
 11. The smart inverter Phase 2 communications requirements may be met by any of the four options prescribed in Section Hh.5 of each IOU’s Rule 21.
 12. The smart inverter Phase 2 communications requirements should not be interpreted as requiring IEEE 2030.5 capabilities at inverters that communicate with the utility via EMS or aggregator.
 13. The IEEE 1547.1 test procedures, which have yet to be released, may prescribe interoperability test procedures that can be leveraged in order to improve the implementation of the Phase 2 and 3 requirements.
 14. In the absence of a test procedure for Phase 3 Functions 1 (Monitor Key Data) and 8 (Scheduling), manufacturer attestations are the appropriate vehicle by which compliance with these requirements should be demonstrated.
 15. The communications capabilities mandated by the Phase 2 communications requirements must be limited to technical capabilities.

16. The language in SDG&E's Rule 21 Section Hh.5 which states that "allowance of aggregator use under section H.h.5 is subject to Commission approval of applicable forms and agreement not currently developed" is inconsistent with the Commission's intended implementation of the Phase 2 communications requirements.
17. A five-month extension of the compliance deadline for the Phase 2 communications requirements and for Functions 1 (Monitor Key Data) and 8 (Scheduling) of Phase 3 is warranted.
18. The harmonization of the compliance deadline for Phase 3 Functions 2 (DER Disconnect and Reconnect) and 3 (Limit Maximum Active Power) with that for Phase 2 and Functions 1 (Monitor Key Data) and 8 (Scheduling) of Phase 3 is warranted.

THEREFORE IT IS ORDERED THAT:

1. The Petitioner's request that the Commission order Pacific Gas and Electric (PG&E), Southern California Edison (SCE), and San Diego Gas & Electric (SDG&E) (collectively, the investor-owned utilities or "IOUs") to allow generating facilities to meet the Phase 2 communications requirements by any of the four options prescribed in Section Hh.5 of each IOU's Rule 21 is granted. Specifically, the Commission reiterates that the smart inverter Phase 2 requirements must not be interpreted as requiring Institute of Electrical and Electronic Engineers (IEEE) 2030.5 capabilities at inverters that communicate with the utility via Energy Management System or aggregator. The Commission makes these clarifications without changes to previous orders.
2. The Petitioner's request that the Commission order PG&E, SCE, and SDG&E to move forward with the implementation of California Solar and Storage Association's proposed testing pathway for the Phase 2 communications requirements, as described in the Petition and outlined in Appendix C of this Resolution, is granted. PG&E, SCE, and SDG&E must assess compliance with the Phase 2 communications requirements in conformance with stated testing requirements. This direction is given without changes to previous orders.
3. PG&E, SCE, and SDG&E shall, within 20 days of the issuance of this Resolution, begin meeting with the SIWG to discuss the implementation issues identified by parties, both herein and in the course of implementation, with the testing pathway mandated by this Resolution. The IOUs shall reflect the results of said discussions in implementation plans, which they shall share with the SIWG and with other interested parties. This direction is given without changes to previous orders.

4. PG&E, SCE, and SDG&E shall, within 90 days of the publication of IEEE 1547.1, begin meeting with the SIWG and other interested parties, in order to address cybersecurity concerns raised by the Phase 2 communications requirements and develop a pathway forward. This direction is given without changes to previous orders.
5. The Petition's request that the Commission forbid additional testing beyond that prescribed herein or specified by Rule 21 Section L.5 is rejected. However, the Commission expressly forbids the requirement of commissioning testing of the Phase 2 requirements for any significant portion of systems. This direction is given without changes to previous orders.
6. Following the publication of the IEEE 1547.1 test procedures, PG&E, SCE, and SDG&E are ordered to work with the Smart Inverter Working Group to incorporate the new procedures, as appropriate, into the testing regime for the Phase 2 and 3 requirements. Within 9 months of the publication of IEEE 1547.1, PG&E, SCE, and SDG&E must submit separate Tier 2 Advice Letters (ALs) proposing the new testing regime and reporting on the which elements thereof were supported by the consensus of the SIWG. PG&E, SCE, and SDG&E shall additionally report on non-consensus items within the Tier 2 AL. This direction is given without changes to previous orders.
7. The Petition's request that manufacturer attestations be accepted as sufficient evidence of compliance with Phase 3 Function 1 (Monitor Key Data) is granted. PG&E, SCE, and SDG&E must, until 18 months after the publication of a nationally recognized test procedure containing Phase 3 Function 1 accept manufacturer attestations as sufficient evidence of compliance with Function 1. Eighteen months after the publication of a nationally recognized test procedure containing Function 1, PG&E, SCE, and SDG&E shall require that the function be tested according to the prescribed procedures. This direction is given without changes to previous orders.
8. The Petition's request that manufacturer attestations be accepted as sufficient evidence of compliance with Phase 3 Function 8 (Scheduling) is granted. PG&E, SCE, and SDG&E must, until twelve months after the publication of a nationally recognized test procedure containing Phase 3 Function 8, accept manufacturer attestations as sufficient evidence of compliance with Function 8. Twelve months after the publication of a nationally recognized test procedure containing Function 8, PG&E, SCE, and SDG&E shall require that the function be tested according to the prescribed procedures. This direction is given without changes to previous orders.
9. The Petition's request that the Commission order SDG&E to amend Rule 21 Section Hh.5 to remove the parenthetical which states that, "allowance of

