

**PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA**

**ENERGY DIVISION**

**RESOLUTION E-5036  
December 5, 2019**

**R E S O L U T I O N**

Resolution E-5036. Clarifies the testing requirements for smart inverter Phase 2 communications and corrects a typographical error in Resolution E-5000.

**PROPOSED OUTCOME:**

- Clarifies and amends Appendix C of Resolution E-5000, which describes the testing pathway for the smart inverter Phase 2 communications requirements, to streamline and simplify the testing process.
- Corrects a typographical error in Resolution E-5000 and reaffirms that Pacific Gas and Electric, Southern California Edison, and San Diego Gas & Electric must accept manufacturer attestations as sufficient evidence of compliance with Phase 3 Function 1 (Monitor Key Data) until 18 months after the publication of a nationally recognized test procedure containing that function.

**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 Energy Division's own motion.

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**SUMMARY**

Resolution E-5000, issued July 12, 2019, clarified the implementation pathway for the smart inverter Phase 2 communications requirements and Phase 3 advanced

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functions. It also recognized that unanswered questions remained around the implementation of these requirements and functions. In order to provide a forum in which to resolve these remaining questions, the California Public Utilities Commission (CPUC) ordered Pacific Gas and Electric (PG&E), Southern California Edison (SCE), and San Diego Gas & Electric (SDG&E) to work with the Smart Inverter Working Group (SIWG) to address identified implementation issues.

Following discussions in the SIWG, questions remained about the interpretation of Resolution E-5000's Appendix C, which describes the approved testing pathway for the Phase 2 communications requirements. The California Solar & Storage Association (CALSSA) sent a letter requesting clarification to Energy Division staff and to the service list for Resolution E-5000.

This Resolution responds to CALSSA's letter and offers the following clarifications. First, in order to fulfill the testing requirements set forth in Resolution E-5000's Appendix C, either the inverter manufacturer or the gateway manufacturer must attest that the inverter communicates with the Nationally Recognized Testing Lab (NRTL)<sup>1</sup> server and executes the commands. Second, this Resolution adopts the definition of the technical term "gateway," as used in Resolution E-5000, that is offered by CALSSA. Third, this Resolution adopts a redline of Resolution E-5000's Appendix C that reflects the clarifications adopted herein.

Additionally, this Resolution corrects a typographical error in Resolution E-5000 and reaffirms that the PG&E, SCE, and SDG&E must accept manufacturer attestations as sufficient evidence of compliance with Phase 3 Function 1 (Monitor Key Data) until 18 months after the publication of a nationally recognized test procedure containing that function.

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<sup>1</sup> The term "Nationally Recognize Testing Lab (NRTL)", as used throughout this Resolution, refers to both (1) those testing labs that have been recognized by the Occupational Safety and Health Administration (OSHA) as providing evaluation, testing, and certification of electrical products and (2) SunSpec Authorized Testing Laboratories (SunSpec ATLs).

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**BACKGROUND****A. Proceeding (R.11-09-011)**

The CPUC 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' CPUC-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, parties to R.11-09-011 formed the SIWG to develop proposals to take advantage of the rapidly advancing technical capabilities of inverters.<sup>2</sup> 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<sup>3</sup>. In March 2016, the SIWG completed its first set of recommendations for the Phase 3 advanced functions. On June 23, 2016, the CPUC adopted Decision (D.)16-06-052,

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<sup>2</sup> 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 Attachment 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>.

<sup>3</sup> The 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.

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which effectively established the CPUC's clear policy direction toward communications-capable smart inverters.

**B. Resolution E-4832 (April 6, 2017) and Resolution E-4898 (April 26, 2018)**

On April 6, 2017, the CPUC issued Resolution E-4832, which adopted tariff changes that incorporated the Phase 2 communications requirements into each Utility's Rule 21 tariff language. On April 26, 2018, the CPUC issued Resolution E-4898, which adopted tariff changes that incorporated the Phase 3 recommendations into each Utility's Rule 21 tariff language.

The SunSpec Alliance<sup>4</sup> 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, this issuance set February 22, 2019 as the effective deadline for the Phase 2 requirements and for Phase 3 Functions 1 (Monitor Key Data) and 8 (Scheduling).<sup>5</sup> 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.

CALSSA submitted a Petition for Modification of Resolutions E-4832 and E-4898 ("the Petition") on February 11, 2019, to request that the CPUC clarify and modify the smart inverter Phase 2 and 3 requirements.

