

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

NEPR

Received:

Aug 30, 2026

5:24 PM

**IN RE: INTERCONNECTION
REGULATIONS**

**CASE NO.: NEPR-MI-2019-0009
CEPR-MI-2018-0008**

SUBJECT: Comments on Distributed
Generation and Microgrid Interconnection
Regulation - Case No. NEPR-MI-2019-0009
Post-Workshop Comments of Robert A.
Garcia Cooper on Subjects Discussed During
Virtual Stakeholder Workshop 2
Continuation, Held August 28, 2026

**POST-WORKSHOP COMMENTS OF ROBERT A. GARCIA COOPER ON SUBJECTS
DISCUSSED DURING VIRTUAL STAKEHOLDER WORKSHOP 2 CONTINUATION
SESSION, HELD AUGUST 28, 2026**

TO THE HONORABLE PUERTO RICO ENERGY BUREAU:

Attention: Edison Avilés Deliz, Chairman

COMES NOW Robert A. Garcia Cooper, in his individual capacity as state-certified Engineer in Training (EIT, Certificate No. 28591), licensed Expert Electrician (Perito Electricista, License No. 10971), PhD student in electrical engineering at the University of Puerto Rico at Mayaguez, published researcher in energy systems and resilience economics, Senior Member of the Institute of Electrical and Electronics Engineers (IEEE), and former electricity metering technician, Probador Especial de Contadores by its official Spanish title, at PREPA's Electricity Metering Research Center Centro de Estudios de Medición, and Wholesale Metering Districts of San Juan and Bayamón, and respectfully submits these post-workshop comments in connection with the above-captioned proceeding.

I. PURPOSE OF THESE COMMENTS

The undersigned appeared and provided oral testimony during Virtual Stakeholder Workshop 2 Continuation Session, held August 28, 2026. These comments supplement that testimony by

placing its key elements on the written record with the precision that spoken testimony in a workshop setting cannot always guarantee. The undersigned wishes to address three subjects discussed during the session: cost allocation, meter socket adapters, and network impedance measurement.

II. COST ALLOCATION - CUMULATIVE VERSUS INCREMENTAL CONDITIONS AND THE LEGAL DEADLOCK

During the cost allocation discussion of the August 28 session, the undersigned placed the following observations on the oral record, building upon the analysis submitted in the undersigned's post-workshop comments filed August 27, 2026, Sections V.B and VII, which are incorporated here by reference.¹

LUMA Energy's presentation of August 28 correctly acknowledges that existing interconnection frameworks do not cleanly allocate costs for cumulative and cascading upgrades triggered when multiple distributed energy resources interconnect. That acknowledgment appears in LUMA's own cost allocation slide presented during the session and is consistent with the structural gap the undersigned identified in the August 27 comments.

However, the twelve-step supplemental review process LUMA also presented does not resolve that problem. Step 10 of that process evaluates smart inverter functions including Volt-VAR and Volt-Watt. Those functions are responses to a cumulative feeder condition created by all prior interconnections, not by the new applicant alone. The cost trigger and the cost cause are not the same entity. The applicant whose interconnection activates Step 10 did not create the voltage condition that Step 10 is evaluating. That condition is the cumulative product of every prior interconnection on that feeder.

Before concluding that capital upgrades are the primary solution to these cumulative conditions, the Bureau should consider that neither the PR100 study, which addresses hosting capacity through grid improvements and distributed energy storage investment, nor the Sandia study cited in this proceeding provides a sufficient basis for that conclusion. The Sandia study explicitly did not explore the voltage stabilization benefits of Volt-VAR and Volt-Watt, and the Sandia authors themselves acknowledge in their findings that those benefits may significantly reduce overvoltage and Volt-Watt activation. The only study in the record of this docket that actually applies Volt-VAR and distributed energy storage to a representative Puerto Rico distribution feeder at 4.16 kV and measures the result is the research of Anny Huaman-Rivera, filed in this docket on April 12,

¹ Puerto Rico Energy Bureau. (2026, August 28). NEPR-MI-2019-0009 Virtual Stakeholder Workshop 2 Continuance [Video]. YouTube. <https://youtu.be/vElbfFpYriM?t=5084>

2024, which demonstrates hosting capacity increases of 20 to 90 percent depending on feeder characteristics without capital upgrades to the grid infrastructure.²

The full analysis of the legal deadlock between Act 114-2007 and Joint Resolution 5-2026, the equity implications of the first come first serve structure confirmed by Engineer Baretty, and the three recommended actions within the Bureau's existing authority are set forth in the undersigned's August 27 comments, Sections V.B and VII, and are not repeated here.

