NEPR

Received:

Jun 20, 2025

10:00 PM

GOVERNMENT OF PUERTO RICO
PUERTO RICO PUBLIC SERVICE REGULATORY BOARD
PUERTO RICO ENERGY BUREAU

IN RE: INTERCONNECTION REGULATIONS	**CASE NO. NEPR-MI-2019-0009** **SUBJECT: Submittal of LUMA's Revised Smart Inverter Sheets and Responses to Stakeholder Comments to LUMA's Comments of April 25, 2025**

MOTION TO SUBMIT LUMA'S REVISED SMART INVERTER SHEETS AND RESPONSES TO STAKEHOLDER COMMENTS TO LUMA'S COMMENTS OF APRIL 25, 2025

TO THE PUERTO RICO ENERGY BUREAU:

COME NOW LUMA Energy ServCo, LLC and **LUMA Energy, LLC** (collectively "LUMA"), through the undersigned legal counsel, and respectfully state and request the following:

I. Introduction

On January 1, 2025, Smart Inverter Settings Sheets ("Settings") developed by LUMA entered into effect, as approved by the Puerto Rico Energy Bureau ("Energy Bureau"). These Settings were established to ensure smart inverters meet standards for grid support and operational efficiency and to improve the integration and functionality of distributed energy resources within Puerto Rico's electric distribution system, while maintaining grid safety and reliability. The Settings were developed following a process of revisions, a technical conference/workshop, and stakeholder commenting period, based on an initial version published by LUMA in April 2024.

After approving these Settings, the Energy Bureau commenced a process, through meetings of a Smart Inverter Working Group ("SIWG") and related commenting periods, to examine potential revisions to the Settings, directed at examining implementation issues and possible modifications to the Settings. Following the conclusion of this lengthy process, LUMA has developed a revised version of the Smart Inverter Settings Sheets, which LUMA is pleased to submit to the Energy Bureau herein. While LUMA has examined the comments of stakeholders in this process, including revisions to the Settings proposed by some stakeholders, LUMA's revised version of the Settings also takes into consideration system-level data, system simulations, operational experience, and alignment with industry standards, among others, as well ensuring the Settings are within the values set forth in the standards required by Regulation 8915[1]. This approach ensures that the revisions are not only data-driven but also consistent with industry standards and practices and meet applicable regulations. LUMA has endeavored to appropriately balance the interests of accommodating for the capabilities of commercially available inverter technologies and maintaining the safety, reliability and operational integrity of the transmission and distribution system. LUMA proposes that these revised Settings become effective as soon as possible.

LUMA is also addressing herein the comments received by stakeholders in response to the comments submitted by LUMA on April 25, 2025 regarding various subjects discussed in the SIWG meetings. LUMA is respectfully requesting the Energy Bureau to take into consideration these responses and LUMA's revised Settings in making any determinations relating to the SIWG process.

II. Relevant Background/Procedural History

1. On November 15, 2024, LUMA submitted to the Energy Bureau a final version of LUMA's Technical Bulletin on Smart Inverter Settings Sheets with an effective date of January 1, 2025 ("January 2025 Smart Inverter Settings Sheets"), in compliance with a Resolution and Order from the Puerto Rico Energy Bureau issued on November 7, 2024 ("November 7th Order), in which the Energy Bureau approved this document with the inclusion of a modification. *See Motion to*

[1] The Puerto Rico Electric Power Authority's Regulation to Interconnect Generators with the Distribution System of the Electric Power Authority and Participate in the Net Metering Programs, January 2017.

Submit Final Technical Bulletin Regarding Smart Inverter Settings Sheets in Compliance with Resolution and Order of November 7, 2025, and Request for Agenda for Workshop Scheduled for November 21, 2024 ("November 15th Motion").

2. As explained in LUMA's November 15th Motion, the Smart Inverter Settings Sheets were the result of a process of revisions of an initial version published by LUMA in April 2024, resulting in a revised version submitted to the Energy Bureau on September 17, 2024, and which was modified prior to finalization as per the November 7th Order. *See id*., p 2.[2] That process also involved a stakeholder technical conference/workshop held on June 18, 2024, and the subsequent filing of comments by stakeholders. *See id.*, pp. 2-6.[3]

3. On November 21, 2024, February 11, 2025, and April 3, 2025, meetings of the Smart Inverter Working Group ("SIWG") were held, in accordance the November 7th Order and Resolutions issued by the Energy Bureau on January 13, 2025 and March 10, 2025. The SIWG was established by the Energy Bureau in its November 7th Order to hold meetings geared at addressing issues relating to the implementation and possible modifications to the January 2025 Smart Inverter Settings Sheets. *See* November 7th Order, pp. 6-7. The SIWG meetings were held with the participation of LUMA, various stakeholders, and Energy Bureau consultants, including

[2] *See also Motion to Submit Revised Technical Bulletin regarding Smart Inverter Settings Sheets Issued by LUMA* filed on September 13, 2024; and *Motion to Submit Revised Technical Bulletin regarding Smart Inverter Settings Sheets and Request to Substitute Exhibits 1 and 2 Submitted on September 13, 2024* filed on September 17, 2024.
[3] *See also Urgent Request Regarding LUMA's Publication of a "Smart Inverter Settings Sheets- Technical Bulletin/ NEPR-MI-2019-0009*" filed on April 4, 2024; *Renewed Request Regarding LUMA's Technical Bulletin* filed on June 17, 2024; *Request for Various Orders Regarding June 18th Conference and Technical Bulletin* filed on June 25, 2024; *Enphase Energy, Inc. Comments on Default Smart Inverter Settings* filed on July 15, 2024; *Comments of Sunrun Inc.* filed on July 15, 2024; *Comments of SESA Puerto Rico* filed on July 16, 2024; *Comments of Tesla, Inc.* filed on August 20, 2024; *Motion in Support of Revised Technical Bulletin on Smart Inverter Setting Sheets* filed on September 26, 2024; and *Tesla, Inc. Response to LUMA's Motion to Submit Revised Technical Bulletin Regarding Smart Inverter Settings Sheets* filed on October 1, 2024.

the Electric Power Research Institute (EPRI). Following each meeting, some SIWG stakeholders submitted comments to the Energy Bureau regarding the subjects discussed in the meeting.[4]

4. On April 25, 2025, LUMA submitted its comments on several topics discussed during the SIWG meetings ("LUMA's April 25th Comments"). *See Motion to Submit LUMA's Comments on Subjects Discussed During Smart Inverter Working Group Meetings*.

5. In response to LUMA's April 25th Comments, Enphase Energy, Inc. ("Enphase") and the Solar and Energy Storage Association of Puerto Rico ("SESA") submitted comments on May 7, 2025 ("Enphase's May 7th Comments") and May 14, 2025 ("SESA's May 14th Comments"), respectively, opposing some of LUMA's positions set forth in LUMA's April 25th Comments and requesting the Energy Bureau to revise the January 2025 Smart Inverter Settings Sheets in accordance with a proposal of modified settings presented by SESA. *See Enphase Energy, Inc. Comments to PREB re: Smart Inverter Working Group Filings* filed on May 7, 2025 and *Comments of the Solar and Energy Storage Association of Puerto Rico (SESA) Regarding Urgent Need for Immediate Action on Smart Inverter Settings* filed on May 14, 2025.

6. On May 24, 2025, LUMA filed a *Notice of Intent to File Comments in Response to Comments Presented by Enphase and SESA and to Submit LUMA's Proposal regarding the Smart Inverter Settings Sheets* ("May 24th Motion"). In it, LUMA informed that it disagreed with the conclusions set forth in Enphase's May 7th Comments and SESA's May 14th Comments regarding LUMA's recommendations in LUMA's April 25th Comments. *See* May 24th Motion, p. 3. LUMA also asked for an opportunity to submit to the Energy Bureau LUMA's position on Enphase's May

[4] *See Enphase Energy, Inc. Comments to PREB Smart Inverter Working Group re: Customer Protections for System Curtailments under the Volt-Watt Smart Inverter Function* filed on December 11, 2024; *Initial Feedback from the Solar & Energy Storage Association of Puerto Rico (SESA)* filed on December 11, 2024; *Comentarios Suplementaris de la Oficina Independiente de Protección (OIPC) al Consumidor Sobre lo Discutido en el Primer Taller Sobre "Smart Inverters"* filed on December 26, 2024; *Input regarding real-world impact of new Smart Inverter Settings since going into effect January 1st, 2025, and Request for Urgent Modifications to required Smart Inverter Settings* filed on February 10, 2025; and *SESA Re-Filing of Smart Inverter Settings Recommendations* filed on April 25, 2025.

7th Comments and SESA's May 14th Comments, as well as present LUMA's proposal regarding the January 2025 Smart Inverters Settings, for the Energy Bureau to have a complete record before making any determinations on these subjects. *See id*. Accordingly, LUMA requested that the Energy Bureau grant LUMA until June 20, 2025, to submit its response to Enphase's May 7th Comments and SESA's May 14th Comments, as well as additional comments and proposals relating to the January 2025 Smart Inverter Settings Sheets. *See id*., pp. 4-5.

III. Filing of Comments and Revised Smart Inverter Settings

7. In accordance with LUMA's May 24th Motion, LUMA submits herein its responses to the comments made by Enphase and SESA in Enphase's May 7th Comments and SESA's May 14th Comments, respectively. *See Exhibit 1*. In addition, LUMA submits herein LUMA's proposed revisions to the January 2025 Smart Inverter Settings Sheets, which LUMA proposes should enter into effect as soon as possible, and a document providing background information on the proposed revisions. *See Exhibits 2 and Exhibit 3,* respectively. In preparing the proposed revised Smart Inverter Settings Sheets LUMA considered the feedback obtained from the stakeholders during the SIWG meetings and separate discussions held with stakeholders, alongside system-level data, simulation results, operational experience, alignment with industry standards and best practices from other jurisdictions, while ensuring that all values are within the IEEE Std. 1547-2018 range of values. *See Exhibit 3*, Section 1.0. LUMA has endeavored to strike an appropriate balance between accommodating the capabilities of commercially available inverter technologies and maintaining the safety, reliability and operational integrity of the transmission and distribution system. *See id*.

8. LUMA reaffirms its commitment to the safe, sustainable, and orderly growth of small-scale renewable energy production, for the benefit of all customers and Puerto Rico's energy future.

WHEREFORE, LUMA respectfully requests the Energy Bureau to (i) **take notice** of the aforementioned; (ii) **take into consideration** LUMA's comments and proposed revised settings included in *Exhibits 1, 2 and 3* herein in issuing any determination on the subject matters addressed in the SIWG meetings; and (iii) **approve** the proposed revised Smart Inverter Settings Sheets in *Exhibit 2* herein to be made effective as soon as possible.

RESPECTFULLY SUBMITTED.

In San Juan, Puerto Rico, this 20th day of June 2025.

We hereby certify that we filed this Motion using the electronic filing system of this Puerto Rico Energy Bureau and that copy of this Motion will be notified to hrivera@jrsp.pr.gov; arivera@gmlex.net; mvalle@gmlex.net; agustin.irizarry@upr.edu; javrua@sesapr.org; contratistas@jrsp.pr.gov; aconer.pr@gmail.com; john.jordan@nationalpfg.com; cfl@mcvpr.com; and mqs@mcvpr.com.

DLA PIPER

DLA Piper (Puerto Rico) LLC
500 Calle de la Tanca, Suite 401
San Juan, PR 00901-1969
Tel. 787-945-9147
Fax 939-697-6147

/s/ Laura T. Rozas
Laura T. Rozas
RUA Núm. 10,398
laura.rozas@us.dlapiper.com

Exhibit 1
Responses to SESA and Enphase Comments

Response to Comments Made by Solar and Energy Storage Association (SESA) and Enphase Regarding Smart Inverter Settings

NEPR-MI-2019-0009

June 20, 2025

Response to Comments made by SESA and Enphase Regarding Smart Inverter Settings

Introduction

On November 7, 2024, the Puerto Rico Energy Bureau (Energy Bureau) approved LUMA's Smart Inverter Settings Technical Bulletin, with modifications, through its *Resolution and Order* in Case No. NEPR-MI-2019-0009. The approved settings aim to enhance grid support, operational efficiency, and the integration of distributed energy resources, while ensuring the safety and reliability of Puerto Rico's electric system. The development of these Smart Inverter Settings was the result of a comprehensive process that included stakeholder input, technical workshops, and iterative revisions.

