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

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, Held August 25, 2026

POST-WORKSHOP COMMENTS OF ROBERT A. GARCIA COOPER ON SUBJECTS DISCUSSED DURING VIRTUAL STAKEHOLDER WORKSHOP 2, HELD AUGUST 25, 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, held August 25, 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 clarify one aspect of the oral testimony, develop the legal and technical implications of the observations placed on the record, and propose a path forward for the Energy Bureau's consideration.

II. THE FIVE-TIER FRAMEWORK PRESENTED DURING ORAL TESTIMONY

The undersigned's oral intervention during the simplified process and cost allocation discussion at timestamp 00:58:50 identified five prosumer conditions that exist or will exist on Puerto Rico's distribution system and that the cost allocation framework must distinguish between. The complete oral testimony is captured in the workshop recording available at the Energy Bureau's YouTube channel, with footnote references to specific timestamps provided throughout these comments.

The five tiers as presented are as follows. Tier one describes a healthy feeder with voltage within threshold where the prosumer exports freely and cost allocation questions are fully legitimate. Tier two describes a condition where Volt-VAR is active, the inverter operates, but active power export is continuously reduced because the apparent power ceiling is partially occupied by reactive power the grid requires, transferring the cost of voltage regulation from grid infrastructure to privately owned inverters through uncompensated reactive power obligations. Tier three describes a feeder where voltage intermittently crosses the inverter operating threshold, causing trip events during violation windows and partial net metering access. Tier four describes a feeder genuinely saturated by DER penetration where OIPC Comment 24 on Section 4.04(D) applies directly to cost allocation. Tier five describes a feeder where voltage settings impede inverter operation around the clock, preventing both export and self-consumption from a grid-tied prosumer's own generation.[1]

The feeder data supporting Tiers four and five were presented at timestamp 01:01:50, referencing Feeder 1421-05, substation FONALLEDAS, with 11.78 percent DG penetration and chronic above-threshold voltage throughout August 2026 despite LUMA's own hosting capacity classification showing no saturation, and Feeder 1903-01, substation JUAN DOMINGO, with 57.48 percent DG penetration and a daytime light demand of 0.089 MVA against 818 kW of existing DG capacity.[2]

[1] Puerto Rico Energy Bureau. (2026, August 28). NEPR-MI-2019-0009 Virtual Stakeholder Workshop 2 [Video]. YouTube. https://youtu.be/Axpq2OQPcOk?t=3515

[2] Puerto Rico Energy Bureau. (2026, August 28). NEPR-MI-2019-0009 Virtual Stakeholder Workshop 2 [Video]. YouTube. https://youtu.be/Axpq2OQPcOk?t=3710

III. NECESSARY CLARIFICATION REGARDING TIER TWO

The undersigned wishes to clarify for the written record that Tier two as described above does not represent a condition currently existing at scale on Puerto Rico's distribution system. It is a condition this regulation will create once Volt-VAR smart inverter mandates are finalized and the Technical Interconnection Requirements take effect. Until the TIR establishes mandatory Volt-VAR settings and inverters are configured accordingly, active power displacement through reactive power priority at the apparent power ceiling is not occurring systematically across Puerto Rico's feeders.

Tiers three, four, and five by contrast describe conditions that exist in the field today, independently of any smart inverter mandate. Prosumers are currently experiencing voltage threshold trips, feeder saturation conditions, and chronic above-threshold voltage preventing both export and self-consumption on specific circuits documented in LUMA's own hosting capacity map.

This distinction matters for regulatory sequencing. Tiers three through five require immediate attention within the framework being developed now. Tier two represents a future injury this regulation will produce if it mandates Volt-VAR operation without first establishing a compensation framework. The window to build that compensation mechanism into the regulatory architecture closes when the TIR is approved. Once Volt-VAR is mandated the Tier two condition will exist system-wide with no remedy in place. That is the sequencing problem this proceeding must resolve before it concludes.

IV. SCIENTIFIC BASIS FOR THE 60 PERCENT PENETRATION THRESHOLD

During the cost allocation discussion at timestamp 3:00:17 [3], the undersigned placed on the oral record that Anny Huaman-Rivera, in her thesis work filed in this docket on April 12, 2024, and in her subsequent peer-reviewed publication, determined that approximately at 60 percent PV penetration on a representative Puerto Rico 4.16 kV feeder, voltage violations approaching 1.05 per unit begin to appear; and that the Maharjan study, cited by the undersigned in the IRP docket, Case No. NEPR-AP-2023-0004, confirms that at 60 percent PV penetration the Effective Site-Dependent Short Circuit Ratio falls to a median of 1.31, below 2, which is classified as a very weak grid condition where voltage becomes sensitive to both active and reactive power disturbances. The full citations are included in the exhibits section below.