The undersigned wishes to add two observations that arose specifically during the August 28 session.

First, Commissioner Ugarte raised the forward-looking dimension of the same structural problem during the session, asking whether a prosumer who bears the full cost of a system upgrade that benefits subsequent interconnections on the same feeder would have any mechanism for cost recovery from those future beneficiaries, and whether that cost could be distributed among future customers who interconnect.³ This question identifies the mirror image of the backward-looking cost attribution problem the undersigned identified in the August 27 comments. Both are expressions of the same statutory gap.

Second, in response to Commissioner Ugarte's questions, LUMA's Vice President of Regulatory Affairs, Gustavo Bonet, stated during the session that LUMA does not at this moment have a proposal for how to address that part of the program, and that it would have to be an analysis nourished by the workshop conversations.⁴ The Bureau now has on the record that neither the backward-looking proportionality problem nor the forward-looking reimbursement problem has a proposed solution from the utility. Both gaps belong in the Bureau's final order with a recommendation to the legislature.

III. METER SOCKET ADAPTERS

The undersigned addressed the revenue integrity dimensions of meter socket adapter installations in detail in the Comments filed July 18, 2026, Section VIII, of the above-captioned proceeding. Those observations, including the professional credentials, the documented energy theft investigation experience, the new sealing obligations, the historical pattern of theft modalities following technology transitions, and the recommended framework requirements, are incorporated here by reference and are not repeated.

² Puerto Rico Energy Bureau. (2026, August 28). NEPR-MI-2019-0009 Virtual Stakeholder Workshop 2 Continuance [Video]. YouTube. <https://youtu.be/vElbfFpYriM?t=5284>

³ Puerto Rico Energy Bureau. (2026, August 28). NEPR-MI-2019-0009 Virtual Stakeholder Workshop 2 Continuance [Video]. YouTube. <https://youtu.be/vElbfFpYriM?t=5523>

⁴ Puerto Rico Energy Bureau. (2026, August 28). NEPR-MI-2019-0009 Virtual Stakeholder Workshop 2 Continuance [Video]. YouTube. <https://youtu.be/vElbfFpYriM?t=5574>

The undersigned wishes to supplement the oral testimony of August 28 with a written clarification. During the session, the undersigned attempted to articulate a concern regarding the informal market for metering intervention services but was unable to complete that argument with the precision it requires within the available time and amid cross-examination. The following is offered to place that argument clearly and completely on the record.

The undersigned acknowledges that LUMA's confirmation during the session that utility personnel must be present at the moment of MSA installation and meter removal represents a meaningful improvement over a framework with no utility supervision at that point.⁵ The undersigned commends that position.

With respect to Commissioner Ramos's observation that a very small percentage of people installing new systems would expose themselves to the risk of tampering, the undersigned agrees.⁶ The vast majority of prosumers are honest ratepayers who have made a legitimate investment in distributed generation and have no interest in compromising the revenue measurement point. Commissioner Ramos is correct on that point and the undersigned does not dispute it.

The concern is more specific than consumer behavior. It concerns the conditions under which an informal market for metering intervention services becomes commercially viable. Evidence pointing toward such a market exists in Puerto Rico's documented theft history, as detailed in the July 18 comments. Throughout the undersigned's professional service at PREPA's Centro de Estudios de Medición, certain intervention modalities exhibited geographic concentration within specific service areas rather than spreading uniformly across the island. Some of the most technically unique and sophisticated interventions remained confined to a defined geographic territory over extended periods. This regional specificity is not consistent with individual consumers acting independently across a large area. It is consistent with a specific individual or small group with specialized technical knowledge offering a service to multiple customers within a defined territory through informal and illegal channels.