As part of the ongoing Smart Inverter Working Group (SIWG) review process, LUMA submitted additional comments on April 25, 2025, addressing topics discussed in SIWG meetings. In response, the Solar and Energy Storage Association (SESA) and Enphase filed comments on May 7 and May 14, 2025, respectively, challenging aspects of LUMA's recommendations. This document presents LUMA's responses to those stakeholder comments and reaffirms its proposed revisions to the Smart Inverter Settings, which are based on stakeholder feedback, operational data, simulations, and compliance with Regulation 8915 and IEEE Std. 1547-2018.

These proposed revisions are intended to ensure continued system reliability, support the capabilities of commercially available inverter technologies, and maintain alignment with regulatory and technical standards.

Response to Comments made by SESA and Enphase Regarding Smart Inverter Settings

1.0 Request to Approve Smart Inverter Settings Proposed by SESA and Enphase

1.1 Statement of Position

Both SESA and Enphase requested the Puerto Rico Energy Bureau (Energy Bureau) to approve the specific changes to Smart Inverter Settings proposed by SESA (filed on February 10 and April 25, 2025). According to SESA, these reflect “real-world operational experience” and are “vetted by major inverter manufacturers,” which would reduce customer curtailment and increase grid support.

1.2 Response

During this process, LUMA has welcomed engagement with stakeholders to consider revisions to the Smart Inverter Settings, with the involvement of the Electric Power Research Institute (EPRI), which also participated in the meetings. During the third meeting of the SIWG, LUMA expressed its openness and requested SESA to provide the data supporting their proposal to ensure any decisions to revise the Smart Inverter Settings are data driven. LUMA has also met several times with SESA and other stakeholders to discuss the Smart Inverter Settings. However, as of this date, LUMA has not received any supporting data from SESA. While LUMA has reviewed SESA’s proposal and listened to the feedback provided by stakeholders during this process, it has also taken into consideration the system-level data and results of simulations conducted. Also, LUMA’s operational experience, best practices from other jurisdictions, and alignment with industry standards were considered to determine whether and what revisions to the settings are appropriate, while also ensuring that the revisions are within the IEEE Std. 1547-2018 range of values, which is the standard mandated by Regulation 8915[1]. As a result, LUMA has developed revised Smart Inverter Settings, which LUMA is submitting to the Energy Bureau today. In developing these revised settings, LUMA has also endeavored to strike an appropriate balance between accommodating the capabilities of commercially available inverter technologies and maintaining the safety, reliability, and operational integrity of the transmission and distribution system. LUMA proposes that the revised settings submitted today by LUMA be adopted as soon as possible.

[1] *The Puerto Rico Electric Power Authority’s Regulation to Interconnect Generators with the Distribution System of the Electric Power Authority and Participate in the Net Metering Programs, January 2017 (“Regulation 8915”).*

Response to Comments made by SESA and Enphase Regarding Smart Inverter Settings

2.0 Volt/Watt Activation Timeline

2.1 Statement of Position

SESA requested the Energy Bureau to defer the Volt/Watt activation until at least June 30, 2026, because premature activation would create financial harm to customers without a compensation mechanism.

2.2 Response

LUMA opposes the proposal to further defer Volt/Watt activation. Volt/Watt and Volt/Var are essential grid stability tools that are already in use under abnormal operational conditions. Delaying activation continues to jeopardize the operability of the Distribution System and increase grid risks under high distributed energy resources (DER) penetration. The Volt/Watt function also has the benefit of keeping DER systems online during a high-voltage scenario, resulting in maintaining the system connected for a longer period of time.

As discussed in the background document for the revised Smart Inverter Settings prepared by LUMA (being submitted on this date), LUMA recommends an initial “optional” adoption of the Volt/Watt settings for all DER customers, but mandatory adoption for: (a) those with high DER penetration circuits above 30% and, (b) all customers identified in an area of a feeder that is experiencing high-voltage based on supplemental studies or as informed by customer calls indicating problematic operating conditions.

3.0 Additional Expert-Facilitated Workshops

3.1 Statement of Position

If the Energy Bureau chooses not to order the adoption of SESA's settings, SESA requests the Energy Bureau to convene an expert-facilitated workshop focused on short-term adjustments to the settings.

3.2 Response

LUMA sees no need to convene additional expert-facilitated workshops for the repeated discussion of the same subjects. As a result of the SIWG, three lengthy expert-facilitated meetings (ranging from three (3) to about five (5) hours in length) have already been held, followed by three (3) commenting periods, during which stakeholders submitted comments on seven (7) occasions. In addition, LUMA has met separately with stakeholders on at least five (5) occasions. Sufficient dialogue has already occurred regarding the Smart Inverter Settings. LUMA has examined the system-level data and performed simulations to support the revised settings that it is submitting today, which also account for industry practices and regulatory requirements. LUMA has also consistently expressed openness to reviewing data from developers, such as Enphase, and has reiterated this request across multiple venues. However, to the extent that there is no willingness to share such data, there is no purpose in continuing to revisit the same discussions. Continually reopening matters that have been thoroughly discussed in this process undermines regulatory finality. On the other hand, further delaying the implementation of the revised settings developed by LUMA undermines efforts to protect the safety and reliability of the grid, which is a pressing concern in light of the extensive DER penetration. In sum, further delaying the implementation of these revised settings is not justified.

Response to Comments made by SESA and Enphase Regarding Smart Inverter Settings

4.0 LUMA's Authority to Revise Smart Inverter Settings

4.1 Statement of Position

Concerning LUMA's April 25, 2025, filing, SESA alleges that LUMA seeks unilateral authority to revise the settings without industry collaboration or Energy Bureau's oversight; the settings should be adopted or modified via regulatory processes with public input and final approval of the regulator.

4.2 Response

LUMA rejects SESA's and Enphase's characterization of LUMA's role. As LUMA has explained in previous submittals[2], LUMA published the Technical Bulletin to provide supporting technical information to the Puerto Rico Electric and Power Authority (PREPA) Regulation 8915, which requires the application of the IEEE 1547-2018 standard for Smart Inverter Settings, as it may be updated. *See e.g.*, Regulation 8915, Section IV, Article B, Paragraph 1 ("In addition to the requirements of this Section, the customer's DER must comply with the applicable standards in effect, including, but not limited to, IEEE 1547 …"). LUMA has all the rights and responsibilities of PREPA with respect to the implementation of Regulation 8915, pursuant to the Puerto Rico Transmission and Distribution System Operation and Maintenance Agreement executed among the Authority, LUMA, and the Puerto Rico Public-Private Partnerships Authority (the "Authority") dated as of June 22, 2020 (T&D OMA). Under the T&D OMA, LUMA is responsible for "(i) provid[ing] management, operation, maintenance, repair, restoration and replacement and other related services for the Transmission and Distribution (T&D) System, in each case that are customary and appropriate for a utility transmission and distribution system service provider, […] and (ii) establish[ing] policies, programs and procedures with respect thereto" (collectively, the "O&M Services"). *See* T&D OMA, Section 5.1. The O&M Services are to be provided in accordance with "Contract Standards"[3] (*see id.*), requiring compliance with Applicable Law[4], Prudent Utility Practice[5], and other

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[2] *See Docket No. NEPR-MI-2019-0009, Motion to Submit Final Technical Bulletin Regarding Smart Inverter Settings Sheets in Compliance with Resolution and Order of November 7, 2024 and Request for Agenda for Workshop Scheduled for November 21, 2024, p. 3.*

[3] *"Contract Standards" is defined as "the terms, conditions, methods, techniques, practices and standards imposed or required by: (i) Applicable Law; (ii) Prudent Utility Practice; (iii) applicable equipment manufacturer's specifications and reasonable recommendations; (iv) applicable insurance requirements under any insurance procured pursuant to [the T&D OMA]; (v) the Procurement Manuals, as applicable, and (vi) any other standard, term, condition or requirement specifically contracted in [the T&D OMA] to be observed by [LUMA]". Id. Section 1.1 at page 9.*

[4] *"Applicable Law" is defined as including "any foreign, national, federal, state, Commonwealth, municipal or local law, constitution, treaty, convention, statute, ordinance, code, rule, regulation, common law, case law or other similar requirement enacted, adopted, promulgated or applied by any [governmental body] …" in each case applicable to the parties to the T&D OMA. Id. at page 3.*

[5] *"Prudent Utility Practice" is defined, in pertinent part, as "…at any particular time, the practices, methods, techniques, conduct and acts that, at the time they are employed, are generally recognized and accepted by companies operating in the United States electric transmission and distribution business as such practices, methods, techniques, conduct and acts appropriate to the operation, maintenance, repair and replacement of assets, facilities and properties of the type covered by the [T&D OMA] . . . ." Id. at page 26.*

Response to Comments made by SESA and Enphase Regarding Smart Inverter Settings

standards, terms, conditions, and requirements specified in the T&D OMA (*see id*. at page 9). The O&M Services include being "responsible for all electric transmission, distribution, load serving and related activities for the safe and reliable operation and maintenance of the T&D System, … including "compliance with interconnection of renewables in accordance with Applicable Law". *See Id*. Annex I, Section 1(a).

With respect to these rights and responsibilities, the T&D OMA provides that, with some exceptions (not applicable in this case) "[LUMA] shall (A) be entitled to exercise all of the rights and perform the responsibilities of [PREPA] in providing the O&M Services, and (B) have the autonomy and responsibility to operate and maintain the T&D System and establish the related plans, policies, procedures and programs with respect thereto as provided in [the T&D OMA]". *Id*. Section 5.1. Hence, pursuant to the T&D OMA, LUMA has the authority to perform PREPA's rights and obligations under Regulation 8915.

In sum, in issuing the Smart Inverter Settings, LUMA is exercising the rights and obligations of PREPA under Regulation 8915 as provided under the T&D OMA and providing stakeholders clarity as to the version of a basic industry standard already made applicable to Puerto Rico by way of Regulation 8915.

LUMA further emphasizes that its recommendations are aimed at reducing high-voltage issues and potential risks to the electric system, in alignment with LUMA's obligation under the T&D OMA to maintain a safe and reliable operation of Puerto Rico's energy system.[6]

[6] *See Docket No. NEPR-MI-2019-0009, Motion to Submit LUMA's Comments on Subjects Discussed During Smart Inverter Working Group Meetings submitted on April 25, 2025, p.7.*

5.0 Retroactive Application of Smart Inverter Settings

5.1 Statement of Position

Both SESA and Enphase allege that LUMA proposes the retroactive application of the Smart Inverter Settings on systems installed after 2018, and they oppose it. According to SESA, forcing retroactive changes raises serious due process and constitutional questions. Enphase argues that it is not clear how the proposed retroactive requirements would be enforced upon original equipment manufacturers (OEMs) since the Energy Bureau does not have regulatory jurisdiction over OEMs; OEMs are not parties to the interconnection agreements. Both SESA and Enphase indicate that they may favor a regulator-approved retroactive activation of mutually agreed-upon Smart Inverter Settings voluntarily, which would include incentives for the customer to voluntarily agree to implement the settings.

5.2 Response

LUMA disagrees with SESA's and Enphase's description of LUMA's proposal. LUMA is proposing that the settings be applied to systems installed after 2018 to address systems that have been installed since the implementation of Regulation 8915. This regulation already requires the application of IEEE 1547-2018.[7] Therefore, most systems that have been installed since then should have the capabilities to adjust their settings in accordance with IEEE 1547-2018. Applying the settings to all of these systems captures a larger DER population and, as a result, has a more meaningful grid impact. The application of the settings in this fashion allows for increased hosting capacity, safety, and proper inverter behavior across the system.

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[7] *See Regulation No.. 8915, Section VI, Article B. Paragraph 2..*

6.0 Compensation for Non-exported Energy

6.1 Statement of Position

SESA disagrees with LUMA's position that LUMA is not required to compensate customers for non-exported energy.

6.2 Response

LUMA firmly rejects the notion of compensation for complying with regulatory requirements. Smart Inverter Settings are mandatory under Regulation 8915.[8] These settings are non-discretionary, safety-critical grid functions, and LUMA has the responsibility to implement them pursuant to Regulation 8915 and LUMA's obligations under the T&D OMA.