aggregator use under section H.h.5 is subject to Commission approval of applicable forms and agreement not currently developed”, is granted. No later than 30 days from the adoption of this Resolution, SDG&E must file a Tier 1 Advice Letter removing this language. This direction alters tariff language that was approved by Resolution E-4832. Changes to the original ordering paragraph are shown in Appendix D.

10. The compliance deadline for the Phase 2 communications requirements and for Phase 3 Functions 1 (Monitor Key Data) and 8 (Scheduling) is extended until January 22, 2020. This direction alters deadlines established by Resolutions E-4832 and E-4898. Changes to the original ordering paragraphs are shown in Appendix D.
11. The compliance deadline for Phase 3 Functions 2 (DER Disconnect and Reconnect) and 3 (Limit Maximum Active Power) is extended until January 22, 2020. This direction alters deadlines established by Resolution E-4898. Changes to the original ordering paragraph are shown in Appendix D.

This Resolution is effective today.

I certify that the foregoing resolution was duly introduced, passed and adopted at a conference of the Public Utilities Commission of the State of California held on July 11, 2019; the following Commissioners voting favorably thereon:

/s/ALICE STEBBINS

ALICE STEBBINS

Executive Director

MARTHA GUZMAN ACEVES

CLIFFORD RECHTSCHAFFEN

GENEVIEVE SHIROMA

Commissioners

President Michael Picker and Commissioner Liane M. Randolph being necessarily absent, did not participate.

Appendix A: The Phase 3 Advanced Functions

From Resolution E-4898 at 3-4:

The Phase 3 advanced functions are summarized as follows:

Function 1. Monitor Key Distributed Energy Resource (DER) Data: The inverter takes measurements as it converts power. With the ability to communicate, the inverter can send this information, such as voltage and active and reactive power, to the utility.

Function 2. DER Disconnect and Reconnect Command (Cease to Energize and Return to Service): In certain situations, the utility may need to de-energize circuits to perform maintenance or repairs, or to prevent unsafe conditions during an emergency. With this function, the utility can send a command to the inverter to disconnect the DER from the local electrical system or prevent the DER from energizing the local system.

Function 3. Limit Maximum Active Power Mode: This function establishes an upper limit on active power that a DER or system of DERs can produce or use. By limiting active power, this function helps to prevent adverse voltage conditions on the distribution grid and other related issues, especially in high DER penetration areas.

Function 4. Set Active Power Mode: Similar to the previous function, this function establishes the active power that a DER or a system of DERs can produce or use.

Function 5. Frequency Watt Mode: As a system-wide parameter, frequency is affected by all devices connected to the electric power system. High frequency events are often a sign of too much power in the grid and vice versa. Frequency Watt Mode is one method for countering these events, which is accomplished by reducing power in response to rising frequency or vice versa.

Function 6. Volt Watt Mode: As a general rule, the production of active power raises voltage. This relationship can be problematic when solar photovoltaic (PV) systems interconnect in large numbers on distribution circuits where utilities have not planned for voltage rise and where existing distribution

equipment cannot lower voltage. Volt Watt Mode modifies active power from DERs based on predetermined voltage ranges to prevent the local voltage on the distribution circuit from rising/ dropping outside of allowable levels. Voltage regulators are a common mitigation measure used on circuits with and without PV to ensure that voltage stays within acceptable levels all the way to the end of the circuit. As PV injects power to the grid at various points along a circuit, the complex interaction of ever-changing load and generation conditions can cause imbalances in voltage levels. These voltage excursions can be mitigated by the smart inverter's Volt Watt Mode raising or lowering voltage but that change in voltage reduces the amount of real power that is exported.