During the August 28 session, the undersigned was asked whether any of the energy theft investigation cases involved net metering meters specifically.⁷ The honest answer given was that the undersigned does not recall a specific case. That answer reflects the nature of the undersigned's professional role rather than the absence of a connection between metering infrastructure and revenue integrity risk. Cases were referred to the undersigned based on technical complexity, not based on the program classification of the meter. What the undersigned does recall is that when a technically unique intervention modality was encountered more than once, the question eventually

⁵ Puerto Rico Energy Bureau. (2026, August 28). NEPR-MI-2019-0009 Virtual Stakeholder Workshop 2 Continuance [Video]. YouTube. <https://youtu.be/vElbfFpYriM?t=11338>

⁶ Puerto Rico Energy Bureau. (2026, August 28). NEPR-MI-2019-0009 Virtual Stakeholder Workshop 2 Continuance [Video]. YouTube. <https://youtu.be/vElbfFpYriM?t=11037>

⁷ Puerto Rico Energy Bureau. (2026, August 28). NEPR-MI-2019-0009 Virtual Stakeholder Workshop 2 Continuance [Video]. YouTube. <https://youtu.be/vElbfFpYriM?t=10168>

arose among the investigative team as to the origin of the meters presenting that pattern. On more than one occasion that inquiry pointed to a specific geographic area, confirming the regional concentration observed across multiple cases. Some interventions were very difficult to detect and even more difficult to process precisely because the methods were sophisticated and the supply chain was informal and invisible. Still, the undersigned does not assert this as a certainty. The field evidence encountered suggests it. That distinction is important and the undersigned wishes to be precise about it on the record.

The relevant question therefore is not whether individual consumers would take that risk. It is whether the professional or team(s) that supplies such services would find it economically attractive to enter this market. That calculus depends on scale. A single or even a hundred MSA installations may present no meaningful target. The informal market would not mobilize to acquire, disassemble, reverse engineer, and develop intervention methods for a technology that has not achieved sufficient deployment to generate a viable customer base. The economics of the informal market may require mass deployment before the return on that technical investment becomes attractive.

The undersigned therefore does not suggest that the risk is immediate. The honest statement is that once MSAs are deployed at a scale sufficient to constitute a viable informal market, the pattern Puerto Rico's metering history has documented consistently may assert itself. Someone will identify the new access pathway, develop an intervention method, and offer that service. The Bureau is not being asked to prevent a certainty. It is being asked to understand what it is enabling at scale before it enables it, and to ensure that the framework accompanying MSA inclusion is adequate to manage the risk that emerges as deployment grows.

During the session the undersigned identified three new sealing obligations created by the MSA installation, the adapter to socket connection, the adapter body itself, and the meter seated over the adapter, and expressly invited representatives of the companies that manufacture MSAs to correct that characterization if it was inaccurate. Engineer Gabriel Ferrer, representing Enphase Energy, subsequently confirmed in response to Commissioner Ramos that there are two positions where a seal can be placed, between the meter socket base and the meter socket adapter, and on top of the meter socket adapter where the utility meter is seated.⁸ The undersigned accepts that technical clarification and notes that it corrects the three-point characterization offered during the oral testimony and the Comments filed July 18, 2026. The Bureau may nonetheless wish to invite further clarification on whether the adapter body itself presents any additional intervention risk that warrants a sealing requirement beyond the two points Engineer Ferrer confirmed, before the TIR sealing protocol is finalized.

The cost implications of monitoring, verifying, and defending the revenue integrity of MSA installations across whatever number of service points are ultimately deployed have not yet been

⁸ Puerto Rico Energy Bureau. (2026, August 28). NEPR-MI-2019-0009 Virtual Stakeholder Workshop 2 Continuance [Video]. YouTube. <https://youtu.be/vElbfFpYriM?t=11120>

quantified in any proposal before the Bureau. If a customer elects to install an MSA for their own convenience, the probability of revenue integrity risk at that installation point increases relative to a standard meter installation as deployment reaches scale. That incremental risk and its associated monitoring and verification costs are a foreseeable consequence of that election. The undersigned respectfully recommends that the Bureau also account for this risk allocation question explicitly in the final regulation before MSA provisions are finalized.