In addition, the applicable legal, regulatory, and contractual framework does not create a right to compensation for non-exported energy, while it does authorize LUMA to limit energy exports when necessary to protect the electric power system. Compensation is limited to actual net energy delivered to the grid, as established under Act 114-2007, Regulations 8915 and 8916, and the standard DER interconnection agreements.

[8] *See Regulation 8915, Section IV, Article B, Paragraph 2.*

7.0 Real-time Access to Data

7.1 Statement of Position

Both SESA and Enphase argue that LUMA is demanding real-time access from private companies to inverter operational data. SESA argues that this data is proprietary and subject to confidential agreements and that LUMA’s suggestion raises data privacy, cybersecurity, and operational cost issues. Enphase argues that Enphase is prevented from sharing customer data with LUMA without the customer’s express permission and that data sharing creates material costs to OEMs. Enphase suggests that a standardized method for customers, installers, or OEMs to report voltage issues would help fill in data gaps and mitigation solutions.

7.2 Response

LUMA acknowledges the concerns raised by SESA and Enphase. LUMA is not proposing measures that would infringe on confidentiality agreements, data privacy, or other valid information protections. LUMA insists that visibility into smart inverters' behavior is essential to understanding DER behavior and system impacts and supporting grid stability and planning. The data that LUMA is requesting to be visible is non-personal and strictly technical (e.g., voltage, frequency, power output, ride-through behavior). This data is used to evaluate hosting capacity, verify compliance, and model feeder behavior, not for customer surveillance. To the extent that access to this type of data is limited, data-driven decisions will be hampered. LUMA proposes to use methods, such as customer consent, common file formats, and standardized reporting, to address the mentioned stakeholder concerns.

8.0 EPRI Common File Format

8.1 Statement of Position

SESA argues that LUMA wants to make EPRI's common file format mandatory and enforceable for all developers alongside "proof-of-setting compliance". SESA argues that SESA encouraged publishing the settings using the common file format to improve clarity and reduce implementation costs, but did not propose that it be mandated. According to SESA, there is no industry precedent or regulatory mandate for such a requirement.

8.2 Response

The subject of using EPRI's Common File Format was raised by the Energy Bureau when it included it as a subject of discussion during the SIWG process. LUMA agrees that there should be a single, standardized, and universal setup and verification system to standardize reporting, ensure verifiable compliance, and facilitate technical reviews. EPRI's Common File Format, implemented across the board, can serve these functions. Therefore, LUMA proposes that its implementation be mandatory and enforceable for all developers. If the use of this file format is not made mandatory, its utility will be undermined as LUMA will have to develop multiple verification systems to ensure compliance, which would be inefficient and provide limited information. Furthermore, developers should be required to provide evidence of the applied settings upon request, enabling ongoing monitoring and validation of DG compliance with technical requirements.

Exhibit 2
LUMA's Proposed Revised Smart Inverter Settings Sheets

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SMART INVERTER SETTINGS SHEETS 2.0

June 20, 2025

Note to the updated version (June 20th, 2025):

This revised version of the Technical Bulletin 2024-001 will become effective immediately upon approval by the Puerto Rico Energy Bureau (PREB). It reflects updates that consider input from industry stakeholders—including equipment manufacturers and developer groups—as well as customer feedback, system performance data, and best practices adopted in other jurisdictions with high levels of DER integration. These refinements aim to ensure that the smart inverter settings not only align with IEEE Std 1547-2018 but also support a stable, safe, and interoperable electric system as Puerto Rico continues its transition to a more distributed and renewable energy landscape.

Note to original version:

LUMA Energy publishes the Technical Bulletin 2024-001 to provide supporting technical information to the current regulation, *Regulation for the Interconnection of Generators with the Distribution System of the Puerto Rico Electric Power Authority and to Participate in Net Metering Programs*, Regulation No. 8915, February 6, 2017. This bulletin seeks to apply the IEEE 1547-2018 standard for smart distributed energy resources (DERs) settings. Regulation 8915 in its Article of Control and Protection, #2 indicates that "In addition to the requirements contained in this Section, the customer's DG must comply with applicable standards, including, but not limited to, IEEE 1547, IEEE 519 and IEEE/ANSI C37.90 (Standard for Relays and Relay Systems Associated with Electric Power Apparatus)".

The main purpose of adopting the requirements in this bulletin is to improve the system stability and operations under high penetration of DERs. Starting **January 01, 2025**, all DER applications must indicate the use of inverters meet the utility required default settings and functions that are specified in this bulletin.

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1. Required Smart Inverter Functions

Smart Inverters must be (a) UL 1741 SB listed, (b) set to the default setting provided in this document, and (c) perform the default functions, provided in this document, “Smart Inverter Settings Sheets”.

Customers must comply with the requirements set forth in this “Smart Inverter Settings Sheets” except where alternative site-specific Smart Inverter settings and function activation statuses are defined in the interconnection agreement as a result of a detailed interconnection study. Any alternative settings and function activation statuses defined in the interconnection agreement will take precedence and supersede the default settings and function activation statuses provided in this document. Notwithstanding the following provisions of this “Smart Inverter Settings Sheets”, customer’s Smart Inverter(s) shall conform with the requirements and functions required pursuant to interconnection agreement.

1.1. Communication Requirements

Table 1-1 lists the eligible communication protocols for Smart Inverters connected to the distribution system. Smart Inverters connecting to the distribution system shall be capable of supporting at least one of these protocols.

Table 1-1- List of eligible communication protocols

Protocol	Transport	Physical Interface/Layer
IEEE 2030.5 (SEP 2.0)	TCP/IP	Ethernet
IEEE 1815 (DNP3)	TCP/IP	Ethernet
SunSpec Modbus	TCP/IP	Ethernet
	N/A	RS-485

1.2. Smart Inverter Functions and Control Modes

Table 1-2- Smart Inverter Control Modes lists functions and control modes that must be supported by Smart Inverters as well as the default status of each function and control mode.

Table 1-2- Smart Inverter Control Modes

Applicable to Retail Customers Interconnected			
Function/ Control Mode of Operation	**Required/Optional**	**Description**	**Default Activation Status**
Anti-Islanding	Required	Refers to the ability to detect loss of utility source and cease to energize	Activated
Constant power factor	Required	Refers to Power Factor set to a fixed value.	Deactivated
Active Power-Reactive Power	Required	Refers to the control of real power output as a function of reactive power	Deactivated
Constant Reactive Power	Required	Refers to Reactive Power set to a fixed value	Deactivated
Voltage Ride through	Required	Refers to the ability of Smart Inverter to ride through a certain range of voltages before tripping off	Activated
Frequency Ride through	Required	Refers to ability of Smart Inverter to ride through a certain range of frequencies before tripping off	Activated
Voltage – Reactive Power (Volt/Var)	Required	Refers to control of reactive power output as a function of voltage	Activated
Voltage – Active Power (Volt/Watt)	Required	Refers to control of real power output as a function of voltage	Activated [1]
Frequency Droop (Frequency – Watt)	Required	Refers to control of real power as a function of frequency	Activated
Enter Service	Required	Refers to the ability of smart inverters to begin operation with an energized utility source.	Activated
Normal Ramp-up Rates	Optional	Refers to ability to transition between energy output levels over the normal course of operation	Activated, if available

[1] LUMA recommends an initial "optional" adoption of the Volt/Watt settings for all DG customers, but mandatory adoption for: (a.) those high DG penetration circuits above 30% and, (b.) all customers identified in an area of a feeder that is experiencing high voltage based on supplemental studies or as informed by customer calls indicating problematic operating conditions.

2. Smart Inverter Function and Control Mode Settings

This section lists the required settings for Smart Inverter functions and control modes.

2.1. Anti-Islanding

Smart Inverters shall detect the unintentional island and trip as specified in Table 2-1.

Table 2-1- Responses to Islanding and Open Phase Conditions - ACTIVATED

Applicable to Retail Customers Interconnected	
Condition	**Maximum Trip Time (s)**
Islanding/Open Phase	2

2.2. Response to Abnormal Voltage

2.2.1. Voltage Trip Settings

Smart Inverters shall meet the abnormal voltage response requirements, as specified in Table 2-2.

Table 2-2- Smart Inverter Response to Abnormal Voltage

Voltage Trip Settings	Default Voltage (pu)	Adjustable Range for Voltage (pu)	Default Trip/Clearing Time (s)	Adjustable Range for Trip Time (s)
Over Voltage 2 (OV2)	V ≥ 1.2	1.2	0.16	Fixed at 0.16
Over Voltage 1 (OV1)	V ≥ 1.1	1.1 - 1.2	13	1 - 13
Under Voltage 1 (UV1)	V ≤ 0.88	0 - 0.88	21	11 - 50
Under Voltage 2 (UV2)	V ≤ 0.5	0 - 0.5	2	2 - 21

2.2.2. Voltage Ride-Through

Smart Inverters shall meet the Low/High Voltage Ride-Through requirements, as specified in Table 2-3.

Table 2-3- Low/High Voltage Ride-Through Minimum Requirement – ACTIVATED

Voltage Range	Voltage Range (pu)	Operating Mode/Response	Minimum Ride Through Time (s) (Design Criteria)	Maximum Response Time (s) (design criteria)
High Voltage 2	V ≥ 1.2	Cease to Energize	N/A	0.16
High Voltage 1	1.1 < V ≤ 1.2	Momentary Cessation	12	0.083
Near Normal Voltage	0.88 ≤ V ≤ 1.1	Continuous Operation	Infinite	N/A
Low Voltage 1	0.7 ≤ V < 0.88	Mandatory Operation	20	N/A
Low Voltage 2	0.5 ≤ V < 0.7	Mandatory Operation	10	N/A
Low Voltage 3	V < 0.5	Momentary Cessation	1	0.083

2.3. Response to Abnormal Frequency

2.3.1. Frequency Trip Settings

Smart Inverters shall meet the abnormal frequency response requirements, as specified in Table 2-4.

Table 2-4- Smart Inverter Response to Abnormal Frequency

Frequency Trip Settings	Default Frequency (Hz)	Adjustable Range for Frequency (Hz)	Default Trip/Clearing Time (s)	Adjustable Range for Trip Time (s)
Over Frequency 2	f ≥ 62	61.8 - 66	0.16	0.16 - 1000
Over Frequency 1	f ≥ 61.2	61.2 - 66	300	21 - 1000
Under Frequency 1	f ≤ 58.5	50 - 58.8	300	21 - 1000
Under Frequency 2	f ≤ 56.5	50 - 57	0.16	0.16 - 1000

2.3.2. Frequency Ride-Through

Smart Inverters shall meet the Low/High Frequency Ride-Through requirements, as specified in Table 2-5.

Table 2-5- Low/High Frequency Ride-Through Minimum Requirement – ACTIVATED

Frequency Ride-Through Settings	Frequency Range (Hz)	Operating Mode	Minimum Ride Through Time (s)
High Frequency 2	f > 62	N/A	N/A
High Frequency 1	61.2 < f≤ 62	Mandatory Operation	299
Near Normal Frequency	58.8 ≤ f ≤ 61.2	Continuous Operation	Infinite
Low Frequency 1	57 ≤ f < 58.8	Mandatory Operation	299
Low Frequency 2	f < 57	N/A	N/A

2.4. Voltage-Reactive Power Control Mode Settings

An example Volt-Var characteristic is shown in Figure 2-1. The voltage-reactive power characteristic shall be configured in accordance with the default parameter values specified in Table 2-6.