Function 7. Dynamic Reactive Support: This function is similar to the Volt Var Function from Phase 1. However, instead of modifying reactive power in response to the steady-state voltage level, this function responds to the rate of change in voltage.

Function 8. Scheduling Power Values and Modes: This function enables scheduling of active and reactive power, as well as modification of settings of other functions.

Appendix B: The Proposed Phase 2 Testing Pathway of the California Solar and Storage Association (CALSSA)From the Petition at 13-14:

To test a gateway for conformance to IEEE 2030.5, the testing lab tests communications between a server simulating a utility and the gateway without regard to what is connected on the far end of the gateway. However, the entity getting tested can connect a specific inverter model to the gateway. In that case, the testing lab can note the inverter model in the test results or a letter associated with the test results. Conformance with the standard is tested up to the gateway, but it is noted that a specific inverter model was connected to the gateway during testing.

For inverters that are not certified to IEEE 2030.5 at the level of the inverter or the inverter control unit, CALSSA recommends that the Commission require each inverter model or family of models to undergo compatibility testing as part of IEEE 2030.5 conformance testing of a gateway. In this testing, a nationally recognized testing laboratory (NRTL) would perform the following SunSpec CSIP test procedures on the aggregator or energy management system while it is connected to the inverter or inverter control unit:¹³⁷

- Inverter Status (BASIC-028)
- Inverter Meter Reading (BASIC-029)
- Basic Inverter Control – Volt/Var (BASIC-006)
- Basic Inverter Control – Fixed Power Factor (BASIC-008)
- Basic Inverter Control – Volt-Watt (BASIC-011)

The NRTL should produce two reports. A test report would state that the gateway conformed to IEEE 2030.5. This can be certified by the SunSpec Alliance. A separate letter would state the inverter models that were connected to the gateway during testing. The CEC or another list maintaining entity can receive

¹³⁷ These tests are currently part of the CSIP Conformance Test Procedures. It must be verified that the commands do not include set points beyond the ranges of adjustability specified in Rule 21. (Footnote included from the Petition)

that letter, in addition to an affidavit from the manufacturer, and use them as the basis for a list of compliant inverter models.¹³⁸

The NRTL may perform a single verification for an inverter product family that uses the same communications tool and firmware. If a 5 kW inverter and a 10 kW inverter have different model numbers but the communications interface is the same, there is no need to test them separately for compatibility testing under IEEE 2030.5.

From the Petition at 23:

B. Inverter models that do not conform individually to IEEE 2030.5 must be used in combination with an aggregator or energy management system during IEEE 2030.5 conformance testing. The aggregator or EMS manufacturer attests that the inverter communicates with the server and can execute the commands. The NRTL does not witness those commands or see a report but states that the aggregator attested that they witnessed the execution of the commands during the test.

C. California Energy Commission or another entity maintains a list of inverters that are certified to IEEE 2030.5 or have an affidavit of successful compatibility testing including validation from the NRTL.

D. The IOUs draw from that list to populate the list of eligible inverters in their interconnection application portals. In addition to the CEC list, the IOU list contains dedicated storage inverters that have undergone all relevant testing but are not on the CEC list due to additional testing requirements that are specific to solar.¹³⁹

¹³⁸ The list of eligible inverters maintained by utilities may include models that are not on the CEC list, particularly for dedicated storage inverters that are approved by the utilities. (Footnote included from the Petition)

¹³⁹ We exclude recommendations A and E from this excerpt as they do not relate to the proposed standard testing pathway and are not adopted by this Resolution.

Appendix C: Approved Testing Pathway

In order to make the direction of the Commission explicit, we detail the approved testing pathway for the Phase 2 communications requirements below. The IOUs shall implement the smart inverter Phase 2 requirements as described by CALSSA in the Petition and as reiterated herein.

This appendix is intended for use in conjunction with the testing specifications proposed in the Petition. However, where any discrepancies arise, this appendix governs. Where this language allows for multiple interpretations, it should be read in the manner most consistent with the interoperability requirements put forth in IEEE 1547 and 1547.1.

Testing Pathway:

Inverters or inverter control units (ICUs) that are certified to IEEE 2030.5 at the inverter level will be considered compliant with the Phase 2 communications requirements and will not be required to pass the following compatibility testing.