[3] Puerto Rico Energy Bureau. (2026, August 28). NEPR-MI-2019-0009 Virtual Stakeholder Workshop 2 [Video]. YouTube. https://youtu.be/Axpq2OQPcOk?t=10812

The Energy Czar's filing of August 14, 2026 places Puerto Rico's average feeder penetration at 61.3 percent, drawn from LUMA's own data. Puerto Rico's distribution system has already crossed the threshold these studies identify as the point at which voltage violations emerge and grid inertia problems begin to manifest. This is not a future condition. It is the current state of the system within which this regulation will take effect.

V. THE EXPORT STUDY PARAMETERS, THE LEGAL DEADLOCK IN COST ALLOCATION, AND THEIR STRUCTURAL CAUSES

A. Parameters of the Proposed Export Study and the Voltage Threshold Question

During the cost allocation discussion at timestamp 2:58:05, the undersigned asked Engineer Alfonso Baretty, Section Manager for Renewable Integration at LUMA Energy, to clarify what voltage thresholds govern LUMA's proposed supplemental review study, what constitutes an unsafe condition for purposes of restricting export authorization, and what standard operating procedure defines when export authorization would follow from a study finding. The undersigned referenced ANSI C84.1's 1.05 per unit upper limit and the research of Anny Huaman-Rivera, filed in this docket on April 12, 2024, which determined that on a representative Puerto Rico 4.16 kV feeder, voltage violations approaching 1.05 per unit begin to appear at approximately 60 percent PV penetration.[4]

Engineer Baretty responded at timestamp 3:02:00 as follows, reproduced verbatim:

"The threshold for DER penetration as function of maximum demand is precisely a screening concept. It is indicative and not constitutive of the need or that there is a certainty that some upgrade will be required. However, it is a good indication that we need to study the feeder to assess if there are certain unsafe and inoperable conditions. Now going to the specifics about the criteria of what constitutes an unsafe condition, those are or will be laid out clearly in the Technical Interconnection Requirements. What we have proposed based on the smart inverter settings since June 20th of last year is to have ANSI C84.1 Class B which goes a little bit further than 1.05 and it is actually closer to 1.06. Beyond that ANSI itself describes that as an unsafe condition. The result of any particular load flow study, not only at feeder level but also at the transmission level, is really a function of many many things. We have feeders that their penetration level is way higher than 15 percent, say 30 percent, and they do not have significant issues. And on the other hand we have feeders that have penetration lower than 15 percent and given their topology, their wire size,

[4] Puerto Rico Energy Bureau. (2026, August 28). NEPR-MI-2019-0009 Virtual Stakeholder Workshop 2 [Video]. YouTube. https://youtu.be/Axpq2OQPcOk?t=10689

their load conditions and behavior, they have issues. That is the reason why we need to study them and set some reasonable trigger so we can assess the impact and ultimately determine which are those upgrades required for safe and reliable operation." [5]

The undersigned places the following observation on the record in direct response to Baretty's answer.

LUMA's proposed threshold of ANSI C84.1 Class B at approximately 1.06 per unit corresponds to approximately 127.2 volts on a 120 volt nominal system. Direct measurement data from the undersigned's own service point on Feeder 1421-05, substation FONALLEDAS, shows average secondary voltages of 127.7 volts during the week of August 2 through August 8, 2026, and 128.1 volts on August 9, 2026, corresponding to 1.064 and 1.067 per unit respectively. Independent corroborating data from a second service point on Feeder 1903-01, substation JUAN DOMINGO, shows average line-to neutral voltages of 128.8 volts, corresponding to 1.073 per unit, and from 7/28/2026 to 8/04/2026 line-to-line voltages exceeded 254 Volts for over 162 hours. Both values exceed the Class B threshold that Engineer Baretty confirmed as LUMA's proposed unsafe condition limit.

Feeder 1421-05 has 11.78 percent DG penetration. LUMA's own hosting capacity map classifies it as unsaturated and requiring no supplemental study. Its chronic above-threshold voltage condition is not attributable to DER penetration. It is an operational parameter within LUMA's authority. And it exceeds LUMA's own proposed safety threshold around the clock.