IV. OBSERVATIONS IN RESPONSE TO COMMENTS ON THE RESOURCE AND LIABILITY IMPLICATIONS OF NETWORK IMPEDANCE MEASUREMENT

The undersigned wishes to recognize the significant contribution Engineer Gabriel Ferrer made to this proceeding during the August 28 session.⁹ His identification of network impedance as a metric for cost allocation represents a valuable and previously unconsidered tool that grounds the cost allocation discussion in physics rather than subjective criteria. The undersigned commends this contribution to the Bureau's attention and believes it provides a clear pathway toward a more defensible and proportional cost allocation methodology.

During the August 28 session, Engineer Alfonso Baretty, Senior Manager for Renewable Integration and Generation Assets at LUMA Energy, offered observations in response to Engineer Ferrer's impedance proposal, noting that the voltage effect at any service point depends on the physical characteristics of the secondary circuit, that attribution of responsibility may be complicated when the customer's service entrance cable extends beyond code minimum distance from the transformer, that the voltage outcome depends on multiple variables including DER export current and system size, and that the measurement entails resources that need to be considered within the overall cost allocation process.¹⁰ The undersigned wishes to address those observations with the following clarifications, while acknowledging that any final measurement protocol should await Engineer Ferrer's complete methodology submission, which the commission invited during the session.

First, regarding specialized equipment. If Engineer Ferrer's method involves the procurement of specialized equipment, the undersigned defers to his submission before drawing any conclusions about that specific approach. However, the undersigned notes that peer-reviewed methods for impedance measurement at the point of common coupling do not necessarily require specialized equipment beyond what a utility planning department engaged in DER interconnection studies should already carry as standard test inventory. The delta V over delta I method for source

⁹ Puerto Rico Energy Bureau. (2026, August 28). NEPR-MI-2019-0009 Virtual Stakeholder Workshop 2 Continuance [Video]. YouTube. <https://youtu.be/vElbfFpYriM?t=3984>

¹⁰ Puerto Rico Energy Bureau. (2026, August 28). NEPR-MI-2019-0009 Virtual Stakeholder Workshop 2 Continuance [Video]. YouTube. <https://youtu.be/vElbfFpYriM?t=4821>

impedance estimation at the point of common coupling, described in Timbus et al., requires only a data logger capable of simultaneously measuring voltage and current on both lines at the service entrance.¹¹

The undersigned proposes the following field measurement protocol as a practical methodology consistent with that approach. Prior to DER energization, a data logger capable of simultaneously measuring voltage and current on both lines is connected at the service entrance. Logging commences before DER connection to establish a baseline record of feeder voltage and current under utility-only supply conditions. The DER is then connected and energized. At the moment the inverter begins exporting, the data logger captures the voltage and current step change at the service point. The change in voltage divided by the change in current at that transition moment yields the source impedance estimate at the point of common coupling under actual operating conditions, consistent with the methodology described in Timbus et al.¹²

The time resolution of the data logger is a critical parameter. Timbus et al. explicitly note that the ΔV over ΔI relationship is valid only if the source voltage and grid impedance are not changing between the two sample instants. The undersigned has conducted field measurements at multiple time resolutions and directly observed the contamination effect the authors warn against. When the measurement window is sufficiently large, other load events elsewhere on the feeder may introduce spurious components into the calculated impedance via system voltage, producing unreliable results. Sufficient time resolution is therefore not merely a precision preference. It is a prerequisite for a defensible impedance estimate. Any protocol adopted for regulatory cost allocation purposes should specify minimum logger time resolution as a mandatory requirement.