**D. Resolution E-5000 (July 12, 2019)**

On July 12, 2019, the CPUC issued Resolution E-5000, which addressed the issues raised in the Petition. Resolution E-5000 did the following:

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<sup>4</sup> The SunSpec Alliance (SunSpec) is a trade alliance of developers, manufacturers, operators, and service providers. SunSpec develops and supports the development of open information standards for the distributed energy industry. More information is available at [sunspec.org](http://sunspec.org).

<sup>5</sup> Resolutions E-4832 and E-4898 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 Alliance<sup>5</sup> (SunSpec) communication protocol certification test standard.

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- Reaffirmed 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;
- Clarified that the Phase 2 requirements do not require IEEE 2030.5 capabilities at the inverter level;
- Ordered PG&E, SCE, and SDG&E to adopt the testing pathway laid out by the Petition as the primary method of determining compliance with the Phase 2 requirements;
- Mandated 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;
- Clarified 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 the Resolution;
- Modified the effective dates of the Phase 2 requirements and of the requirement for Phase 3 Functions 1 (Monitor Key Data), 2 (DER Disconnect and Reconnect), 3 (Limit Maximum Active Power Mode), and 8 (Scheduling).<sup>6</sup>

Additionally, Resolution E-5000 recognized that unanswered questions remained around the logistical elements of the approved testing pathway. In order to provide for a smooth implementation, the CPUC ordered 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.

#### **E. Post-Resolution E-5000 Activity (July 12, 2019-Present)**

In August of 2019, pursuant to Resolution E-5000, Energy Division Staff convened the SIWG to discuss remaining smart inverter Phase 2 and 3 implementation challenges. While stakeholders made progress on the majority of the topics outlined by Resolution E-5000, questions remained about the

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<sup>6</sup> The eight Phase 3 functions are listed in Attachment A.

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interpretation of Resolution E-5000's Appendix C, which describes the approved testing pathway for the Phase 2 communications requirements. Stakeholders agreed that clarification was required and the CALSSA agreed to request said clarification.

On October 9, 2019, CALSSA provided their request for clarification ("Request for Clarification") to Energy Division staff and to the service list for Resolution E-5000. The letter is included as Attachment B. Its content is discussed in the Issue 1 Discussion Section herein.

On October 15, 2019, SCE provided comments on the Request for Clarification ("Comments") to Energy Division staff and to the service list for Resolution E-5000. The letter is included as Attachment C. Its content is discussed in the Issue 1 Discussion Section herein.

During the SIWG discussions of Phase 3 Functions 1 (Monitor Key Data) and 8 (Scheduling), stakeholders identified a typographical error in Resolution E-5000. This error is clarified in the Issue 2 Discussion Section herein.

## **DISCUSSION**

### **Issue 1: Implementation Pathway for Functions 2 and 3**

#### **Request for Clarification**

In the Request for Clarification, CALSSA seeks clarification of Resolution E-5000 and asks that the CPUC adopt a specific definition of the term "gateway," which is used in Resolution E-5000.

CALSSA requests clarification of the following sentences from Resolution E-5000's Appendix C, which describes the approved testing pathway for the Phase 2 communications requirements: "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."<sup>7</sup> Specifically, CALSSA requests that the CPUC amend Resolution E-5000 to allow

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<sup>7</sup> Resolution E-5000 at p. 51.

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the stated attestation to originate with either the gateway manufacturer or the inverter manufacturer, rather than requiring said attestation to come from the gateway manufacturer only.

Additionally, based on SIWG discussions of the topic, CALSSA proposes the following definition of the term "gateway": "Anything other than the DER that provides a communications interface (CSIP/IEEE 2030.5) to the utility for the purposes of exchanging the content contained in the communications messages with one or more DERs."<sup>8</sup>

### Comments

In their Comments on the Request for Clarification, SCE states that they, "support the intent behind CALSSA's request for clarification."<sup>9</sup> However, they request that a redline of Resolution E-5000's Appendix C be adopted in order to ensure sufficient clarity. The redline provided by SCE eliminates references to inverter control units, simplifies references to gateways, and inserts the underlined portion into the following sentence: "Instead, the gateway manufacturer must attest that the inverter communicates with the NRTL server and the inverter manufacturer attests that the inverter executes the commands."<sup>10</sup>

### Discussion

First, we consider CALSSA's request that the attestation of communications capabilities, as defined by Resolution E-5000's Appendix C, be allowed to originate with either the gateway manufacturer or inverter manufacturer. The Request for Clarification notes that it is CALSSA's belief that this clarification is consistent with SIWG discussions on the matter. Given the additional discussion of the roles and responsibilities of each party involved in the execution of the testing pathway outlines in Appendix C, we find that the clarification requested by CALSSA is reasonable. In order to streamline and simplify the testing process, we clarify that, in order to fulfill the testing requirements set forth in Resolution E-5000's Appendix C, either the inverter manufacture or the gateway

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<sup>8</sup> Request for Clarification at p. 2.

