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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: Motion to Submit Revised Technical Bulletin regarding Smart Inverter Settings Sheets issued by LUMA**

MOTION TO SUBMIT REVISED TECHNCIAL BULLETIN REGARDING SMART INVERTER SETTINGS SHEETS ISSUED BY LUMA

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

1. LUMA submits this motion to the Puerto Rico Energy Bureau regarding a revised Technical Bulletin titled "Smart Inverter Settings Sheets". This Technical Bulletin is issued pursuant to LUMA's responsibilities under the Puerto Rico Transmission and Distribution System Operation and Maintenance Agreement[1] and aims to provide updated technical guidance aligned with the IEEE 1547-2018 standard for interconnection and interoperability of distributed energy resources ("DERs"). The revised bulletin takes into consideration stakeholder feedback and is designed to enhance compliance with the Regulation for the Interconnection of Generators with the Distribution System of the Puerto Rico Electric Power Authority, Regulation No. 8915.

[1] Puerto Rico Transmission and Distribution System Operation and Maintenance Agreement by and among LUMA, the Puerto Rico Electric Power Authority and the Puerto Rico Public Private Partnerships Authority dated as of June 22, 2020.

2. The Technical Bulletin outlines the specific settings required for smart inverters to ensure they meet standards for grid support and operational efficiency. The revisions made in this document take into consideration comments received during the Technical Conference/Stakeholder Workshop held on June 18, 2024, and from subsequent discussions with stakeholders. The updated bulletin includes clarifications and adjustments to default settings, which aim to improve the integration and functionality of DERs within Puerto Rico's distribution system. The Technical Bulletin is part of a much-needed integrated approach to maintain grid safety and reliability.

3. LUMA proposes that this revised Technical Bulletin becomes effective by October 17, 2024. This timeframe is deemed reasonable to accommodate the adjustments and ensure a smooth implementation of the standards.

II. Relevant Background/Procedural History

1. On April 4, 2024, the Solar and Energy Storage Association of Puerto Rico ("SESA") submitted to this Puerto Rico Energy Bureau of the Public Service Regulatory Board ("Energy Bureau") a letter regarding an *Urgent Request Regarding LUMA's Publication of a "Smart Inverter Settings Sheets- Technical Bulletin"/ NEPR-MI-2019-0009* ("SESA's Request"). In it, SESA objected to the validity of a Technical Bulletin published by LUMA on April 1, 2024, on its official website titled "Smart Inverter Settings Sheets- Technical Bulletin" (the "Technical Bulletin") in which LUMA requires compliance by DERs with the IEEE 1547-2018 standard for smart distributed energy resources settings. SESA essentially argued that a rulemaking process under Act 38-2024, known as the Government of Puerto Rico Uniform Administrative Procedure Act (as amended "Act 38"), was required for the adoption of the Technical Bulletin and requested stakeholder workshops be held before the approval, among other things.

2. On April 15, 2024, the Energy Bureau issued a Resolution and Order ("April 15th Order") in which, among others, it granted LUMA and the Independent Consumer Protection Office ("ICPO") until April 20, 2024, to present their position regarding SESA's Request. *See* April 15th Order on page 3. In addition, the Energy Bureau scheduled a Technical Conference for May 16, 2024, at 10:00 a.m. (the "May 16th Technical Conference") to discuss the suitability of the requirement that a supplemental study be required for distributed generators ("DGs") interconnecting to a feeder exceeding 15% of its annual peak load[2] "or in the alternative any other less onerous but safe criteria, to require a supplemental study to DG proponents and the measures proposed by LUMA, in the [Manual of Technical Requirements for Interconnection submitted by LUMA in this proceeding[3]] and/or the Technical Bulletin, to reduce or manage the operational challenges of the high penetration of DGs and avoid or postpone having to make improvements in the distribution network". *See id.* at pages 2-3 (footnotes added; translation ours).

3. On April 19, 2024, ICPO submitted a motion in compliance with the Energy Bureau's April 15th Order, in which it recognized the prospective nature of the Technical Bulletin, and raised questions regarding the process to adopt it, among others. *See Moción en Cumplimiento de Orden Emitida el 15 de Abril de 2024*, filed on April 19, 2024.

