Agustín A. Irizarry Rivera, Ph.D., P.E.
P.O. Box 1016
Hormigueros, Puerto Rico 00660
787-448-2553

5 March 2026

Esq. Lorena I. Vélez-Miranda
Senior Associate Attorney
EarthJustice
48 Wall Street, 15th Floor
New York, NY 10005
Via e-mail: lvelez@earthjustice.org

Re: Report – Case NEPR-AP-2023-0003 Rate review

Attached is my report for the rate review case. Please read the report and communicate if any portion of it needs clarification. You may contact me via phone 787-448-2553 or via email agustinirizarry@gmail.com.

Best regards,

Agustín Irizarry Rivera, PhD, PE

Table of content

I. Summary

Based on data from the Low-Income Energy Affordability Data (LEAD) Tool the percentage of gross household income spent on energy costs in Puerto Rico's households is excessive for every household in Puerto Rico that makes less than 80% of its Area Median Income (AMI). **Energy burden is already excessive without additional rate increases.**

Electric energy burden reduction can be achieved for all income households with AMI below 150% that adopt a solar rooftop photovoltaic system with batteries. A significant electric energy burden reduction can be achieved for very low-income households, 30% or below of area median income, thru the adoption of small solar rooftop photovoltaic systems with batteries. Previous studies show that similar size systems can provide resilience and continuity of energy service after hurricanes.

If a significant permanent increase on the electric energy base rate is approved it will create a strong incentive for customers to permanently disconnect from the electric grid. The price increase will be for unreliable electric power while the declining prices of rooftop solar photovoltaic systems plus batteries offer a reliable power alternative at a reduced price.

A higher energy burden will increase grid defection and this will render the rate proposal unfeasible.

Genera's inefficient operation of the San Juan combined cycle plant during 2025, with an average heat rate of 10,159 BTU/kWh, is costing Puerto Rico's households an additional 1.85 cent per kWh of fuel consumed in that plant.

If the cost of LNG delivered to the San Juan combined cycle plant were $9.40/MMBTU and if its heat rate were as, it was, on average, from March 2023 thru January 2024, 8,334 BTU/kWh the fuel cost of electricity generated at the San Juan combined cycle plant would be 7.834 cents/kWh.

Instead, the average 2025 fuel cost of electricity generated at this plant has been 10.31 cents/kWh. The CC SJ plant generates 20% of the electricity in Puerto Rico. Generation inefficiencies, and excessive fuel cost, increase the electric energy burden.

Percentage-of-income payment plans (PIPP) cap bills at a set proportion of household income, ensuring that customers are not charged more than they can reasonably afford. Several states do offer these programs, including; New Jersey, Ohio, Illinois and Pennsylvania. **The Puerto Rico Energy Bureau should mandate the existence of percentage of income payment programs in Puerto Rico**.

We acknowledge that capital improvements, as well as maintenance, is urgently needed to improve the reliability of electric service from the electric grid. If a significant rate increase will create an unbearable energy burden in low- and moderate-income households and will prompt grid defection, what shall we do? **The best alternative is to reject a permanent basic rate increase and adopt a temporary, and limited, rate increase to be applied only to those that can afford it**.

II. Energy Burden

Based on data from the Low-Income Energy Affordability Data (LEAD) Tool the percentage of gross household income spent on energy costs in Puerto Rico's households is excessive for every household in Puerto Rico that makes less than 80% of its Area Median Income. It is already excessive without additional rate increases.

The Low-Income Energy Affordability Data (LEAD) Tool allow data-driven decisions on energy goals and program planning of state and local authorities by improving their understanding of low-income and moderate-income household energy characteristics.[1]

The LEAD Tool is an online, interactive platform that allows users to explore and compare various national, state, city, or county profiles with estimated, locally specific low-to-moderate income household energy characteristics. The tool allows users to download interactive maps, charts, and data for housing unit counts; average monthly housing electricity, gas, and other fuel expenditures; and average energy burden tabulated by categories such as: demographic data, cost of energy and household income.

LEAD Tool data comes primarily from the U.S. Census Bureau's American Community Survey 2022 Public Use Microdata Samples (Five-Year Average, 2018–2022) and is calibrated to the U.S. Energy Information Administration's electric utility (Survey Form-861) and natural gas utility (Survey Form-176) data from 2022.