<sup>9</sup> SCE Comments at p. 1.

<sup>10</sup> *Id.* at p. 2.

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manufacturer must attest that the inverter communicates with the NRTL server and executes the commands.

Second, we consider the definition of the term "gateway" that is put forth in CALSSA's clarification request. Given that the definition is supported by the SIWG and is consistent with the intention of Resolution E-5000, we find that the addition of this explicit definition will clarify the intention of Resolution E-5000.

Third, we consider the changes suggested by SCE in the redline offered in their Comments. The simplification of references to gateways is consistent with the clear usage of an explicitly defined term. As such, we adopt these redlines in conjunction with the adoption of the explicit definition of "gateway" discussed above. SCE also requests the addition of the underlined portion into the following sentence: "Instead, the gateway manufacturer must attest that the inverter communicates with the NRTL server and the inverter manufacturer attests that the inverter executes the commands."<sup>11</sup> We note that SCE's Comments do not provide any explicit reason to insert this additional language. As such, we find that this language further complicates the issue without providing additional value and reject SCE's request for its addition.

Finally, we consider SCE's request for a redlined version of Resolution E-5000's Appendix C. We believe that the request for a redline of Appendix C is reasonable and will provide additional clarity. The redlined version of Resolution-5000's Appendix C is included as Attachment D to this Resolution. This redline reflects the clarifications adopted herein.

## **Issue 2: Clarification of Typographical Error in Resolution E-5000**

### Resolution E-5000

Ordering Paragraph 7 of Resolution E-5000, issued July 12, 2019, states the following:

*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*

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<sup>11</sup> SCE Comments at p. 2.



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*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.<sup>12</sup>*

The 18-month timeline is similarly referenced twice in the Discussion of Issue 5, Attestations for Phase 3 Functions 1 and 8.<sup>13</sup>

In the Conclusion of Issue 5, Attestations for Phase 3 Functions 1 and 8, however, the following is stated:

*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.<sup>14</sup>*

### Discussion

First, we consider the rationale behind the 18-month timeline. As stated in the Comments on Draft Resolution E-5000, the upcoming IEEE 1547.1 standard will likely constitute a nationally recognized test procedure containing Phase 3 Function 1. Because full conformance with IEEE 1547-2018 likely will not be required until 18 months after the publication on IEEE 1547.1, a requirement for Function 1 testing ahead of that 18-month timeline would be unnecessarily onerous for manufacturers.<sup>15</sup> We find this argument compelling.

Second, we consider the single paragraph in which it is stated that, *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

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<sup>12</sup> Resolution E-5000 at p. 42 (emphasis added).

<sup>13</sup> *Id.* at p. 30.

<sup>14</sup> Resolution E-5000 at p. 31 (emphasis added).

<sup>15</sup> *Id.* at p. 30.

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prescribed procedures. Given that this language contradicts both Ordering Paragraph 7 and the other instances wherein this timeline is discussed in the discussion section, we find that this reference to a twelve-month timeline is a typographical error.

In the interest of avoiding unnecessary regulatory burden and maintaining the original intent of Resolution E-5000, we clarify that the language in Resolution E-5000's Conclusion of Issue 5, Attestations for Phase 3 Functions 1 and 8, as cited above, contains an error. The corrected version is as follows:

*The IOUs shall, until **eighteen 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. **Eighteen 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.*

This determination should not be interpreted as altering the ordering language offered in Resolution E-5000, Ordering Paragraph 8, which established that, "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."<sup>16</sup>

## **COMMENTS**

Public Utilities Code section 311(g)(1) provides that 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 October 31, 2019.

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<sup>16</sup> Resolution E-5000 at p. 43 (emphasis added).

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Comments on the draft Resolution were timely filed on November 21, 2019 by Southern California Edison (SCE) and the SunSpec Alliance (SunSpec).