4. On April 22, 2024, LUMA submitted a response to SESA's Request indicating, among others, that the Technical Bulletin was not a regulation but rather a technical document that seeks to apply the IEEE 1547-2018 standard for smart distributed energy resources as provided in,

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[2] This is a requirement arising from the Regulation for the Interconnection of Generators with the Distribution System of the Puerto Rico Electric Power Authority, Regulation 8915 ("Regulation 8915"). *See* Regulation 8915, Section IV, Art. A, Parr. 4. It also appears in Section 1.28(B) of the proposed *Generating Facility and Microgrid Interconnection Regulation* issued by the Energy Bureau by Resolution of June 15, 2021.

[3] This refers to a manual proposed by LUMA in this proceeding, the most recent version of which was submitted on May 19, 2022. *See* LUMA's *Motion Submitting Complete Version of Technical Interconnection Requirements Document* filed on that date.

and in compliance with, Regulation 8915, and that, therefore, a rulemaking process under Act 38 was not required.

5. On May 3, 2024, SESA filed a *Reply to LUMA's April 22, 2024*, *Response to Urgent Request,* essentially reiterating their position regarding the Technical Bulletin and requesting the stay of the Technical Bulletin and a regulatory review process thereof, among others.

6. On May 13, 2024, the Energy Bureau issued a Resolution and Order rescheduling the May 16th Technical Conference for June 18, 2024.[4]

7. On June 12, 2024, the Energy Bureau issued a Resolution ("June 12th Resolution") establishing an agenda for the "Technical Conference/Stakeholder Workshop" scheduled for June 18, 2024, and indicating that it sought to "use the Technical Conference/Stakeholder Workshop as an opportunity to discuss the best approach to adopt specific equipment requirements for inverter-based resources" and that, "[i]n addition to the topics identified in the April 15th Order, the Technical Conference/Stakeholder Workshop of June 18, 2024 will also be used to discuss how to best implement the grid support functionality of smart inverters and what equipment requirements are needed to orderly provide this capability to the electric grid". *See* June 12th Resolution on page 2.

8. On June 17, 2024, LUMA filed a motion submitting as *Exhibit 1* thereto the presentation prepared by LUMA to be provided during the Technical Conference/Stakeholder Workshop scheduled by the Energy Bureau for June 18, 2024 (the "June 18th Presentation"). *See Motion to Submit Presentation for Technical Conference/Stakeholder Workshop Scheduled for June 18, 2024,* filed on June 17, 2024.

[4] This was in response to a *Motion to Request the Rescheduling of the Technical Conference Set for May 16, 2024,* filed by LUMA on April 29, 2024.

9. On June 18, 2024, the June 18th Technical Conference/Stakeholder Workshop was held ("June 18th TC/Workshop"). Among other things and as pertinent to this Motion, during the June 18th TC/Workshop, LUMA representatives discussed the June 18th Presentation which included a discussion of a revised version of the Technical Bulletin with redlined revisions in attention to stakeholder comments received and asked for leave to submit a corrected version of the June 18th Presentation (to correct certain text as indicated by LUMA during the proceeding) and the redlined Technical Bulletin. In addition, during the June 18th TC/Workshop there was a discussion on the reasonableness of the requirement for a supplemental study under Regulation 8915 when the aggregate capacity of all DGs interconnected to the same feeder, including the proposed one, exceed 15% of the annual peak load of the feeder. In this regard, LUMA representatives indicated that it was possible to increase this threshold to 30% based on technical considerations.

10. On June 21, 2024, LUMA submitted a corrected version of June 18th Presentation and the redlined Technical Bulletin shown and discussed during the June 18th TC/Workshop as part of the June 18th Presentation. *See Motion to Submit Presentation Shown at Technical Conference/Stakeholder Workshop Held on June 18, 2024, with Correction and Revised Technical Bulletin* filed on June 21, 2024 ("June 21st Motion"). LUMA also informed that, following the June 18th TC/Workshop, LUMA made an additional revision to the Technical Bulletin to address comments received during the June 18th TC/Workshop and submitted this revised version of the Technical Bulletin. *See June 21st Motion* on page 3 and *Exhibit 3*. LUMA explained that this revised version of the Technical Bulletin included a change to clarify that, in the case of the expansion of a DER facility, only the additional DER installed on or after July 1, 2024, must meet the Technical Bulletin's default setting requirements. *See id*. at page 3.