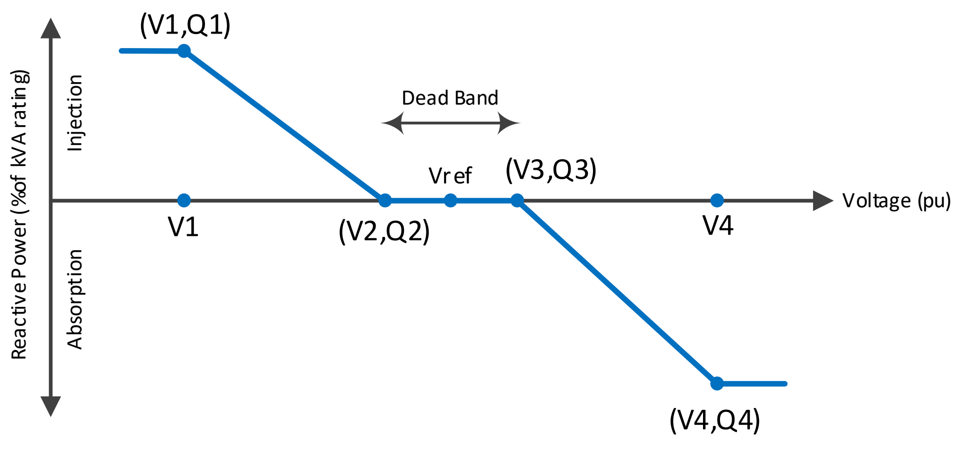

Figure 2-1. Example Volt-Var characteristic

Table 2-6- Volt-Var Settings – ACTIVATED[2]

Volt-Var Parameters	Definitions	Default Values (% of nominal rating)	Allowable Range	
			Minimum	Maximum
Vref	Dead band center	VN	95% VN	105% VN
V2	Dead band lower voltage limit	98% VN	Vref - 3%VN	Vref
Q2	Reactive power injection or absorption at voltage V2	0	maximum reactive power capability, absorption	maximum reactive power capability, injection
V3	Dead band upper voltage limit	104% VN	Vref	105% VN
Q3	Reactive power injection or absorption at voltage V3	0	maximum reactive power capability, absorption	maximum reactive power capability, injection
V1	Voltage at which DER shall inject Q1 reactive power	92% VN	Vref - 18%VN	V2 - 2%VN
Q1	Reactive power injection at voltage V1	44%	0	maximum reactive power capability, injection
V4	Voltage at which DER shall absorb Q4 reactive power	107% VN	V3 + 2%VN	Vref + 18%VN
Q4	Reactive power absorption at voltage V4	44%	maximum reactive power capability, absorption	0
Open loop response time	Time to 90% of the reactive power change in response to the change in voltage	5 sec	1 sec	90 sec

[2] This requires that the Smart Inverter operates with a reactive power priority and generate/absorb reactive power to the ranges specified in this table irrespective of active power production.

2.5. Voltage-Active Power Control Mode Settings

Two examples of these characteristics are shown in Figure 2-2. The characteristic shall be configured in accordance with the default parameter values specified in Table 2-7.

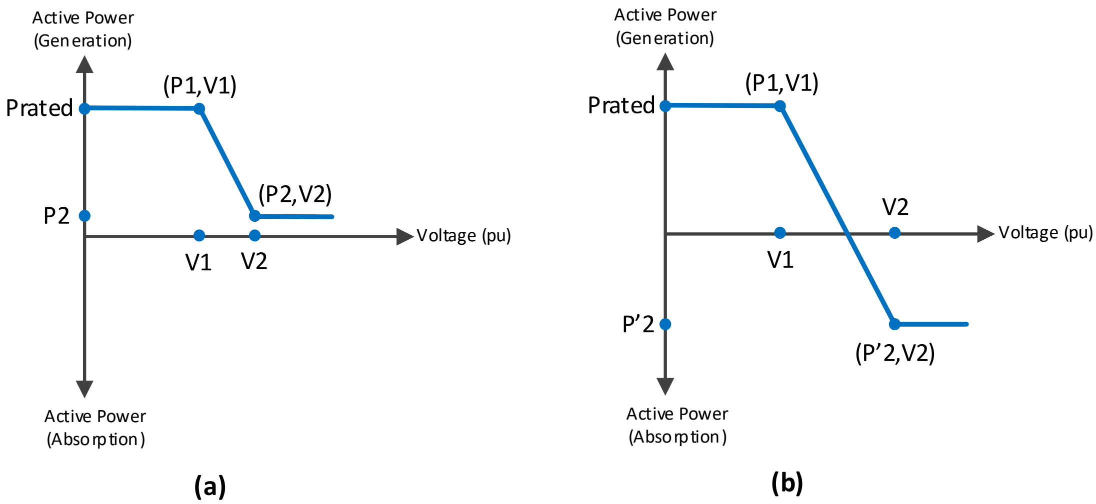

Figure 2-2. Example Volt-Watt characteristics

Table 2-7- Volt-Watt Settings – Activated[2]

Voltage-active power parameters	Default Settings	Ranges of allowable settings	
		Minimum	Maximum
V1	107% VN	105% VN	109% VN
P1	P_{RATED}	NA	NA
V2	110% VN	V1 + 1% VN	110% VN
P2 (applicable to DER that can only generate active power)	The lesser of 0.2 P_{RATED} or P_{MIN}[3]	P_{MIN}	P_{RATED}
P'2 (applicable to DER that can generate and absorb active power)	0	0	P'_{RATED}[4]
Open-loop response time	10 sec	0.5 sec	60 sec

[2] See footnote 1.

[3] P_{MIN} is the minimum active power output in p.u. of the DER rating (i.e., 1.0 p.u.)

[4] P'_{RATED} is the maximum amount of active power that can be absorbed by the DER.

2.6. Enter Service Settings

Smart Inverters shall be set to the Enter Service Settings in Table 2-8.

Table 2-8 Enter Service Settings

Enter Service Criteria		Default Setting	Ranges of allowable settings
Permit Service		Enabled	Enabled/Disabled
Applicable voltage within range	Minimum value	≥ 0.88 p.u.	0.88 p.u. to 0.95 p.u.
	Maximum value	≤ 1.06 p.u	1.05 p.u. to 1.1 p.u.
Frequency within range	Minimum value	≥ 59.0 Hz	59 Hz to 59.9 Hz
	Maximum value	≤ 60.5 Hz	60.1 Hz to 61.0 Hz
Enter Service Delay		300 s	0 seconds to 600 seconds
Enter Service Randomized Delay		N/A	1 second to 1000 seconds
Enter Service Ramp Rate		50 s	1 second to 1000 seconds

2.7. Ramp Rate Settings

The following is the ramp-rate requirement during normal and reconnection operation of Smart Inverters:

- Normal ramp-up rate (Optional): For transitions between energy output levels over the normal course of operation, the default value is 100% of maximum current output per second with a range of adjustment between 1% to 100%.

2.8. Frequency Droop Settings

Smart Inverters shall be set to the Frequency Droop Settings in Table 2-9.

Table 2-9 Frequency Droop Settings

Frequency droop parameters	Default Settings	Ranges of allowable settings	
		Minimum	Maximum
Dead Band (db_{OF}, db_{UF}) (HZ)	0.1	0.017	1.0
Droop Coefficient (k_{OF}, k_{UF})	0.05	0.02	0.05
Response Time ($T_{response}$) (s)	5	0.2	10

Exhibit 3
Comments on Revisions to Smart Inverter Settings Sheets

Smart Settings Update Information

NEPR-MI-2019-0009

June 20, 2025

Smart Settings Update Information

Contents

Smart Settings Update Information

Introduction

In accordance with its responsibility to maintain the safety and reliability of the electric system, in November 2024, LUMA submitted the Smart Inverter Technical Bulletin 2024-001 (Technical Bulletin) to the Puerto Rico Energy Bureau (Energy Bureau), establishing default Smart Inverter Settings aligned with IEEE Std. 1547-2018 with the objective to mitigate the operational impacts that Distributed Energy Resources systems (DER) have on the electric grid. At that time, LUMA records indicated over 142,600 DER systems connected to the grid, with studies at that time indicating emerging issues exacerbated by the growing volumes of DER connecting to the grid. The bulletin was adopted with an effective date of January 1, 2025, and currently serves as the technical foundation for the interconnection of inverter-based DER across Puerto Rico. In May 2025, LUMA records indicate over 165,000 DER systems connected to the Puerto Rico energy grid, representing a 16% increase since November 2024.

In parallel, the Energy Bureau convened the Smart Inverter Working Group (SIWG) through a Resolution and Order, requiring LUMA's participation and bringing together key stakeholders—including the Energy Bureau, Tesla, Enphase, Solar Energy Storage Association of Puerto Rico (SESA), Electric Power Research Institute (EPRI), and LUMA—to collaboratively review the proposed settings. The SIWG workshops focused on evaluating technical requirements, addressing stakeholder concerns, and developing strategies to improve grid safety and stability amid increasing DER penetration. Beyond the SIWG process, LUMA also held separate discussions with stakeholders, including SESA, Interstate Renewable Energy Council (IREC), Enphase and EPRI, to further understand stakeholder concerns and validate the impact of proposed updates to the initially proposed settings.

The feedback obtained from these engagements was used to evaluate the feasibility of adopting recommended settings. LUMA utilized historical system data, simulation results, and evaluated best practices from other jurisdictions to inform the technical revisions and recommendations, which are presented in this document and in recommended updates to Smart Inverter Settings. Note that the historical data and simulations used to develop these recommendations incorporate data during normal system operations, grid disturbances, and emergency and restoration operations, such as restoring from a partial or total outage.

By proposing changes to the Smart Inverter Settings, LUMA strives to maximize the impact of the capabilities of commercially available inverter technologies, as represented by interest groups, SESA, Enphase and other technology vendors, and maintain the safety, reliability, and operational integrity of the transmission and distribution system. These setting changes were evaluated based on the historical data referenced above, as well as system simulations, operational experience, and alignment with industry standards such as IEEE Std. 1547-2018, and by interconnection standards in other jurisdictions.

Note that Puerto Rico represents unique challenges when compared to other jurisdictions, which are often mentioned, like California and Hawaii. For example, Puerto Rico experiences a much higher number of grid frequency deviations and more frequent partial and total outages compared to the islands in Hawaii. Puerto Rico also has a much higher total number of small-scale residential rooftop solar systems compared to any island in Hawaii. When compared to the very large and interconnected California grid, Puerto Rico experiences many more grid frequency deviation events and total and partial outages. Also, California's grid can function as a net power exporter to its neighboring states due to the high volume of customer renewables combined with grid-scale resources. These factors need evaluation

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of the performance of Puerto Rico's grid to better understand how Smart Inverter Settings will interact with the way the system operates today.

LUMA recommends that these proposed settings be applied to all DER systems. Furthermore, LUMA reiterates its obligation to ensure the safe and reliable operation of the grid for the benefit of all customers, regardless of whether they choose to adopt DER technologies or not, by reaffirming its authority to regulate energy exports to the grid when necessary. This includes ensuring that voltage issues and potential risks to Puerto Rico's electric grid can be managed and maintained, service transformers are appropriately loaded within their manufacturer-specified thermal limits, and that the grid frequency response of the DER system aligns with the system's needs.

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1.0 Updates to Bulletin

1.1 Minor modifications or sections with no changes

Throughout the document, minor typographical and orthographical corrections were made. These corrections improve readability, clarity, and consistency without altering technical content. These changes are made to reduce unambiguous language to stakeholders, including developers, equipment manufacturers, customers, and regulatory personnel.

No technical updates were made to several sections of the document based on stakeholder feedback and where full alignment already exists, and are aligned with analysis against historical system data, or common industry practices. These sections continue to reflect current standards and validated operational parameters.

Table 1: Technical Bulletin Sections with No Major Changes

Section (from Bulletin)	Title
1.1	Communication Requirements
1.2	Smart Inverter Functions and Control Modes
2.1	Anti-Islanding
2.2	Response to Abnormal Voltage
2.3	Response to Abnormal Frequency

1.2 Sections with Major Technical Updates

LUMA recommends technical updates to specific sections of the Technical Bulletin to align with the operational realities of Puerto Rico's electric grid, to reflect evolving industry practices, and to address stakeholder inputs received along the way. These revisions were informed primarily by feedback received through the SIWG and direct consultation with key stakeholders, including SESA, inverter manufacturers, and subject matter experts, including EPRI and IREC.

1.2.1 Voltage-Reactive Power Control Mode (Volt/Var) and Voltage-Active Power Control Mode (Volt/Watt) (Sections 2.4 and 2.5 in Bulletin)

LUMA recognizes the need for Smart Inverters to better manage the voltage at the point of interconnection. The power injected at a DER facility creates a voltage rise on the secondary, which can also generate a voltage rise on the primary distribution circuit. Volt/Var and Volt/Watt Power Control modes provide a means to reduce the potential for voltage rise and maintain an acceptable voltage level at the inverter point of interconnection by responding to local operational conditions, particularly in areas of high-DER density.

LUMA recommends prioritization of Volt/Var mode, which is intended to utilize the inverter capabilities to manage voltage at the point of interconnection with minimal impact on active power output. As proposed, Volt/Var will be the primary means by which a customer's inverter is able to operate within the voltage ranges specified by the American National Standards Institute (ANSI).