Engineer Baretty further stated that the criteria defining unsafe conditions will be laid out in the TIR. The undersigned notes that this confirms the concern raised in Section IX of the undersigned's July 18, 2026 comments. The voltage threshold that determines when a prosumer may or may not export, and therefore whether their net metering agreement delivers what it promises, will be established in a document that has not yet been subjected to stakeholder comment and that will take effect simultaneously with the regulation under LUMA's proposed Section 16.2 Special Condition Precedent. A threshold with this degree of economic consequence to prosumers must be established in the regulation itself or subjected to a full stakeholder participation process before TIR approval, consistent with OIPC Comment 35 on Section 8.01.

B. The First Come First Serve Structure and Its Equity Implications

At timestamp 3:05:52 the undersigned raised a follow-up question to Engineer Baretty, asking him to confirm whether LUMA's proposed approach, by allowing earlier prosumers to interconnect

[5] Puerto Rico Energy Bureau. (2026, August 28). NEPR-MI-2019-0009 Virtual Stakeholder Workshop 2 [Video]. YouTube. https://youtu.be/Axpq2OQPcOk?t=10920

and export freely while subjecting later prosumers to study requirements and potential export restrictions, effectively establishes a first come first serve structure.[6]

Engineer Alfonso Baretty responded at timestamp 3:07:44 as follows, reproduced verbatim:

"So that is the law really. It is not the utility. It is not even the industry. That is what the law leads us to. And even what the law states about who is responsible for paying the upgrades really reflects a first come first serve feature. So I agree with you and we can talk about that but that goes beyond the scope of this and I do agree with you it is certainly intertwined the equity part with the repercussions of the technical part and it is something that we have to acknowledge as an overall group rather than one particular stakeholder. But it is what we have right now."[7]

The undersigned concurs with Engineer Baretty's characterization and wishes to name its equity implications explicitly.

The first come first serve structure Engineer Baretty confirmed has an equity dimension that the cost allocation framework must acknowledge. The timing of distributed generation adoption in Puerto Rico follows the trajectory of market prices for photovoltaic and storage systems relative to household economic capacity.

The undersigned's published research on the true cost of electric service documents this relationship directly. At the time early prosumers were installing distributed generation systems in Puerto Rico, the continental U.S. minimum sustainable price for PV installation was approximately $2.55 per watt and the modeled market price was $2.95 per watt, placing the average stand-alone PV system cost between $14,700 and $17,100, with storage costs potentially raising that figure beyond $33,858. The same research documents that Puerto Rico has the lowest median income of all U.S. states and territories at $11.21 per hour, with a 44.9 percent poverty rate. The research concludes that many Puerto Rican households may not afford to finance a residential energy system at those cost levels, and that if higher income corresponds to higher willingness to pay, low-to-medium income households may not be able to purchase, finance, or otherwise acquire these systems.[8]

As market prices have declined substantially since those benchmarks were established, solar and storage have become financially accessible to a materially broader segment of Puerto Rico's population.

The nonlinear acceleration in residential PV and storage adoption documented in the undersigned's published research, based on data filed by the utility in Case No. NEPR-MI-2019-0007, In Re: The Performance of the Puerto Rico Electric Power Authority, can be interpreted as an aftereffect of

[6] Puerto Rico Energy Bureau. (2026, August 28). NEPR-MI-2019-0009 Virtual Stakeholder Workshop 2 [Video]. YouTube. https://youtu.be/Axpq2OQPcOk?t=11151

[7] Puerto Rico Energy Bureau. (2026, August 28). NEPR-MI-2019-0009 Virtual Stakeholder Workshop 2 [Video]. YouTube. https://youtu.be/Axpq2OQPcOk?t=11265

[8] Garcia Cooper et al., "True cost of electric service: What reliability metrics alone fail to communicate," The Electricity Journal, Vol. 37 (2024), Article 107386, DOI: 10.1016/j.tej.2024.107386, Section 2.1.

elevated grid unreliability. The undersigned's published research documents a multi-annual trajectory of declining utility employee headcount, reduced operation and maintenance expenditures, and reduced capital investments that contributed to the reliability conditions households experienced during the period reflected in the adoption data. [9] Households with sufficient financial capacity responded to documented service deterioration by investing in private generation and storage. The households now arriving in the interconnection queue are arriving partly because declining costs have made a broader participation accessible, not because they were positioned to respond to a reliability event when it occurred. They are now being asked to bear upgrade costs created in part by a reliability-driven adoption wave they could not participate in.