11. On June 25, 2024, SESA filed a *Request for Various Orders Regarding June 18th Conference and Technical Bulletin* in which it requested that the Technical Bulletin be subject to the Energy Bureau's review and approval, that the Energy Bureau determine that the proposed July 1, 2024 implementation date for the Technical Bulletin was not in effect, and that the Energy Bureau make a determination regarding the implementation schedule, among others.

12. On June 28, 2024, the Energy Bureau issued a Resolution and Order ("June 28th Order") granting stakeholders ten (10) business days to provide "detailed, specific and substantiated comments about the enablement/disablement of specific functions and its associated power requirements and UL-1741-SB and SA smart inverter certification" and indicated that it would provide "guidance about the adoption of the discussed smart inverter requirements after evaluating the stakeholder comments".

13. On July 15, 2024, each Sunrun Inc., Enphase Energy, Inc. and SESA, separately submitted comments to the Energy Bureau in attention to the June 28th Order.

14. On August 20, 2024, Tesla, Inc. submitted comments to the Energy Bureau regarding the implementation of specific smart inverter functions in accordance with IEEE 1547-2018 and UL 1741-SB.

15. On August 20, 2024, SESA filed a *Motion Requesting Modification of Supplemental Studies Threshold* ("SESA's August 20th Motion"), in which they requested the Energy Bureau to issue a resolution to increase from 15% to 30% the feeder annual peak load threshold under Regulation 8915 that triggers a supplemental study for the interconnection of DGs. *See SESA's August 20th Motion* on page 5.

16. On August 26, 2024, during a Compliance Hearing in Case No. NEPR-MI-2019-0016, In Re: *Informes de Progreso de Interconexión de la Autoridad de Energía Eléctrica de Puerto Rico*, the Energy Bureau issued a bench order ("August 26th Bench Order") directing LUMA to inform the Energy Bureau in this proceeding of LUMA's position regarding the potential increase from 15% to 30% of the feeder annual peak load threshold triggering the requirement to conduct a supplemental study under Regulation 8915.

17. In compliance with the August 26th Bench Order, on September 5, 2024, LUMA filed a *Motion to Submit LUMA's Position Regarding Modification of Threshold to Require Supplemental Studies Under Regulation 8915 in Compliance with Energy Bureau's Bench Order of August 26, 2024, in Case NEPR-MI-2019-0016* ("September 5th Motion"), in which LUMA informed that, although changing the mentioned threshold from 15% to 30% is technically possible, LUMA does not favor such change unless the determination issued by the Energy Bureau on the matter includes provisions to establish a clear and binding mechanism to ensure the recovery of the costs of supplemental studies and associated network upgrades from distributed generators with a capacity of up to 25 kW connecting to the system ("Small DGs") including past incurred costs. *See* September 5th Motion on pages 2, 5-9. Accordingly, LUMA requested that the Energy Bureau issue a clear and binding determination on the mechanism to recover such costs and take notice that if such determination is made, then LUMA would favor including therein the mentioned increase in feeder annual peak load threshold from 15% to 30% and, if such a resolution were issued, to provide that it be prospective in nature and that this threshold may be revised from time to time as requested by LUMA to address operational conditions and reliability considerations. *See id*. at pages 9-10.

III. Submittal of Revised Technical Bulletin

1. LUMA herein informs that, following the June 18th TC/Workshop, LUMA met with certain stakeholders to discuss the Technical Bulletin. LUMA took into consideration the comments and suggestions shared by the stakeholders and, during this process, LUMA has updated the Technical Bulletin. LUMA submits this updated Technical Bulletin, as *Exhibit 1* herein, as well as a redline version of this bulletin showing the changes made to the version submitted on June 21, 2024, as *Exhibit 2* herein. LUMA respectfully submits that this version of the Technical Bulletin contains revisions to clarify it and/or address appropriate and substantive comments provided by stakeholders. The revisions in this Technical Bulletin primarily consist of: (a) Editorial revisions to ensure that the bulletin language better aligns with the language in the IEEE 1547-2018; (b) the addition of Enter Service requirements to ensure that the DERs can connect to the grid and inject power under non-nominal voltage conditions (a section brought in from the IEEE 1547-2018 standard with default setting adjustments); and (c) the postponement of the Volt-Watt function enablement, as a result of which LUMA will only enable the Volt/VAR function. This latter change was made in light of developers' concern about the impact of voltage regulation on the active power generation of the DERs. After six months, LUMA will evaluate the system performance and will determine if Volt/Watt function needs to be enabled under certain scenarios.