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LUMA also recommends adopting Volt/Watt functionality to be activated as an emergency backstop only after Volt/Var capabilities have been exhausted. In this scenario, if Volt/Var is fully operating to reduce system voltage, but uncontrolled high-voltage persists and continues to rise, a Volt/Watt function will activate to provide a smooth glide path to reduce the net-injection of power to the grid, which results in lowering the voltage. Note that without the Volt/Watt function enabled, the inverter may be required to disconnect from the grid to avoid equipment damage.

- The Volt/Watt function will allow the customer's DER to remain connected to the grid but will gradually reduce net-injection of power to the grid. If this functions correctly, the system voltage will reduce, and the Volt/Watt function will no longer be required, at which point Volt/Var manages voltage.
- However, if the grid voltage continues to rise, which represents an uncontrolled system high voltage likely resulting from a grid emergency, then the DER system will reduce net-injection to the point of full curtailment
- If voltage continues to rise even more, all DERs are required to disconnect from the system to protect the customer equipment and grid assets, and to ensure safety can be maintained.

Furthermore, LUMA recommends an initial "optional" adoption of the Volt/Watt settings for all DER customers, but mandatory adoption for: (a) those high DER penetration circuits above 30% and, (b) all customers identified in an area of a feeder that is experiencing high voltage based on supplemental studies or as informed by customer calls indicating problematic operating conditions.

LUMA acknowledges similar comments made by Enphase and EPRI to ensure no overlap between the point at which Volt/Var ends and when, and will explore adjustments aimed at reducing overlap between the two control modes, minimizing the effect on performance objectives.

The following settings are suggested to eliminate overlap in control curves and provide enough range of operation to fully deploy the curves without abrupt steps or changes.

Table 2: Suggested Settings to Eliminate Overlap Control Curves

Control Curve	Parameter to update	Old value	New Value
Volt – Var	V3	1.05 p.u.	1.04 p.u.
	V4	1.08 p.u.	1.07 p.u.
Volt - Watt	V1	1.08 p.u.	1.07 p.u.

1.2.2 Enter-service Settings (Section 2.6 in Bulletin)

Enter-service refers to the process by which a DER or its individual components (such as an inverter) transitions from a non-operational state (e.g., shutdown or cease-to-energize) to an operational state where it begins actively delivering real and/or reactive power to the electric power system. For this to happen, both voltage and frequency need to be within the specified range of values.

- **Voltage enter-service** – The high and low values for voltage enter-service are 1.06 p.u. and 0.88 p.u., respectively. SESA suggested a high voltage enter-service of 1.1 p.u. The current high voltage value is aligned with standard ANSI 84.1 Range B, which is already an extended service range. Allowing higher voltage values for enter-service would enable DER to enter at already considered dangerous voltage levels. On the other hand, there is consensus for 0.88 p.u. as low voltage value. Based on this, LUMA will retain its existing high and low voltage threshold values for enter-service.

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- **Frequency enter-service** – The current high and low values for frequency enter-service are 60.1 Hz and 59.5 Hz, respectively. SESA suggested values of 60.5 Hz and 59.0 Hz. LUMA is updating frequency enter-service values based on system-recorded data, using both long-term, steady-state data and event-specific, short-term data. New values will be set at 60.5 Hz and 59.0 Hz. This is also consistent with SESA's suggestion.
- **Enter-service period –** This is the time it is required for a DER to reconnect to the system after abnormal conditions in either voltage of frequency have been detected. LUMA will retain the existing 300-second value, which is in the middle of the allowable range in IEEE 1547-2018 (0 to 600 seconds).

1.2.3 Frequency Droop Settings (New Section 2.8 in Bulletin)

This feature was not included in LUMA's initial Technical Bulletin from November 2024. However, during discussions within the SIWG and through direct feedback from SESA, the inclusion of frequency droop control was highlighted as a critical enhancement aligned with industry's best practices and grid needs.

LUMA recognizes the technical relevance of this function, particularly as it supports bulk system stability during frequency disturbances. In response, LUMA is now adopting frequency droop settings as defined in IEEE Std 1547-2018. The values selected are a combination of default IEEE 1547-2018 values and collected system data. These settings ensure consistency with national standards and enhancing the interoperability of DER in Puerto Rico's electric system.

Table 3: IEEE 1547-2018 Settings

Setting	Value	Source
Deadband	0.100 Hz	system data
Droop Coefficient	0.05	1547 default
Response time	5.0 s	1547 default

2.0 Summary of the changes to Technical Bulletin

The table below summarizes changes compared to SESA's filing dated April 25, 2025.

Table 4: Changes to Technical Bulletin Compared to SESA's Motion of April 25, 2025

Section	SESA Proposed Action	EPRI Comments	LUMA Response	LUMA Proposed Update to Bulletin
1.1 Communication Requirements	N/A		N/A	**No changes**
1.2 Smart Inverter Functions and Control Modes	N/A		N/A	**No changes**
2.1 Anti-Islanding	N/A		N/A	**No changes**
2.2 Response to Abnormal Voltage				
2.2.1 Voltage Trip Settings	N/A		N/A	**No changes**
2.2.2 Voltage Ride-Through	N/A		N/A	**No changes**
2.3 Response to Abnormal Frequency				
2.3.1 Frequency Trip Settings	N/A		N/A	**No changes**
2.3.2 Frequency Ride Through	N/A		N/A	**No changes**
2.4 Voltage Reactive Power Control Mode	N/A	Volt/Var and Volt/Watt are overlapping over a wide voltage range of (1.06 p.u.-1.08 p.u.). DER starts to curtail active power when only 1/3 of reactive power capability is utilized to regulate voltage. Recommendation: Shift V4 in Volt/Var to the left, and V1 in Volt/Watt to the right.	Volt/Var and Volt/Watt curve have been adjusted to **minimize overlap and maximize usefulness** as per Enphase and EPRI suggestion.	**Updated curves based on acceptable operational ranges.**
2.5 Voltage Active Power Control Mode	N/A		N/A	**No changes**
2.6 Enter-Service Settings				
Enter-service Voltage Max/Min	Increase enter-service maximum value for	SESA suggests to increase “maximum value” of voltage for enter-service from	**Maximum Value -** LUMA's values are aligned with **CA**	**No changes**

Section	SESA Proposed Action	EPRI Comments	LUMA Response	LUMA Proposed Update to Bulletin
	voltage from **1.06 p.u. (127.2 V)** to **1.10 p.u. (132 V)** to allow faster resumption of service. Implement reconnection criteria that enable inverters to resume operation without excessive delays.	1.06 p.u. to 1.10 p.u., while OV1 in Voltage Trip setting is kept at 1.10 p.u. This may lead to risk of infinite cycling of inverter tripping à enter-service à tripping. Recommendation: Separate the two voltage levels with enough margin.	**Rule 21** and **ANSI 84.1 Range B**. Voltage levels higher than that might be considered safety hazard. **No changes are suggested.** **Minimum Values - no changes.**	
Enter-service Frequency Max/Min	**Minimum Value** Lower the enter-service minimum value from **59.5 Hz** to at least **59.0 Hz** **Maximum Value** Determine frequency settings using actual LUMA data from substations and feeders. Compose frequency distribution plots to determine the best frequency values for Smart Inverter Settings. SESA's initial recommendation is to increase the enter-	LUMA's present frequency range of 59.5~60.1Hz combined with 300s delay time is likely too restrictive. Expanding this range per SESA's suggestion: –Still allows the DER to stay within the "continuous operation" region per the frequency ride-through capability –Doesn't conflict with the frequency trip setting –Has minimum impact to inverter DER, especially those Behind the Meter (BTM) DER without step-up transformers that may saturate under high V/f	Frequency Max/Min values for enter-service were **updated based on system data**. Two large sets of data were used to update these values; data of regular operations of the system and (2) specific data from system events that show system recovery. **This aligns with SESA's comments.**	**LUMA to update** this requirement, consistent with SCADA frequency data observed, to allow **MAX = 60.5 Hz** and **MIN = 59.0 Hz.**

Section	SESA Proposed Action	EPRI Comments	LUMA Response	LUMA Proposed Update to Bulletin
	service maximum value from **60.1 Hz** to **60.5 Hz**, with the potential for increasing up to 61.0 Hz (the upper limit tested and recommended by IEEE 1547-2018) following an initial evaluation period. The 60.5 Hz value would align Puerto Rico's standard with California's 60.5 Hz reconnection threshold.			
Enter-service Time	Reduce time to 15s.	300s enter-service delay is a long time. North American Electric Reliability Corporation (NERC) studied a number of transmission system events and concluded that keeping generation sources online or reducing their delay of connection is important to system restoration. In high DER penetration systems, DER sources should be considered more as grid helpers, not troublemaker	The values for enter-service time will remain as per the original bulletin, **300s.** This is based on observed system data. See appendix for supporting information.	**No changes**
2.7 Ramp Rate Settings	Delete duplicative references.		LUMA to delete redundant content.	**Deleted repetitive content.**

Section	SESA Proposed Action	EPRI Comments	LUMA Response	LUMA Proposed Update to Bulletin
2.8 Frequency Droop Settings	Increase the Frequency-droop deadband from 0.036 Hz (36 mHz) to 0.250 Hz (250 mHz).	SESA suggests to decrease the OLRT of frequency droop response time to 0.5s. Additional study may be necessary to evaluate this. Most BTM DER are single-phase inverters whose frequency measurement may be easily affected by local transients such as harmonics and phase shifting, having too aggressive frequency droop response may introduce adverse impact.	We recognize the usefulness of Frequency-Droop Response to be standardized to industry-acceptable values. LUMA is **updating and adopting values**, based on SCADA frequency system data and IEEE 1547-2018 suggested values.	**Db** - 0.100 Hz (system data) **Droop coefficient** - 0.05 (IEEE 1547-2018 default value) **Response Time** - 5s (IEEE 1547-2018 Default)

Appendix A: Sample results for feeders with Volt/Var and Volt/Watt Power Control modes

Simulation A

Feeder: Fdr_A -02

Voltage Level: 4.16 kV

Number of DER installed: 167

DER Penetration level: 74%

The simulation example presented below showcases an actual feeder with approximately 1160kW (or 1.16MW) of aggregated nameplate DER installed capacity. Scenarios were run to understand how the feeder performs without DER, how the feeder performs with DER operating but without Smart Inverter settings enabled, and then how the feeder performs with DER operating with Smart Inverter settings enabled.

Table 5: Conditions of Feeder Fdr_A -02 on different configuration levels

Case	DER Aggregated Capacity	V max	V min	Sections with Violations	Hosting Capacity (Section with Max value)
DER Off	0	126.0	115.6	0	700 kW
DER On Without Settings	1160 kW	127.94	119.47	550 of 955	0
DER On with Settings	1160 kW	126.30	120.0	100	50 kW

In the first scenario, all DER was turned off to baseline what feeder performance “would be” without DER. For example, do any voltage or thermal violations exist when no DER is present. The results showed no violations exist when no DER is injecting (this would be the case before DER was installed).

In the next scenario, all existing DER is turned on to simulate what actually happens today, with no Smart Inverter (Volt/Var or Volt/Watt) settings enabled. The results are shown in Figure 1. Approximately 550 of 955 (or 58%) of the circuit sections experience some type of voltage violation.

In the final scenario, all existing DER is assumed to have Smart Inverter (Volt/Var) settings enabled. The results shown in Figure 2. Approximately 100 of 955 (or 10%) of sections would experience some type of voltage violation.

The results show that the Volt/Var settings provide a significant correction of the voltage violations seen with DER injecting without Smart Inverter settings enabled. However, it also indicates that Volt/Var alone may not be sufficient to address all the voltage violations present when DER is injecting into the grid. Further evaluation of additional settings like Volt/Watt will be shown subsequently. Supplemental studies may also be required to recommend system improvements to provide improved voltage control.