The undersigned does not assert a direct one-to-one correspondence between the cost level at time of installation and the income level of the installing household. However, the relationship between cost accessibility, energy consumption, and economic capacity is an established principle of consumer market economics which is highlighted in the undersigned's published research [10]. When a technology's cost exceeds the financial capacity of most households, early adoption concentrates among those with greater financial capacity. As costs decline, adoption broadens. Puerto Rico's residential distributed generation market has followed this pattern.

A regulatory framework that assigns upgrade costs exclusively to the later arriving prosumer without accounting for this dynamic does not satisfy the proportionality and benefit received principles of Joint Resolution 5-2026. It compounds an economic disadvantage already documented in the published record of this proceeding. The Energy Bureau may wish to name this dimension explicitly in its final order and carry it to the legislature as part of the recommendation that Act 114-2007's cost assignment framework be revisited.

The current legal framework creates the following deadlock. The new prosumer cannot bear the full upgrade cost because Joint Resolution 5-2026 requires proportionality and benefit received. Existing prosumers who contributed to the saturation condition cannot be retroactively charged because existing interconnection agreements protect them. The general ratepayer base cannot bear the gap because Joint Resolution 5-2026 explicitly prohibits its unfair transfer to all customers, a limitation Gustavo Bonet, Vice President of Regulatory Affairs at LUMA Energy, confirmed at timestamp 1:12:48.[11] The remaining gap has no funding mechanism in the current statutory framework.

The Energy Bureau cannot overcome the law. However, the Honorable Bureau may be positioned to take three actions within its authority.

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[9] Garcia Cooper et al., "True cost of electric service: What reliability metrics alone fail to communicate," The Electricity Journal, Vol. 37 (2024), Article 107386, DOI: 10.1016/j.tej.2024.107386, Section 1.
[10] Id. Section 2.1.
[11] Puerto Rico Energy Bureau. (2026, August 28). NEPR-MI-2019-0009 Virtual Stakeholder Workshop 2 [Video]. YouTube. https://youtu.be/Axpq2OQPcOk?t=4363

First, name the gap explicitly in its final order with sufficient specificity that the legislature understands both the nature of the inequity and its relationship to Act 114-2007's cost assignment language.

Second, carry a formal recommendation to the legislature that Act 114-2007's cost assignment provisions be revisited in light of current DER penetration levels and the equity conditions documented in this proceeding.

Third, within the existing legal framework, require that cost allocation methodology be applied with maximum proportionality, transparency, and auditability, incorporating the following elements.

An auditable calculation showing the specific incremental contribution of the new prosumer's interconnection to the constraint being remedied, expressed both in absolute terms and as a percentage of the total constraint on that feeder.

A transparent disclosure to the new prosumer of the aggregate contribution of all previously interconnected distributed generators on that feeder to the same constraint. The new prosumer need not receive individual system details or personally identifiable information regarding other prosumers. However, they should be entitled to know that other distributed generators collectively contributed a documented and quantified share of the constraint for which they are being asked to pay. Without this information the new prosumer cannot evaluate whether the assigned cost satisfies Joint Resolution 5-2026's proportionality and benefit received principles or whether a basis exists to seek administrative review.

A documented evaluation, consistent with OIPC Comment 24 on Section 4.04(D), of whether any previously interconnected systems that failed applicable screening but were permitted to interconnect contributed to the constraint being assigned to the new prosumer.

A clearly defined ceiling on the portion of upgrade costs assignable to any single new prosumer based on their incremental causal contribution, with any remaining gap explicitly identified as unresolved under the current statutory framework and referred to the legislature for action.

VI. THE VOLT-VAR COMPENSATION MECHANISM AS INFRASTRUCTURE POLICY

The legislative intervention described in Section V becomes significantly less urgent if the Energy Bureau establishes the Volt-VAR compensation framework before the TIR is finalized.

The research cited in Section IV demonstrates on actual Puerto Rico distribution feeders at 4.16 kV that Volt-VAR smart inverter functions eliminate or significantly reduce voltage violations without requiring capital upgrades. The combination of Volt-VAR and residential battery storage increases feeder hosting capacity by 20 to 90 percent depending on feeder characteristics. Puerto Rico has already crossed the penetration threshold at which this function is necessary.