2. LUMA revised this bulletin to enhance compliance with Regulation 8915, and to improve the system stability and operations under high penetration of DER. Implementation of the requirements outlined in this Technical Bulletin increases feeder hosting capacity and thus enables a higher number of interconnections to a feeder before triggering a supplementary study or grid upgrades are needed. This allows more room before additional investment is required.

3. LUMA supports an effective process for DG interconnections and the overall transition to renewable energy. In order to ensure an orderly regulatory framework that safeguards grid safety and reliability, a holistic approach must be taken. LUMA reiterates that that a clear and binding mechanism to recover costs for supplemental studies and associated network upgrades from Small DGs is necessary, and along with such a solution, LUMA would favor increasing the feeder interconnection threshold from 15% to 30% of the feeder annual peak load. While implementation of the Technical Bulletin requirements and the increase in the mentioned threshold may reduce the instances in which supplemental studies are needed, these measures do not address the ongoing backlog of past due payments for supplemental studies and the resulting network upgrades associated with Small DGs.

4. LUMA further notes that, as penetration levels increase, operational conditions and reliability considerations will necessitate revisiting the Technical Bulletin. Once real-time system information is updated (daily load profiles) and advanced metering infrastructure metering is installed, there will be more granular data, and technical requirements may be revisited. LUMA stresses that the implementation of a Technical Bulletin is a component of a much-needed integrated approach that includes a resolution for financing supplemental studies and network upgrades.

5. LUMA also discussed with certain stakeholders the effective date for this revised Technical Bulletin and proposes that it enter into effect by October 17, 2024, which LUMA understands is a reasonable timeframe given the clarifications and revisions made.

WHEREFORE, LUMA respectfully requests this Honorable Energy Bureau to **take notice** of the above, accept LUMA’s revised Technical Bulletin attached in *Exhibit 1* herein and the redline version thereof in *Exhibit 2* herein, and determine that the Technical Bulletin included in *Exhibit 1* herein may enter into effect by October 17, 2024.

RESPECTFULLY SUBMITTED.

In San Juan, Puerto Rico, this 13th day of September 2024.

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 was 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.

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Exhibit 1

Revised Technical Bulletin

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SMART INVERTER SETTINGS SHEETS

September 11, 2024

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 **October 17, 2024**, 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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List of Tables

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1. Required Smart Inverter Functions

Smart Inverters must be (a) UL 1741 SB listed, (b) set to 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 Invert settings and function statuses are defined in the interconnection agreement as a result of a detailed interconnection study. Any alternative settings and function statuses defined in the interconnection agreement will take precedence and supersede the default settings and function 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 1-1 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 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	Deactivated for at least 6 months since deployment of this bulletin
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
Connect/Reconnect Ramp-up rate	Required	Refers to ability to have an adjustable entry service ramp rate when a DER restores output of active power	Activated

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

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.