In their Comments on the draft Resolution, SCE requests that references to Inverter Control Units (ICUs) be removed from Resolution E-5000's Appendix C, arguing that the definition of gateway adopted in this Resolution clearly includes ICUs and that the use of both terms might therefore create confusion.<sup>17</sup> We find that the elimination of the term ICU from Appendix C serves to further clarify the implementation pathway and is consistent with the definition of the term gateway, as is adopted in this Resolution. Hence, the redlined version of Resolution-5000's Appendix C, which is included as Attachment D to this Resolution, is amended to remove references to ICUs.

In their Comments on the draft Resolution, SunSpec requests that the Commission clarify that the term "Nationally Recognized Testing Lab (NRTL)", as used in Resolution E-5000's Appendix C, is not intended to refer to Occupational Safety and Health Administration (OSHA)-recognized labs only.<sup>18</sup> Specifically, SunSpec requests that the term "NRTL" be replaced by the term "SunSpec Authorized Testing Laboratory (SunSpec ATL)".<sup>19</sup>

In response to SunSpec's Comments on the draft Resolution, we first note that the definition of "Nationally Recognized Testing Laboratory (NRTL)", as stated in Rule 21 Section C, Definitions, is as follows: "A laboratory accredited to perform the Certification Testing requirements under this Rule". We acknowledge, however, that there is a lack of clarity in the use of the term "NRTL" in Resolution E-5000. We further recognize that SunSpec has made considerable efforts to evaluate the abilities of testing laboratories to conduct IEEE 2030.5 data communication and cybersecurity testing. Despite these efforts, we note that requiring that all communications testing be carried out by SunSpec ALTs could unduly penalize industry participants that who have moved forward with testing based on the understanding that the definition of "NRTL" includes

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<sup>17</sup> SCE Comments on the draft Resolution at p. 2.

<sup>18</sup> SunSpec Comments on the draft Resolution at p. 1.

<sup>19</sup> SunSpec Comments on the draft Resolution at p. 4.

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those labs recognized by OSHA, even if they have not been authorized by SunSpec.

In order to resolve this issue, we first assert that the term "NRTL" is used in accordance with its Rule 21 definition. In addition, we offer the following clarification: the communications testing that is described by Resolution E-5000's Appendix C may be carried out by an OSHA-recognized NRTL or a SunSpec ATL. The redlined version of Resolution 5000's Appendix C, which is included as Attachment D to this Resolution, has been updated to reflect this clarification.

## **FINDINGS**

1. 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.
2. Resolution E-5000, issued on July 12, 2019, addressed the issues raised in the Petition and harmonized 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.
3. In August of 2019, pursuant to Resolution E-5000, Energy Division Staff convened the Smart Inverter Working Group (SIWG) to discuss remaining smart inverter Phase 2 and 3 implementation challenges.
4. On October 9, 2019, CALSSA requested clarification (the "Request for Clarification") of Resolution E-5000's Appendix C, which describes the approved testing pathway for the Phase 2 communications requirements.
5. On October 15, 2019, Southern California Edison (SCE) issued comments on the Request for Clarification.
6. CALSSA's request that the attestation of communications capabilities, as defined by Resolution E-5000's Appendix C, be allowed to originate with either the gateway manufacturer or inverter manufacturer is reasonable and will serve to simplify and streamline the testing pathway for the Phase 2 communications requirements.
7. The definition of "gateway" suggested by CALSSA in their Request for Clarification is reasonable and will serve to clarify the intention of Resolution E-5000.

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8. The definition of "gateway" adopted in this Resolution includes Inverter Control Units (ICUs). References to ICUs in Appendix C are hence duplicative.
9. The term "Nationally Recognize Testing Lab (NRTL)", as used in Resolution's Appendix C, should refer to both (1) those testing labs that have been recognized by the Occupational Safety and Health Administration (OSHA) as providing evaluation, testing, and certification of electrical products and (2) SunSpec Authorized Testing Laboratories (SunSpec ATLs).
10. SCE's request for a redlined version of Resolution E-5000's Appendix C is reasonable and will clarify the intent of this Resolution.
11. The language in Resolution E-5000's Conclusion of Issue 5, Attestations for Phase 3 Functions 1 and 8, contains a typographical error. Said language should agree with Resolution E-5000, Ordering Paragraph 7.