This baseline window may also be used to capture voltage transient data of independent regulatory value, including pre-existing overvoltage conditions and diurnal voltage profile characteristics relevant to the feeder tier classification framework the undersigned presented during Workshop 2. A data logger capable of this measurement should be considered standard test equipment for any utility planning department engaged in DER interconnection studies.

Second, regarding the cost of the field visit. While a field visit is required to perform the measurement, the undersigned submits that this cost should not be passed to the new prosumer as an additional charge beyond the supplemental study fee already contemplated in the cost allocation framework. The impedance measurement is not a service the new prosumer is requesting for their own benefit. It is a characterization of the pre-existing infrastructure condition of the feeder they are connecting to. If that condition, as Engineer Ferrer documented from field experience, reflects years of deferred maintenance, post-hurricane repairs with multiple splices, and undersized secondary conductors, the cost of documenting that condition is a utility infrastructure

¹¹ Timbus, A.V., Rodriguez, P., Teodorescu, R., and Ciobotaru, M., "Line Impedance Estimation Using Active and Reactive Power Variations," IEEE, 2007, pp. 1273-1278. DOI: [10.1109/PESC.2007.4342176](https://doi.org/10.1109/PESC.2007.4342176)

¹² Id. Section 3. Equations 3, 4a, and 4b.

responsibility, not a customer cost.¹³ If the current legal framework places that cost on the prosumer regardless, the Bureau faces the same legislative gap the undersigned identified in the cost allocation discussion during the undersigned's post-workshop comments filed August 27, 2026. The state permitted this infrastructure condition to develop. The Honorable Bureau may wish to name this gap explicitly in its final order and carry it to the legislature.

Third, regarding transparency and the scope of measurement. The transparency argument the undersigned placed on the record during the undersigned's post-workshop comments filed August 27, 2026, would require that the impedance measurement be performed not only for the new prosumer triggering the supplemental study, but for all prosumers already interconnected on that feeder. Without that baseline characterization across all service points, it is impossible to establish what portion of the feeder's current impedance condition is attributable to which interconnection. Charging only the new prosumer for a measurement that must ultimately encompass the entire feeder to be meaningful is neither proportional nor transparent and does not satisfy the principles of Joint Resolution 5-2026.

The undersigned considers it premature to develop or propose any specific impedance threshold or measurement protocol until Engineer Ferrer has submitted his complete methodology. The undersigned notes that ANSI C84.1 establishes maximum service voltage limits that may inform that development. The undersigned will contribute to that discussion once Engineer Ferrer's submission is on the record.

The undersigned respectfully recommends that the Bureau direct that the impedance measurement question be addressed in coordination with Engineer Ferrer's forthcoming methodology submission before any cost allocation protocol is finalized, and that any resulting measurement cost be treated as a utility infrastructure characterization expense rather than an additional charge to the interconnecting prosumer.

V. DECLARATION

In compliance with applicable Energy Bureau procedural requirements, the undersigned declares as follows:

- A) No party or attorney in this proceeding assisted in drafting these comments.
- B) No party or attorney in this proceeding contributed funds or any other type of resource for the preparation or submission of these comments.

¹³ Puerto Rico Energy Bureau. (2026, August 28). NEPR-MI-2019-0009 Virtual Stakeholder Workshop 2 Continuance [Video]. YouTube. <https://youtu.be/vElbfFpYriM?t=3984>

C) No person other than the undersigned contributed funds or any other type of resource for the preparation or submission of these comments.

Respectfully submitted,

In San Juan, Puerto Rico, on August 30, 2026.



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CERTIFICATE OF SERVICE

I hereby certify that on August 30, 2026, a copy of these Comments was filed with the Puerto Rico Energy Bureau under the title Comments on Distributed Generation and Microgrid Interconnection Regulation - Case No. NEPR-MI-2019-0009 - Post-Workshop 2 Continuation Comments of Robert A. Garcia Cooper, held on August 28, 2026, addressed to the attention of Edison Avilés Deliz, Chairman, and submitted electronically through the Energy Bureau's electronic filing tool at <https://radicacion.energia.pr.gov/>.

Robert A. Garcia Cooper