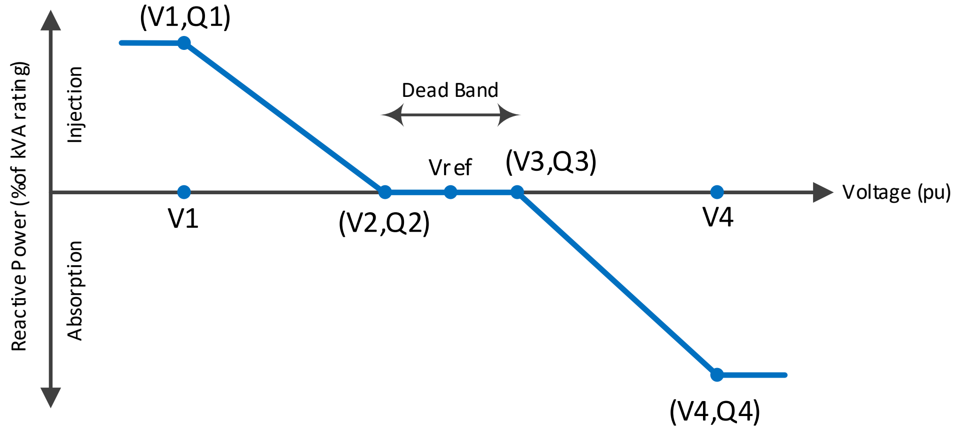

Figure 2-1. Example Volt-Var characteristic

Table 2-6- Volt-Var Settings – ACTIVATED

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	102% VN	Vref	Vref + 3%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(1)	Reactive power injection at voltage V1	44%	0	maximum reactive power capability, injection
V4	Voltage at which DER shall absorb Q4 reactive power	108% VN	V3 + 2%VN	Vref + 18%VN
Q4(1)	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

(1) 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.

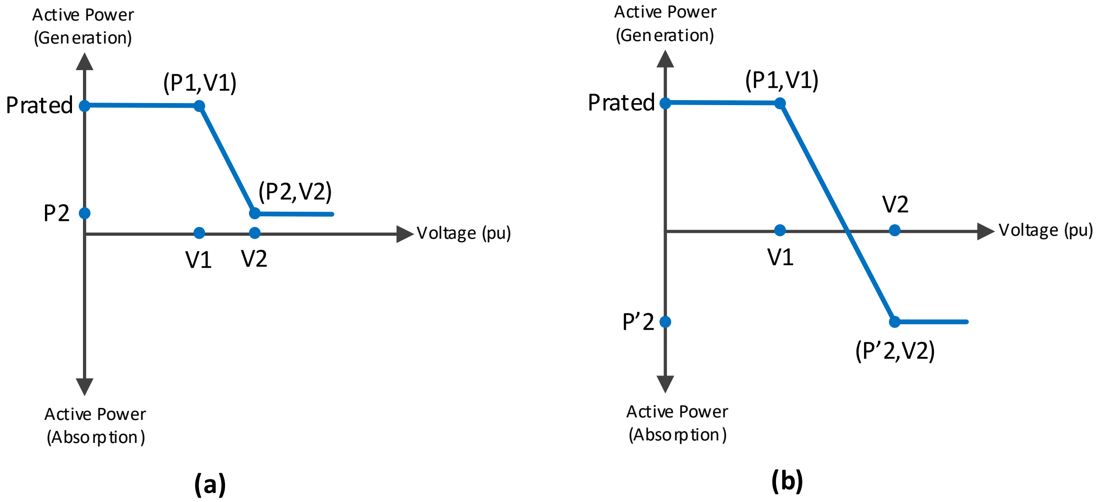

Figure 2-2. Example Volt-Watt characteristics

Table 2-7- Volt-Watt Settings – Deactivated [3]

Voltage-active power parameters	Default Settings	Ranges of allowable settings	
		Minimum	Maximum
V1	106% 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}[1]	P_{MIN}	P_{RATED}
P'2 (applicable to DER that can generate and absorb active power)	0	0	P'_{RATED}[2]
Open-loop response time	10 sec	0.5 sec	60 sec

[1] P_{MIN} is the minimum active power output in p.u. of the DER rating (i.e., 1.0 p.u.).
[2] P'_{RATED} is the maximum amount of active power that can be absorbed by the DER.
[3] Deactivated for at least 6 months since deployment of this bulletin

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			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 1.06 p.u.
Frequency within range	Minimum value	≥ 59.5 Hz	59 Hz to 59.9 Hz
	Maximum value	≤ 60.1 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%.
- Connect/Reconnect Ramp-up rate: Upon starting power into the grid, following a period of inactivity or a disconnection, the inverter shall wait for 300 seconds before reconnecting and shall be able to control its rate of increase of power from 1 to 100% maximum current per second. The default value is 2% of maximum current output per second. The maximum active power step during restoring output is 20%

Exhibit 2

Redlined Revised Technical Bulletin

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SMART INVERTER SETTINGS SHEETS

September~~January~~ 11~~65~~, 2024

VERSION HISTORY:

Version	Date	Description
1	06/20/2022	Initial Draft
2	10/25/2022	Revised based on LUMA comments
3	01/03/2024	Final document

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 **October 17 ~~April 1~~, 2024**, all DER applications must indicate the use of inverters meet the utility required default settings and functions ~~default setting requirements~~ that are specified in this bulletin.