For inverters that are not certified to IEEE 2030.5 at the level of the inverter or the ICU, each inverter model or family of models¹⁴⁰ will demonstrate compliance with the Phase 2 communications requirements via compatibility testing in conjunction with a CSIP-certified gateway (aggregator or EMS)¹⁴¹. In this testing, a NRTL should perform the following SunSpec CSIP test procedures on the aggregator or energy management system while it is connected to the inverter or inverter control unit:

- Inverter Status (BASIC-028)
- Inverter Meter Reading (BASIC-029)

¹⁴⁰ For inverter product families that use the same communications protocols, physical communications layers, firmware, and communication circuit design the NRTL may use engineering judgement to determine whether a single verification will suffice for the product family or whether model-by-model verification is necessary. For example, if a 5 kW inverter and a 10 kW inverter have different model numbers but utilize the same communications interface, the NRTL may determine that a compatibility test of the 5 kW inverter may be applied to the 10 kW model and vice versa.

¹⁴¹ The gateway may have been previously CSIP certified and need not be tested concurrently with the inverter.

- Basic Inverter Control – Volt/Var (BASIC-006)
- Basic Inverter Control – Fixed Power Factor (BASIC-008)
- Basic Inverter Control – Volt-Watt (BASIC-011)

The NRTL need not witness the inverter-level result of these commands. Instead, the gateway manufacturer must attest that the inverter communicates with the NRTL server and executes the commands. The NRTL should then state in the inverter or ICU test report that the manufacturer attested to performance of the commands during the test.

The NRTL should test conformance gateways to IEEE 2030.5 in accordance with the SunSpec CSIP Test Protocols. This testing may be carried out without regard to what is connected on the far end of the gateway. However, the entity under test may connect a specific inverter model to the gateway. If a specific inverter model is used, the testing lab may note the inverter model in the test results or in a letter associated with the test results.

Following the above tests, the NRTL should produce two reports. The test report should state that the gateway conformed to IEEE 2030.5 and CSIP. This may be certified by the SunSpec Alliance. A separate letter should state the inverter models that were connected to the gateway for compatibility testing, as outlined above. The CEC or another list-maintaining entity will receive that letter and use these documents as the basis for a list of compliant inverter models. The IOUs shall draw from that list to populate the list of eligible inverters in their interconnection application portals.¹⁴²

¹⁴² If a non-IOU party maintains the list and excludes any categories of inverter for reasons not related to Rule 21 compliance, the IOUs shall nonetheless ensure the inclusion of those inverters that have undergone all relevant testing among the eligible inverters.

Appendix D: Modifications to the Ordering Paragraphs of Resolutions E-4832 and E-4898**From Resolution E-4832; Issued April 7, 2017****THEREFORE IT IS ORDERED THAT:**

1. Pacific Gas and Electric, Southern California Edison, and San Diego Gas & Electric are permitted to add a subsection of communications requirements in Electric Tariff Rule 21 to incorporate the Smart Inverter Working Group Phase 2 recommendations.
2. For the three IOUs, the new subsection will become mandatory for generating facilities utilizing inverter-based technologies for which an interconnection request is submitted on or after the effective date which is defined as: ~~the later of (a) March 1, 2018 or (b) nine months after the release of the SunSpec Alliance communication protocol certification test standard or the release of another industry recognized communication protocol certification test standard~~ *January 22, 2020.*
3. Southern California Edison Advice Letter 3532-E and Pacific Gas and Electric Advice Letter 4982-E are approved.
4. San Diego Gas & Electric Advice Letter 3023-E is approved with modification to conform the mandatory date of Phase 2 functionality with Pacific Gas and Electric and Southern California Edison *and SDG&E is ordered to file a Tier 1 Advice Letter to modify its Rule 21 tariff in order to remove the parenthetical from Rule 21 Section Hh.5 that states that "allowance of aggregator use under section H.h.5 is subject to Commission approval of applicable forms and agreement not currently developed."*

From Resolution E-4898; Issued April 26, 2018**THEREFORE IT IS ORDERED THAT:**

1. Advice Letters PG&E 5129-E, SCE 3647-E, and SDG&E 3106-E are approved as modified herein.
2. Pacific Gas and Electric, Southern California Edison, and San Diego Gas & Electric shall each file a supplemental Tier 1 compliance Advice Letter within 30 days to modify Electric Rule 21 Tariff to incorporate the changes as ordered herein:

- a. The IOUs shall incorporate the ~~consensus-based~~ effective dates in ~~Table 2 of this Resolution~~; in the following table:

<u><i>Function</i></u>	<u><i>Effective Date</i></u>
<u><i>Function 1 Monitor Key DER Data</i></u>	<u><i>January 22, 2020</i></u>
<u><i>Function 2 DER Disconnect and Reconnect Command (Cease to Energize and Return to Service)</i></u>	<u><i>January 22, 2020</i></u>
<u><i>Function 3 Limit Maximum Active Power Mode</i></u>	<u><i>January 22, 2020</i></u>
<u><i>Function 4 Set Active Power Mode</i></u>	<u><i>12 months after approval of a nationally recognized standard that includes the function.</i></u>
<u><i>Function 5 Frequency Watt Mode</i></u>	<u><i>9 months following SunSpec Alliance Communication Protocol Certification Test Standard.</i></u>
<u><i>Function 6 Volt Watt Mode</i></u>	<u><i>9 months following SunSpec Alliance Communication Protocol Certification Test Standard.</i></u>
<u><i>Function 7 Dynamic Reactive Support</i></u>	<u><i>12 months after approval of a nationally recognized standard that includes the function.</i></u>
<u><i>Function 8 Scheduling Power Values and Modes</i></u>	<u><i>January 22, 2020</i></u>

- b. The IOUs shall incorporate the revisions to the technical capability requirements in Appendix A of this Resolution on Functions 1 and 8;
- c. The IOUs shall incorporate the technical capability requirements of Functions 2, 3, 4, and 7, as proposed;
- d. The IOUs shall incorporate the IEEE 1547 default setting for Function 5;
- e. The IOUs shall incorporate the revisions to the technical capability requirements in Appendix B of this Resolution on Function 6;
- f. The IOUs shall remove the proposed modifications to Phase 2 communications requirements; and
- g. The IOUs shall incorporate the ability to utilize the Phase 3 Functions prior to the effective dates by mutual agreement between the utility and the generating facility.

3. Pacific Gas and Electric, Southern California Edison, and San Diego Gas & Electric shall develop reporting methodology to monitor the frequency and duration of frequency events and, in consultation with the Commission's Energy Division, shall each file a Tier 1 Advice Letter on the proposed methodology no later than 90 days after the effective date of this Resolution.
4. Pacific Gas and Electric, Southern California Edison, and San Diego Gas & Electric shall each file quarterly reports via Tier 1 information-only Advice Letter for one year starting three months after the mandatory activation of Function 5 on frequency events with the methodology approved by the Tier 1 Advice Letters from Ordering Paragraph 3, and following the completion of the quarterly reports, shall file annual reports on frequency events via Tier 1 information-only Advice Letter. No sooner than five years after the activation of Function 5, the IOUs may file proposals via Tier 2 Advice Letter on whether to continue or modify the reporting requirement.
5. Pacific Gas and Electric, Southern California Edison, and San Diego Gas & Electric shall work with stakeholders to develop standardized reporting methodologies to monitor the frequency and amount of voltage excursions and, in consultation with the Commission's Energy Division, shall each file a Tier 1 Advice Letter on the proposed methodologies by October 1, 2018.
6. Pacific Gas and Electric, Southern California Edison, and San Diego Gas & Electric shall each file quarterly reports via Tier 1 information-only Advice Letter for one year starting three months after the mandatory activation of Function 6 on voltage data with the methodologies approved by the Tier 1 Advice Letters from Ordering Paragraph 5, and following the completion of the quarterly reports, shall file annual reports on voltage excursions via Tier 1 information-only Advice Letter. No sooner than five years after the activation of Function 6, the IOUs may file proposals via Tier 2 Advice Letter on whether to continue or modify the reporting requirement.
7. Pacific Gas and Electric, Southern California Edison, and San Diego Gas & Electric shall each file quarterly reports via Tier 1 information-only Advice Letter for one year starting three months after the mandatory activation of Function 6 on the voltage complaint process, and following the completion of the quarterly reports, shall file annual reports on the voltage complaint process via Tier 1 information-only Advice Letter. No sooner than five years after the activation of Function 6, the IOUs may file proposals via Tier 2 Advice Letter on whether to continue or modify the reporting requirement.

8. Pacific Gas and Electric, Southern California Edison, and San Diego Gas & Electric shall each file a Tier 2 Advice Letter proposing revisions to Electric Rule 21 Tariff setting forth additional technical requirements for Function 4 and Function 7 and a report on consensus and non-consensus, no later than eight months from the effective date of this Resolution.