But Volt-VAR must be properly compensated. A mandatory grid service performed by privately owned equipment at the utility's direction, with measurable economic consequences to the equipment owner, requires a compensation mechanism. The undersigned's supplementary comments filed August 7, 2026 provide that mechanism. A utility-controlled, ANSI C12.20-grade measurement methodology requiring no inverter telemetry, no third-party data, and no new tariff. Two measured values, P and Q. One derived value, S. One subtraction.

$$P_{avoided} = S_{derived} - P_{measured}$$

If the compensation mechanism is established before the TIR is finalized, the following consequences follow. Volt-VAR activation is incentivized rather than merely mandated at the prosumer's risk and expense. Feeder hosting capacity increases across the island without capital upgrades on most feeders. The need for upgrade costs that produce the first come first serve deadlock is reduced. Prosumers providing reactive power support receive economic recognition for a grid service the Energy Czar declared essential to system stability in his August 14, 2026 filing.

The compensation mechanism is not only an equity question. It is the infrastructure policy that reduces the need for capital upgrades, defers the legislative intervention the cost allocation gap requires, and aligns prosumer economic incentives with the grid stability objectives of the regulator.

VII. THREE QUESTIONS THAT REQUIRE ANSWERS BEFORE THE REGULATION IS FINALIZED

The undersigned restates for the written record the three questions posed during the workshop oral testimony at timestamp 01:04:13.[12]

One. How do the currently proposed frameworks satisfy the proportionality and benefit received principles of Joint Resolution 5-2026 when it assigns upgrade costs to a prosumer who may have contributed only incrementally, or not at all, to the constraint they are being asked to remedy?

[12] Puerto Rico Energy Bureau. (2026, August 28). NEPR-MI-2019-0009 Virtual Stakeholder Workshop 2 [Video]. YouTube. https://youtu.be/Axpq2OQPcOk?t=3854

Two. Consistent with OIPC Comment 24 on Section 4.04(D), what mechanism ensures upgrade costs are not automatically assigned to a subsequent customer without first evaluating the contribution of previously interconnected projects that failed screening but were permitted to interconnect?

Three. What does this framework provide for prosumers on chronically overvoltage feeders where LUMA's own hosting capacity data excludes DER saturation as the cause, who cannot export, cannot self-consume from their own generation, and whose remedy sits entirely within an operational parameter the utility controls today?

VIII. DECLARATION

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

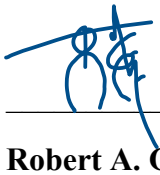
A) No party or attorney in this proceeding assisted in drafting these comments.

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

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 27, 2026.



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EXHIBITS

Exhibit A: Garcia Cooper, R.A., Castro Sitiriche, M., Irizarry Rivera, A., and Andrade Rengifo, F., "True Cost of Electric Service: What Reliability Metrics Alone Fail to Communicate," The Electricity Journal, Vol. 37 (2024), Article 107386, DOI: 10.1016/j.tej.2024.107386.

Exhibit B: Maharjan, M., Ekic, A., Beedle, M., Tan, J., Wu, D., "Evaluating grid strength under uncertain renewable generation," International Journal of Electrical Power and Energy Systems, Vol. 146 (2023), Article 108737, DOI: 10.1016/j.ijepes.2022.108737.

The undersigned respectfully notes that the Huaman-Rivera thesis and peer-reviewed publication are already on file in this docket. The thesis was filed on April 12, 2024 by Kenan D. Davila of Sargent and Lundy and is available at https://energia.pr.gov/wp-content/uploads/sites/7/2024/04/20240412-MI20190009-Tesis-Anny-Huaman-Rivera.pdf. The peer-reviewed publication is Huaman-Rivera, A., Irizarry-Rivera, A., Calloquispe-Huallpa, R., "Increasing photovoltaic hosting capacity in distribution networks in Puerto Rico: Seasonal and technical characteristics analysis and solutions," Energy Reports, Vol. 14 (2025), pp. 867-885, DOI: 10.1016/j.egyr.2025.06.034. These documents are incorporated by reference and are not attached as exhibits given their existing presence in the docket record.

CERTIFICATE OF SERVICE

I hereby certify that on August 27, 2026, a copy of these Comments was filed with the Puerto Rico Energy Bureau under the title Post-Workshop Comments of Robert A. Garcia Cooper on Subjects Discussed During Virtual Stakeholder Workshop 2, Held August 25, 2026, Case No. NEPR-MI-2019-0009, 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