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1. Required Smart Inverter Functions

Smart Inverters must be (a) UL 1741 SB listed, (ab) set to conform to the default setting requirements provided in this document, and (bc) capable of performing the default functions, both provided in this document, "Smart Inverter Settings Sheets", as applicable.

Customers must comply with the requirements set forth in this "Smart Inverter Settings Sheets" or, anyexcept where alternative site-specific Smart Invert settings and functions statuses are that may be defined in the interconnection agreement as a result of a detailed interconnection study. Any alternative settings and function statusess defined in the interconnection agreement will take precedencet and override supersede the default settings requirements and function statusess provided in this document. Notwithstanding the preceding 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 1-1Table 1-1 lists the eligible minimum communication requirements 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 protocolsMinimum Requirements for Communication and Interface

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

1.2. Smart Inverter Functions and Control Modes

Table 1-1Table 1-1 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
Adjustable cConstant 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
Adjustable Constant Reactive Power	Required (If available)	Refers to Reactive Power set to a fixed value	If capable, dDeactivated
Voltage Ride through	Required	Refers to 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 (If available)	Refers to control of real power output as a function of voltage	Activated Deactivated for at least 6 months since deployment of this bulletin
Frequency Droop (Frequency -– Watt)	Required (If available)	Refers to control of real power as a function of frequency	If capable, dAeactivated
Enter Service	Required	Refers to the ability of smart inverters to begin operation with an energized utility source.	Activated.
Normal Ramp-up Rates	Required Optional	Refers to ability to have an adjustable entry service ramp rate when a DER restores output of active power or changes output levels over the normal course of operation. Refers to ability to transition between energy output levels over the normal course of operation	Activated, if available

Connect/Reconnect Ramp-up rate	Required	Refers to ability to have an adjustable entry service ramp rate when a DER restores output of active power	Activated

2. Smart Inverter Function and Control Mode Settings

This section lists the required settings for ~~s~~Smart ~~I~~inverter functions and control modes.

2.1. Anti-Islanding ~~Settings~~

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 ~~Settings~~

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~~	0.16~~Fixed at 1.2~~	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 ~~Settings~~

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~~ide-Through Settings~~	Voltage Range (pu)	~~Smart Inverter Response~~ ~~(~~Operating Mode~~/Response)~~	Maximum Ride Through ~~Response~~ Time (s) (design criteria)	Minimum Ride Through Time (s) (Design Criteria)
High Voltage 2 ~~(HV2)~~	V ≥ 1.2	Cease to Energize	0.16	N/A
High Voltage 1 ~~(HV1)~~	1.1 <~~≤~~ V ≤ 1.2	Momentary Cessation	0.083	12
Near Normal Voltage ~~(NNV)~~	0.88 ≤ V ≤ 1.1	Continuous Operation	N/A	Infinite
Low Voltage 1 ~~(LV1)~~	0.7 ≤ V <~~≤~~ 0.88	Mandatory Operation	N/A	20
Low Voltage 2 ~~(LV2)~~	0.5 ≤ V ≤ 0.7	Mandatory Operation	N/A	10
Low Voltage 3 ~~(LV3)~~	V ≤ 0.5	Momentary Cessation	0.083	1

2.3. Response to Abnormal Frequency ~~Settings~~

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 ~~FOF1~~Frequency (Hz)	Default Trip/Clearing Time (s)	Adjustable Range for Trip Time (s)
Over Frequency 2 ~~(OF2)~~	f ≥ 62	61.8 - 66	0.16	0.16 - 1000
Over Frequency 1 ~~(OF1)~~	f ≥ 61.2	61.2 - 66	300	21 - 1000
Under Frequency 1 ~~(UF1)~~	f ≤ 58.5	50 - 58.8	300	21 - 1000
Under Frequency 2 ~~(UF2)~~	f ≤ 56.5~~7~~	50 - 57	0.16	0.16 - 1000