Figure 11: Feeder Fdr_A -02 Voltage Profile without Smart Settings

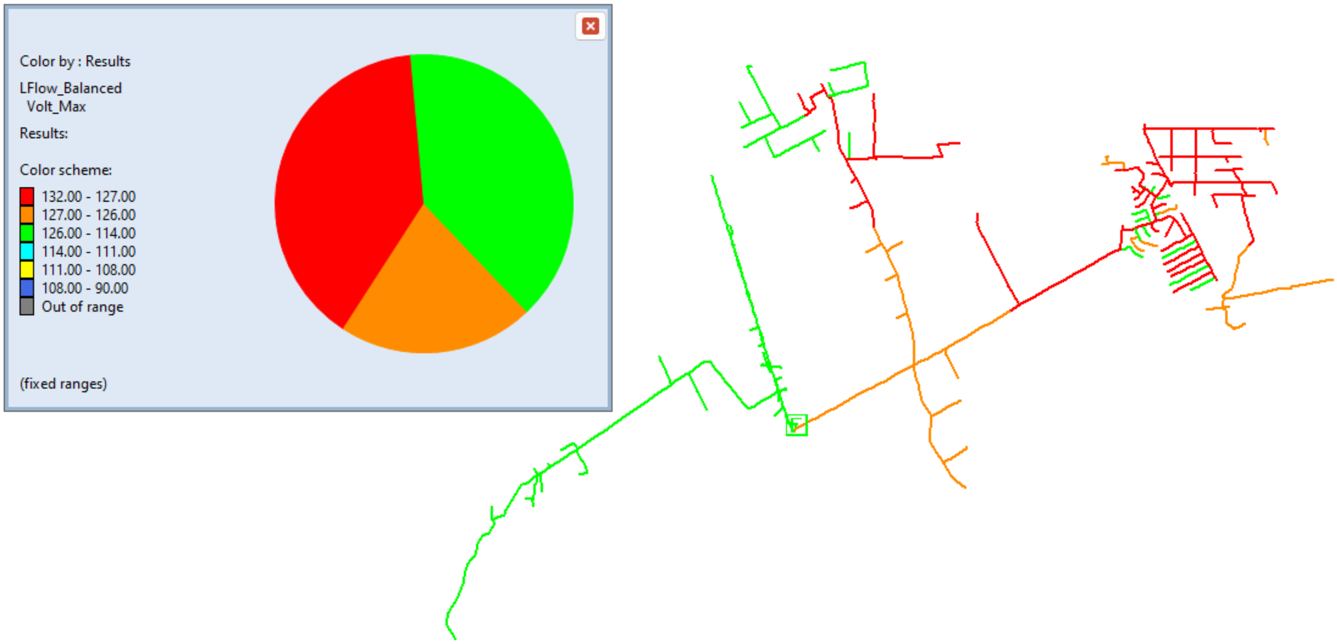
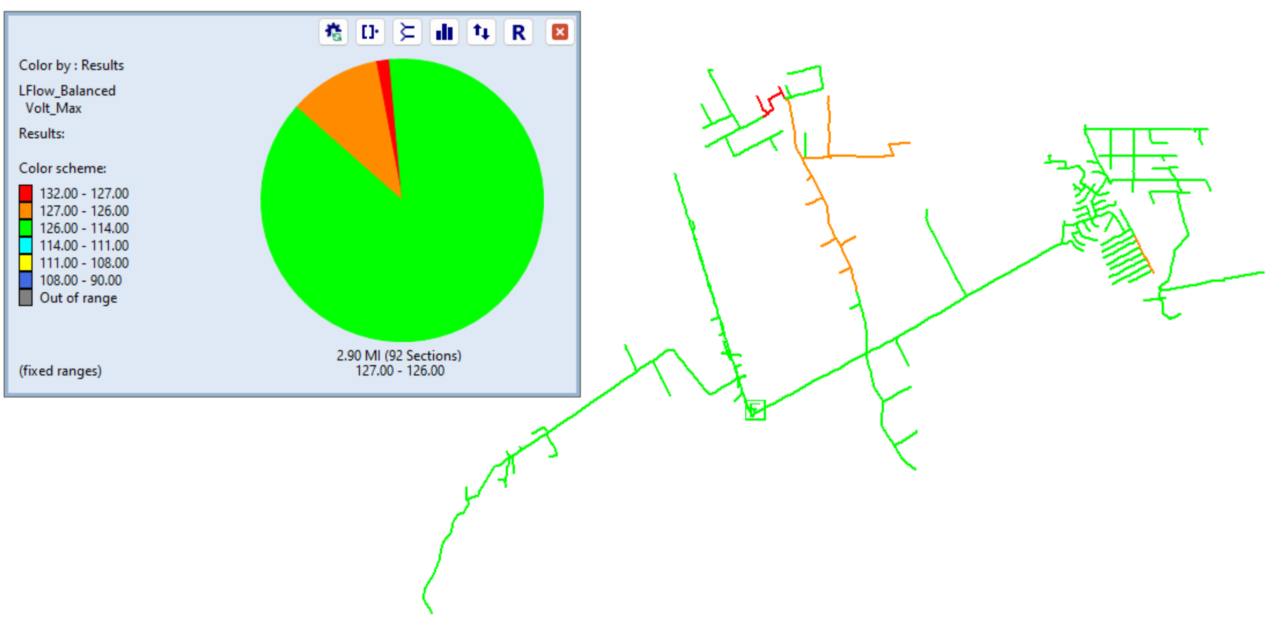


Figure 22: Feeder Fdr_A -02 Voltage Profile with Smart Settings



Simulation B

Feeder: Fdr_B-02

Voltage Level: 4.16 kV

Number of DER installed: 280

DER Penetration level: 97**%**

The next simulation example presented below showcases an actual feeder with approximately 1674kW (or 1.67MW) of aggregated nameplate DER installed capacity. Scenarios were run to understand how the feeder performs without DER, how the feeder performs with DER operating but without Smart Inverter settings enabled, and then how the feeder performs with DER operating with Smart Inverter settings enabled, including Volt/Watt.

Table 76: Conditions of Feeder Fdr_B-02 on different configuration levels

Case	DER Aggregated Capacity	V max	V min	Sections with Violations	Hosting Capacity (Section with Max value)
DER Off	0	126.0	120.0	0 of 677	1315 kW
DER On Without Settings	1674 kW	127.57	124.96	218 of 677	0
DER On with Settings (Volt/Var)	1674 kW	126.12	124.0	28 of 677	30 kW
DER On with Settings (Volt/Var & Volt/Watt)	1607 kW	126.0	124.0	0 of 677	100 kW

In the first scenario, all DER was turned off to baseline what feeder performance “would be” without DER. For example, do any voltage or thermal violations exist when no DER is present. The results showed no violations exist when no DER is injecting (this would be the case before DER was installed).

In the next scenario, all existing DER is turned on to simulate what happens today, with no Smart Inverter (Volt/Var or Volt/Watt) settings enabled. The results are shown in Figure 3. Approximately 218 of 677 (or 1/3) of the circuit sections experience some type of voltage violation.

In the following scenario, all existing DER is assumed to have Smart Inverter (Volt/Var) settings enabled. The results shown in Figure 4. Approximately 28 of 677 (or 4%) of sections would experience some type of voltage violation.

Finally, the last scenario assumes DERs to have both Volt/Var and Volt/Watt setting enabled. The results are shown in Figure 5. All violations are mitigated with both settings activated.

This case shows how the coordinated use of both Volt/Var and Volt/Watt functions can mitigate voltage violations triggered by DERs in this feeder. The use of efficient power control modes corrects the voltage profile along the feeder, conserves operability of the system and potentially delays upgrades that would otherwise be required if not using these control modes.

Figure 33: Feeder Fdr_B-02 Voltage Profile without Smart Settings

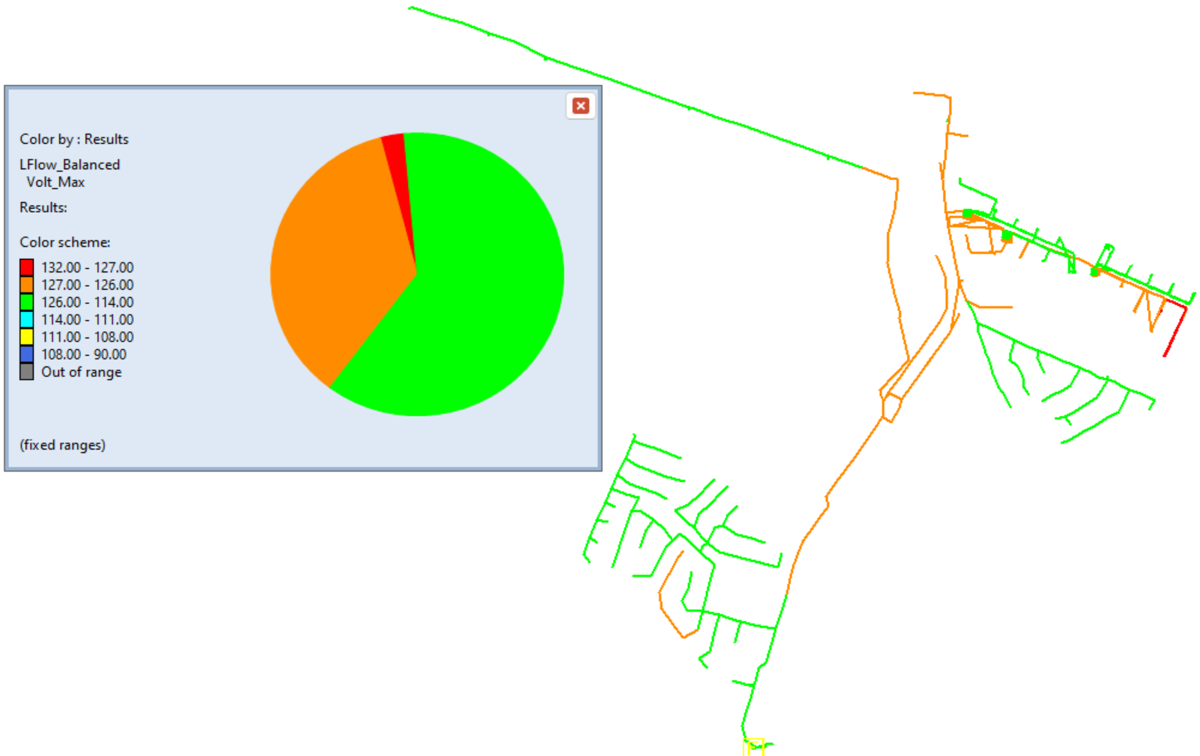


Figure 44: Feeder Fdr_B-02 Voltage Profile with Smart Settings (Volt/Var)