**THEREFORE IT IS ORDERED THAT:**

1. CALSSA's request that the attestation of communications capabilities, as defined by Resolution E-5000's Appendix C, be allowed to originate with either the gateway manufacturer or inverter manufacturer is granted. Changes to the original language are shown in Attachment D.
2. CALSSA's request that the term "gateway," as used in Resolution E-5000, be defined as suggested in the Request for Clarification is granted. The addition of this definition and resulting changes to the original language are shown in Attachment D.
3. SCE's request that the term "Inverter Control Unit (ICU)" be removed from the updated version of Appendix C, as shown in Attachment D, is granted.
4. The communications testing that is described by Resolution E-5000's Appendix C may be carried out by an Occupational Safety and Health Administration (OSHA)-recognized Nationally Recognize Testing Lab (NRTL) or a SunSpec Authorized Testing Laboratory (SunSpec ATL).
5. The language of Ordering Paragraph 7 of Resolution E-5000 is reaffirmed. PG&E, SCE, and SDG&E must accept manufacturer attestations as sufficient evidence of compliance with Phase 3 Function 1 (Monitor Key Data) until 18 months after the publication of a nationally recognized test procedure containing said function. This direction is given without changes to previous orders.

This Resolution is effective today.

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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 December 5, 2019; the following Commissioners voting favorably thereon:

/s/ Alice Stebbins

ALICE STEBBINS  
Executive Director

MARYBEL BATJER

President

LIANE M. RANDOLPH  
MARTHA GUZMAN ACEVES  
CLIFFORD RECHTSCHAFFEN  
GENEVIEVE SHIROMA

Commissioners

**Attachment 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

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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.



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**Attachment B: California Solar & Storage Association Letter Requesting Clarification of Resolution E-5000, Appendix C**

The October 9, 2019 letter is reproduced in full on the subsequent two pages.

October 9, 2019

TO: Energy Division  
California Public Utilities Commission

FR: Brad Heavner, Policy Director  
California Solar & Storage Association

RE: Request for Clarification of Resolution E-5000

The California Solar & Storage Association (CALSSA) requests clarification of two issues related to Resolution E-5000, issued by the California Public Utilities Commission on July 11, 2019.

### **1. Source of Affidavits**

Resolutions E-4832 and E-4898 order the implementation of certain Phase 2 and Phase 3 smart inverter functions. For systems that fulfill communications requirements using a remote or on-site gateway, the resolutions contain the following requirements.

1. The gateway must be capable of communications in conformance with IEEE 2030.5.
2. The inverter must be capable of receiving and responding to communications from a gateway.
3. The inverter must be capable of performing Functions 1 and 8 from the Phase 3 recommendations of the Smart Inverter Working Group.

The Common Smart Inverter Profile (CSIP) test procedures that were developed to verify communications capabilities only test for requirement #1. As no test protocol exists for requirements #2 and #3 above, Resolution E-5000 (Resolution) directed the utilities to accept attestations for those capabilities. In implementing the Resolution, however, it has become necessary to clarify the question of which entity provides the attestations.

Ordering Paragraphs 7 and 8 of the Resolution concerning requirement #3 above provide direction on validating the inverter performance for these functions. These Ordering Paragraphs state that the utilities shall “accept *manufacturer attestations* as sufficient evidence of compliance” for Phase 3 Functions 1 and 8 requirements respectively. [emphasis added] Although it is not stated whether this is the gateway manufacturer or the inverter manufacturer, the meaning is clearly the inverter manufacturer because it is a question of inverter performance.

Ordering Paragraph 2 of the Resolution concerns the Phase 2 communications requirements and references Appendix C. The first sentence of Appendix C makes clear that the appendix concerns requirement #2 above. However, Appendix C of the

Resolution also states, “the *gateway manufacturer* must attest that the inverter communicates with the NRTL server *and executes the commands*.” [emphasis added]

Within the context of communications requirements, executing the commands can only mean that the inverter communicated a proper response back to the server. However, “executes the commands” could also be interpreted to mean requirement #3 above, that the inverter changed its settings in response to a remote command. This is not a Phase 2 issue, and the gateway manufacturer may not be in a position to make the attestation on the inverter’s performance.

During the September 19, 2019 meeting of the Smart Inverter Working Group, participants discussed attestations and which type of manufacturer (gateway or inverter manufacturer) should make the different attestations. It is CALSSA’s understanding that all parties agreed that the inverter manufacturer should make the attestation related to the inverter performance for Functions 1 and 8. CALSSA believes that the Phase 2 communication attestation should be acceptable from either the gateway manufacturer or the inverter manufacturer.