2.3.2. Frequency Ride-Through ~~Settings~~

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	~~High~~ Frequency Range (Hz)	~~High Smart Inverter Response~~ (Operating Mode)	Minimum Ride Through Time (s)
High Frequency 2 ~~(HF2)~~	f ≥ 62	N/A	N/A
High Frequency 1 ~~(HF1)~~	61.2 <≤ f ≤ 62	Mandatory Operation	299
Near Normal Frequency ~~(NNF)~~	58.8 ≤ f ≤ 61.2	Continuous Operation	Infinite
Low Frequency 1 ~~(LF1)~~	57 ≤ f <≤ 58.8	Mandatory Operation	299
Low Frequency 2 ~~(LF2)~~	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~~Figure 2-1~~. The voltage-reactive power characteristic shall be configured in accordance with the default parameter values specified in Table 2-6~~Table 2-6~~.

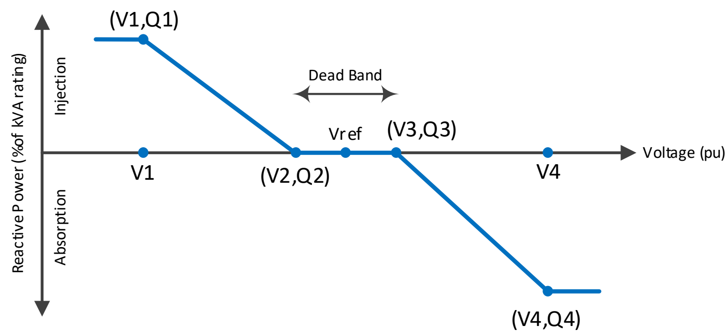

Figure 2-1. Example Volt-Var characteristic

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Table 2-6- Volt-Var Settings – ACTIVATED

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	102% VN	Vref	Vref + 3%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(1)	Reactive power injection at voltage V1	44%	0	maximum reactive power capability, injection
V4	Voltage at which DER shall absorb Q4 reactive power	108% VN	V3 + 2%VN	Vref + 18%VN
Q4(1)	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

(1) 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~~Figure 2-2~~. The characteristic shall be configured in accordance with the default parameter values specified in Table 2-7.

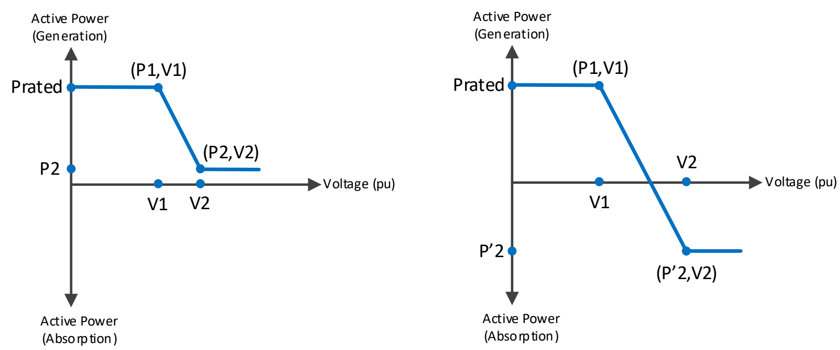

Figure 2-2. Example Volt-Watt characteristics

Table 2-7- Volt-Watt Settings – Deactivated [3] ~~ACTIVATED~~

Voltage-active power parameters	Default Settings	Ranges of allowable settings	
		Minimum	Maximum
V1	106% 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}[1]	P_{MIN}	P_{RATED}
P'2 (applicable to DER that can generate and absorb active power)	0	0	P'_{RATED}[2]
Open-loop response time	10 sec	0.5 sec	60 sec

(1) P_{MIN} is the minimum active power output in p.u. of the DER rating (i.e., 1.0 p.u.).
(2) P'_{RATED} is the maximum amount of active power that can be absorbed by the DER.
(3) Deactivated for at least 6 months since deployment of this bulletin

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 1.06 p.u.
Frequency within range	Minimum value	≥ 59.5 Hz	59 Hz to 59.9 Hz
	Maximum value	≤ 60.1 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

~~2.6.~~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%.
- Connect/Reconnect Ramp-up rate: Upon starting power into the grid, following a period of inactivity or a disconnection, the inverter shall wait for 300 seconds before reconnecting and shall be able to control its rate of increase of power from 1 to 100% maximum current per second. The default value is 2% of maximum current output per second. The maximum active power step during restoring output is 20%