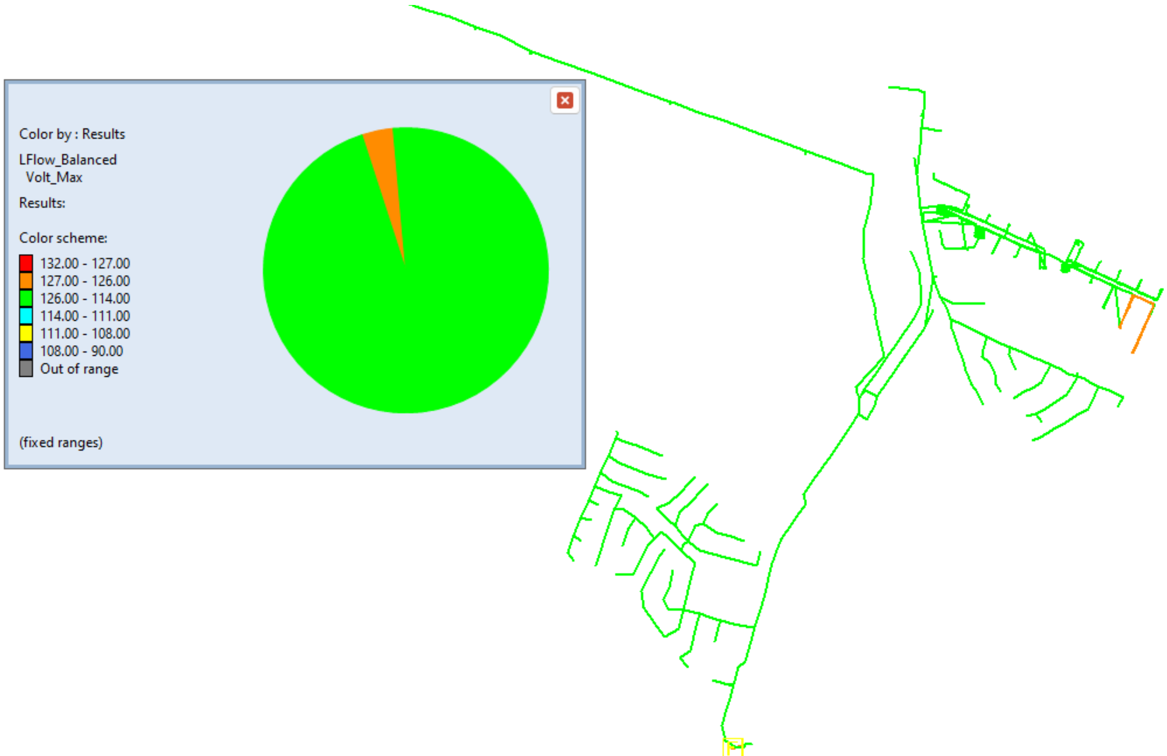
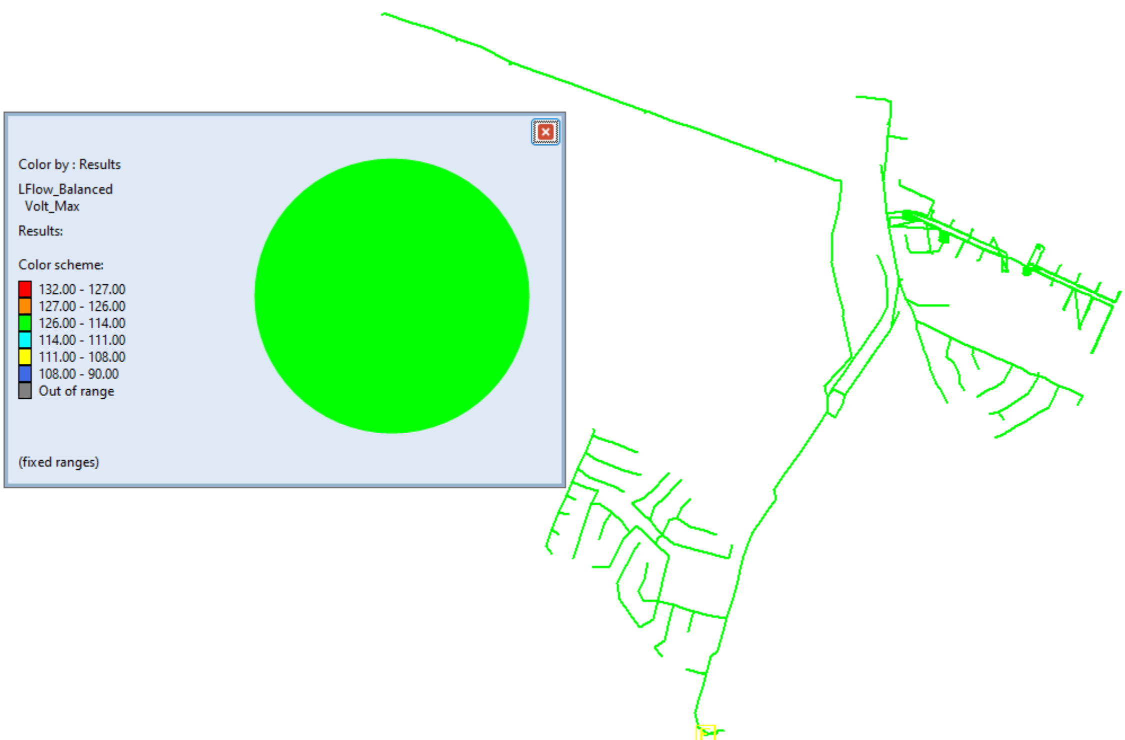


Figure 5 5: Feeder Fdr_B-02 Voltage Profile with Smart Settings (Volt/Var &Volt/Watt)



Appendix B: LUMA Frequency Historical Data

Figure 6: Historical Frequency and Generation Data during the power restoration of April 16 to 19, 2025

Figure 6 shows historical frequency and generation data during the power restoration of April 16 to 19, 2025. The figure shows that during the system restoration, the frequency is mainly within the 59 Hz to 60.5 Hz range, except for some instances where the frequency drops below 59 Hz or goes above 60.5 Hz. However, as shown in Figure 7, the duration of time that the frequency goes outside the 59-60.5 Hz band in each event is less than 200 seconds and did not go under 58.5 Hz or above 61 Hz, which is within the under/over frequency ride-through settings defined in the bulletin for both magnitude and duration.

Figure 8: Historical frequency and generation data during January 17, 2025

Figure 8 shows historical frequency and generation data on January 17, 2025. The figure shows that the frequency is mainly within the 59.5 Hz to 60.5 Hz range, except for one event where the frequency dropped below 59.5 Hz. However, as shown in Figure 9, the duration of time that the frequency dropped below 59.5 Hz (down to about 58.5 Hz) is less than 50 seconds, which is within the under-frequency ride-through settings defined in the bulletin for both magnitude and duration.

Figure 10: Historical Frequency and generation data during March 18, 2025

Figure 10 shows historical frequency and generation data on March 18, 2025. The figure shows that the frequency is mainly within the 59.5 Hz to 60.5 Hz range, except for one event where the frequency dropped below 59.5 Hz. However, as shown in Figure 11, the duration of time that the frequency dropped below 59.5 Hz (down to about 58.7 Hz) is less than 50 seconds, which is within the under-frequency ride-through settings defined in the bulletin for both magnitude and duration.

Figure 6: Historical Frequency and Generation Data during the power restoration of April 16 to 19, 2025

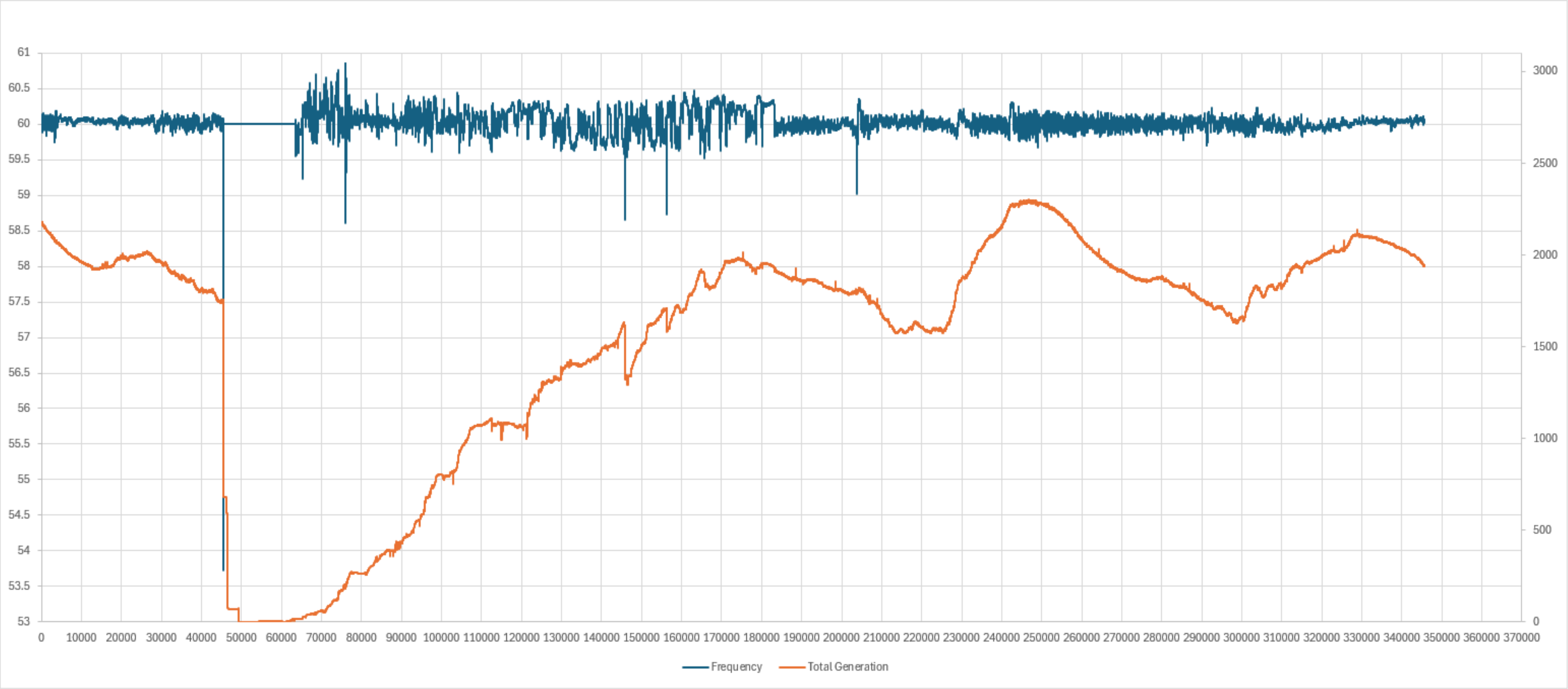


Figure 7: Zoomed version of historical frequency data when frequency goes outside the 59.5-60.5 Hz band