CALSSA requests two clarifications:

- Because Appendix C only concerns Phase 2 communications, “executes the commands” means that the inverter communicated a proper response. A separate attestation on inverters changing settings in response to a communication will come from the inverter manufacturer.
- The Phase 2 requirement can originate from the inverter manufacturer and be submitted by the gateway manufacturer if the gateway manufacturer does not originate the attestation itself.

## **2. Gateway Definition**

Accurately describing categories of devices is challenging because different terms are used in Rule 21, CSIP, and IEEE. CALSSA’s Petition for Modification attempted to use the term “gateway” as referring to both off-site aggregators and on-site energy management systems, but reference to an “inverter control unit” seems to have created confusion.

Per Rule 21, an inverter that does not use IEEE 2030.5 internally can satisfy the requirement for communications capabilities by communicating with an on-site device or an off-site aggregator that translates a signal to 2030.5. The Petition and the Resolution both use the term “gateway” to refer to either type of pathway. However, a specific and clear definition of gateway could avoid confusion.

The SIWG recommends the following definition of a gateway: “Anything other than the DER that provides a communications interface (CSIP/IEEE 2030.5) to the utility for the purposes of exchanging the content contained in the communications messages with one or more DERs.” CALSSA requests that the Commission adopt this definition.

Resolution E-5036

December 5, 2019

By Energy Division's Own Motion Regarding Clarifications to Smart Inverter Requirements and Resolution E-5000/SME

**Attachment C: SCE comments to CALSSA's request for Clarification of Resolution E-5000**

SCE's October 15, 2019 comments are reproduced in full on the subsequent two pages.

## SCE comments to CALSSA's request for Clarification of Resolution E-5000

October 15, 2019

SCE supports the intent behind CALSSA's request for clarification. However, SCE does not believe that CALSSA's request will sufficiently clarify the fundamental ambiguities within Appendix C. SCE strongly believes that in order to ensure clarity for inverter manufacturers, gateway manufacturers, utilities, and DER developers/customers, it is necessary to update the language within Appendix C in a manner that maintains the original intent of Resolution E-5000, and thus, would not necessitate a Petition for Modification. SCE believes that these clarifications can be achieved with the following red-line modifications to Appendix C, which are also consistent with discussions held on this issue within the Smart Inverter Working Group. Therefore, SCE provides the following redline below based on the existing Appendix C language as stated within Resolution E-5000:

### 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 models<sup>140</sup> will demonstrate compliance with the Phase 2 communications requirements via compatibility testing in conjunction with a CSIP-certified gateway ~~(aggregator or EMS)~~<sup>141</sup>. In this testing, a NRTL should perform the following SunSpec CSIP test procedures on the ~~aggregator or energy management system~~ <sup>Gateway</sup> while it is connected to the inverter ~~or inverter control unit~~.

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

**Insert:** *the inverter manufacturer attests that the inverter*

Resolution E-5000

July 11, 2019

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- 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.<sup>142</sup>

Furthermore, SCE supports CALSSA's proposed definition of "Gateway," and would support its inclusion within Rule 21.

**Attachment D: Modifications to Appendix C of Resolution E-5000, issued July 12, 2019****From Resolution E-5000; Issued July 12, 2019****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 models<sup>20</sup> will demonstrate compliance with the Phase 2 communications requirements via compatibility testing in

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<sup>20</sup> 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. (Footnote included from Resolution E-5000)

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conjunction with a CSIP-certified gateway (~~aggregator or EMS~~)<sup>21,22</sup>. In this testing, a NRTL<sup>23</sup> should perform the following SunSpec CSIP test procedures on the ~~gateway 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)
- 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 *inverter or 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

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<sup>21</sup> A "gateway" is anything other than the DER that provides a communications interface (CSIP/IEEE 2030.5) to the utility for the purposes of exchanging the content contained in the communications messages with one or more DERs. (Footnote has been added in redline)

<sup>22</sup> The gateway may have been previously CSIP certified and need not be tested concurrently with the inverter. (Footnote included from Resolution E-5000)

<sup>23</sup> The term "Nationally Recognize Testing Lab (NRTL)", as used throughout this Appendix, refers to both (1) those testing labs that have been recognized by the Occupational Safety and Health Administration (OSHA) as providing evaluation, testing, and certification of electrical products and (2) SunSpec Authorized Testing Laboratories (SunSpec ATLS). (Footnote has been added in redline)



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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.<sup>24</sup>

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<sup>24</sup> 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. (Footnote included from Resolution E-5000)