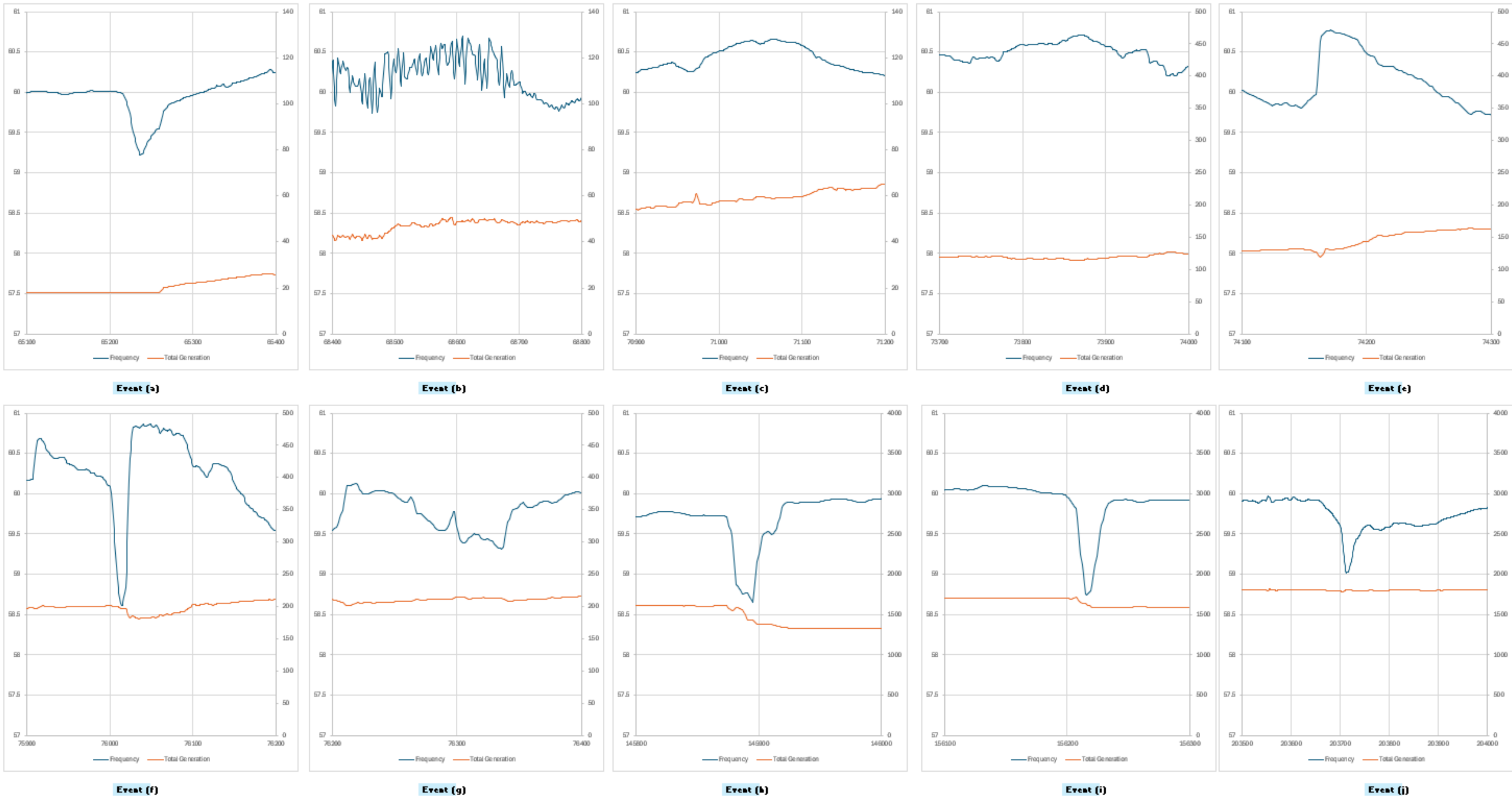


Figure 8: Historical frequency and generation data during January 17, 2025

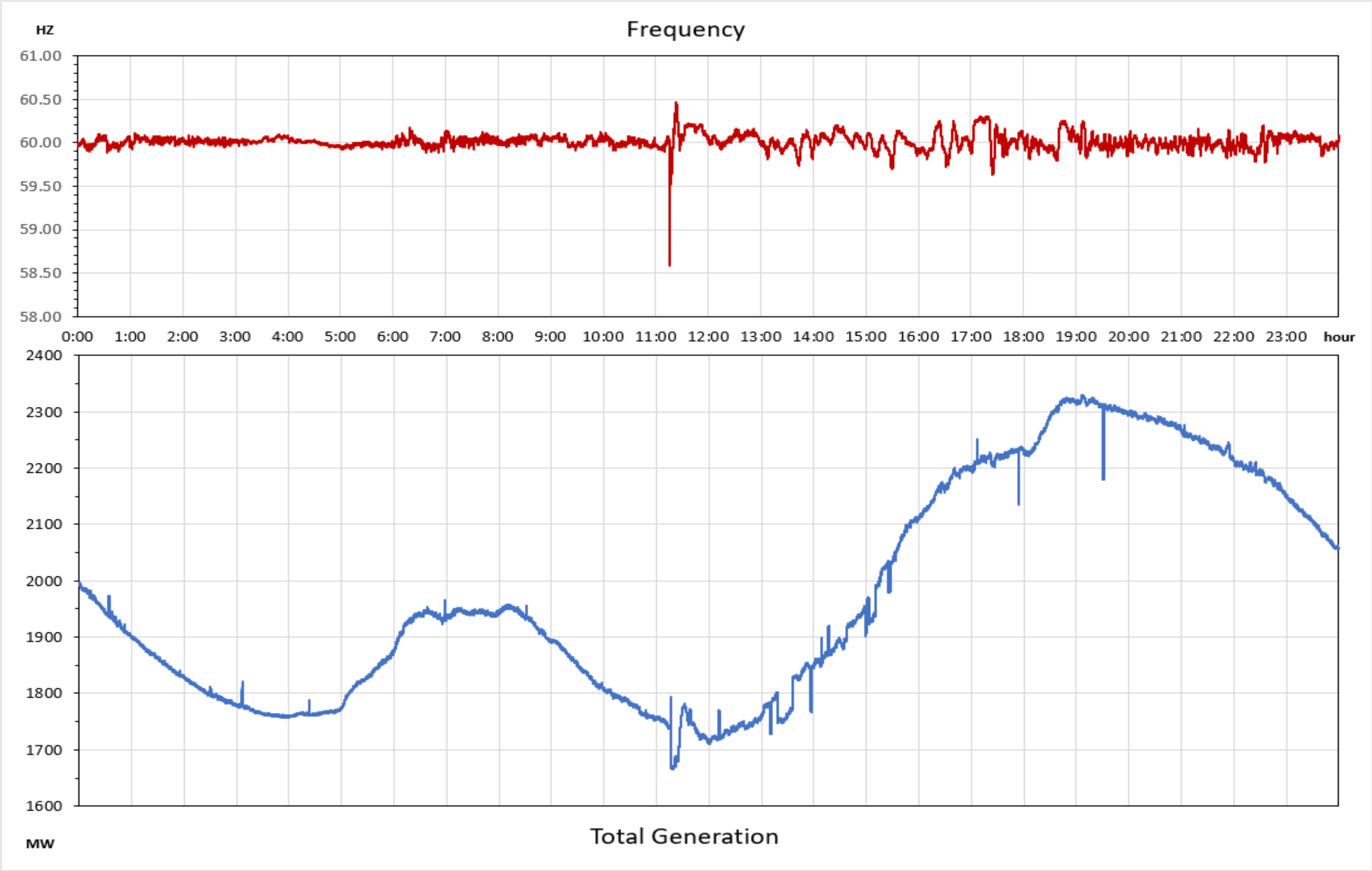


Figure 9: Zoomed version of historical frequency data when frequency goes outside the 59.5-60.5 Hz band (January 17, 2025)

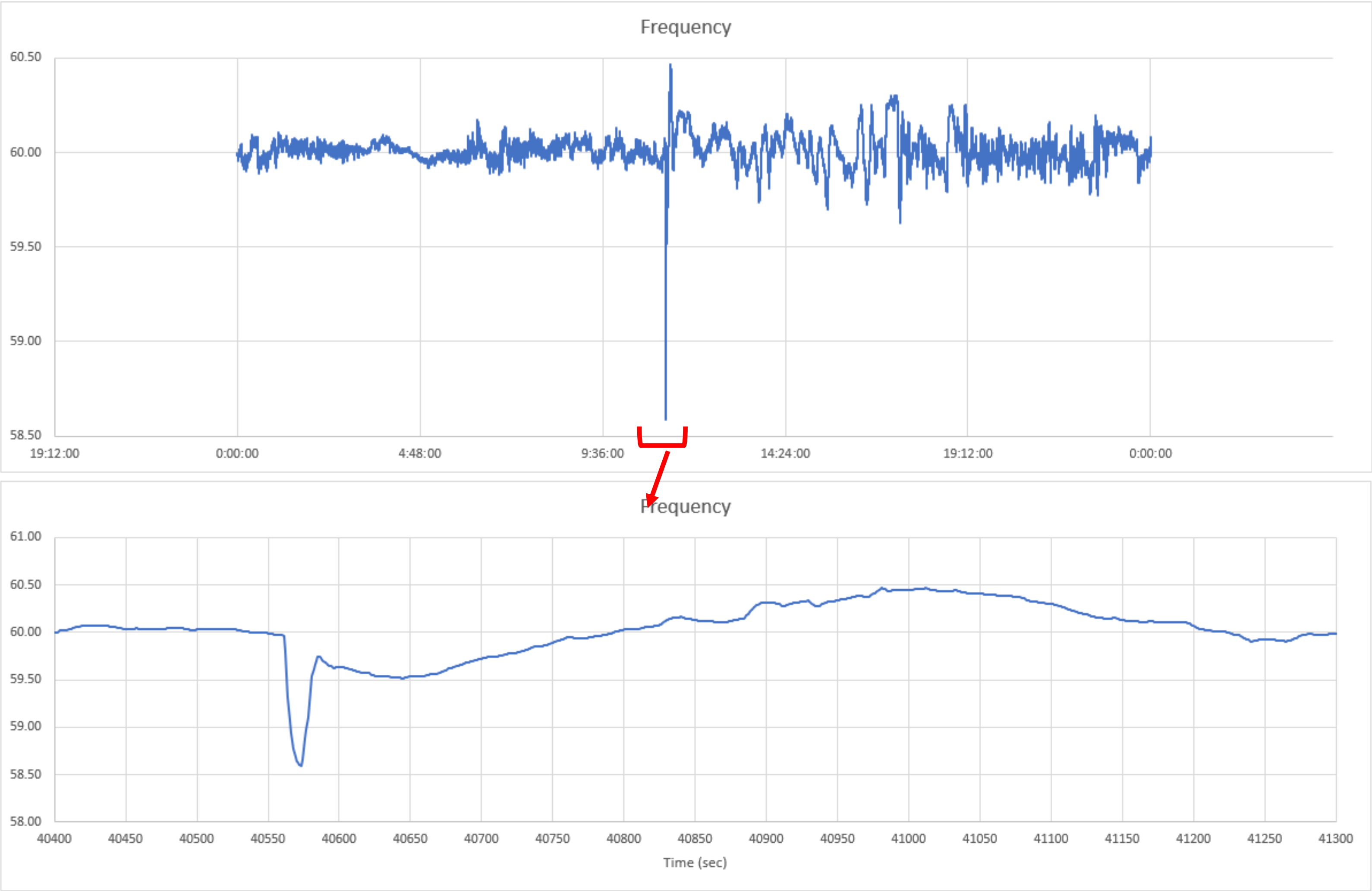


Figure 10: Historical Frequency and generation data during March 18, 2025

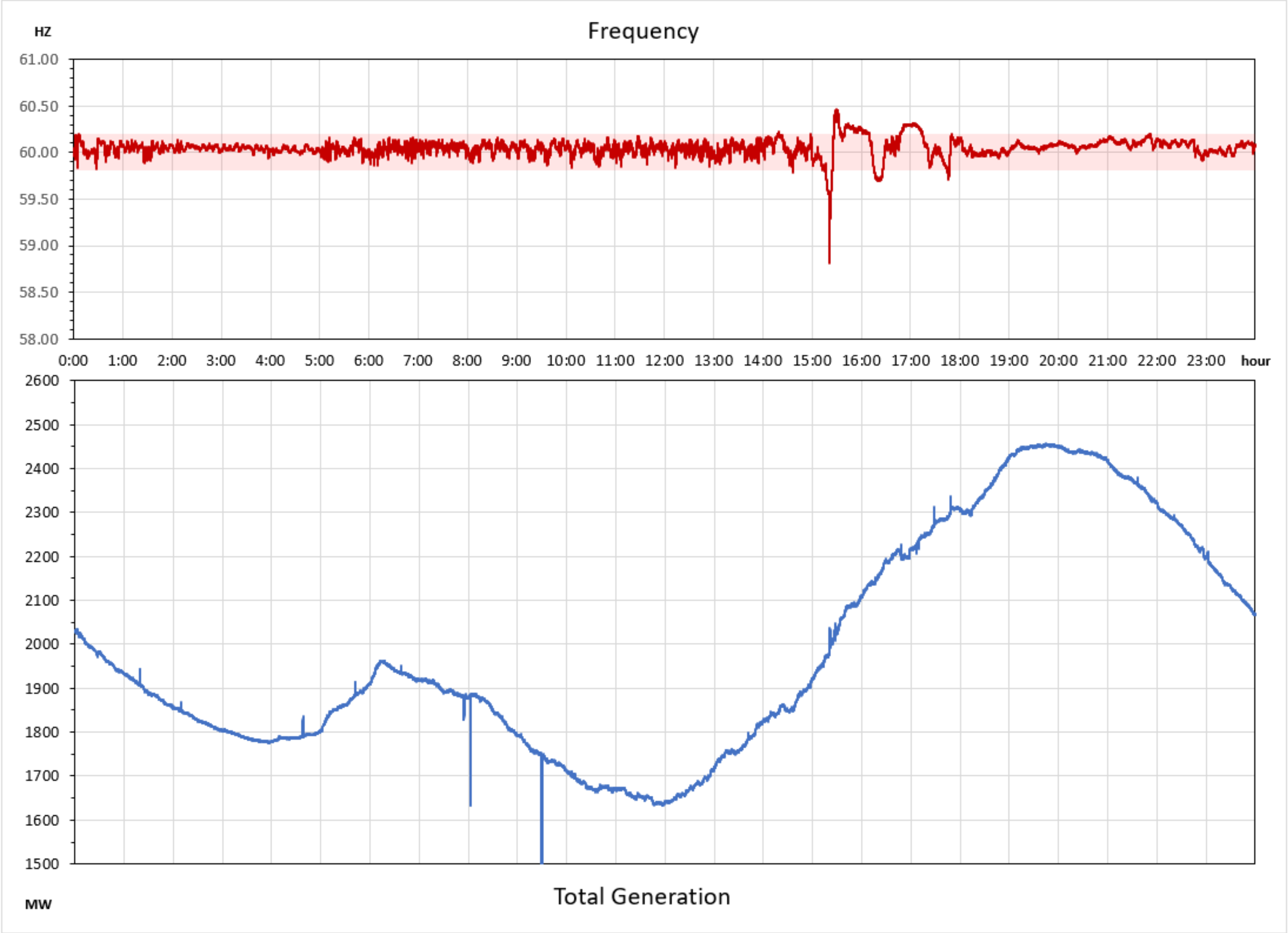


Figure 11: Zoomed version of historical frequency data when frequency goes outside the 59.5-60.5 Hz band (March 18, 2025)