The LEAD Tool was developed and maintained by NREL (National Renewable Energy Laboratory, recently re-named National Laboratory of the Rockies) a national laboratory of the US Department of Energy.[2]

Energy burden is defined as the percentage of gross household income spent on energy costs. Based on LEAD Tool data, the US national average energy burden for low-income households is 6.7%. A low-income household is a household that makes less than 80% of the Area Median Income. An energy burden at or above 6% is considered excessive.

According to the LEAD tool data Puerto Rico's households with 0 to 30% of Area Median Income (AMI, in the US the "areas" are counties, in Puerto Rico the areas are municipalities) already have, in 2022, a total energy burden of 45% (= 37% from electricity + 8% from gas). These are 205,262 households. Thus, if we reduce their electricity bill to $0 these households will still have an 8% energy burden from expenditure in gas. Gas refers to propane, for cooking. There are no transportation costs in the energy burden metric.

Table 1. Area Median Income, Total, Electricity and Gas Energy Burden for Households in Puerto Rico.

Area Median Income	Total Energy Burden (% income)	Electricity Energy Burden (% income)	Gas Energy Burden (% income)	Households	Average Household Annual Income ($)
0-30%	**45**	**37**	**8**	205262	$2,714
30-60%	**12**	**10**	**2**	178432	$10,960
60-80%	**9**	**7**	**2**	122887	$16,669
80-100%	**7**	**6**	**1**	104155	$21,858
100-150%	**5**	**4**	**1**	195843	$30,915
150%+	**2**	**2**	**0**	413080	$79,647

[1] https://www.energy.gov/scep/slsc/lead-tool
[2] https://www.nrel.gov/index

Thus, only households with annual income of 100%+ AMI have a total energy burden below 6%. Figure 1 shows energy burden vs Area Median Income group for Puerto Rico under current electricity prices. It also shows the "energy poverty" threshold, the red horizontal line, at 6% of income.

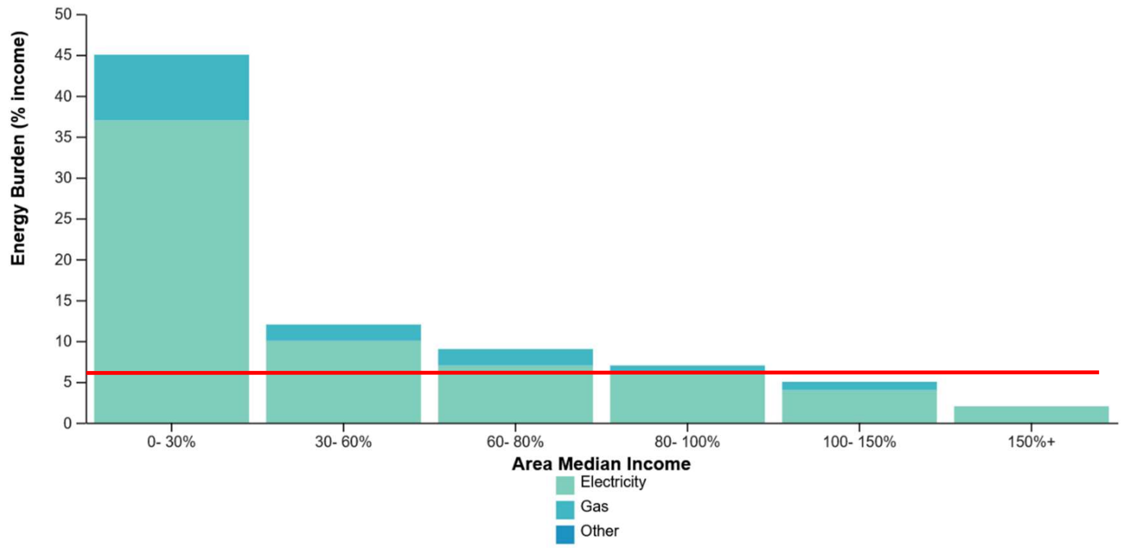

Figure 1. Energy burden vs Area Median Income (AMI) groups for Puerto Rico under current electricity prices. The graph also shows the "energy poverty" threshold, the red horizontal line, at 6% of income.

Figure 2 shows the energy burden, by census track, for Puerto Rico.

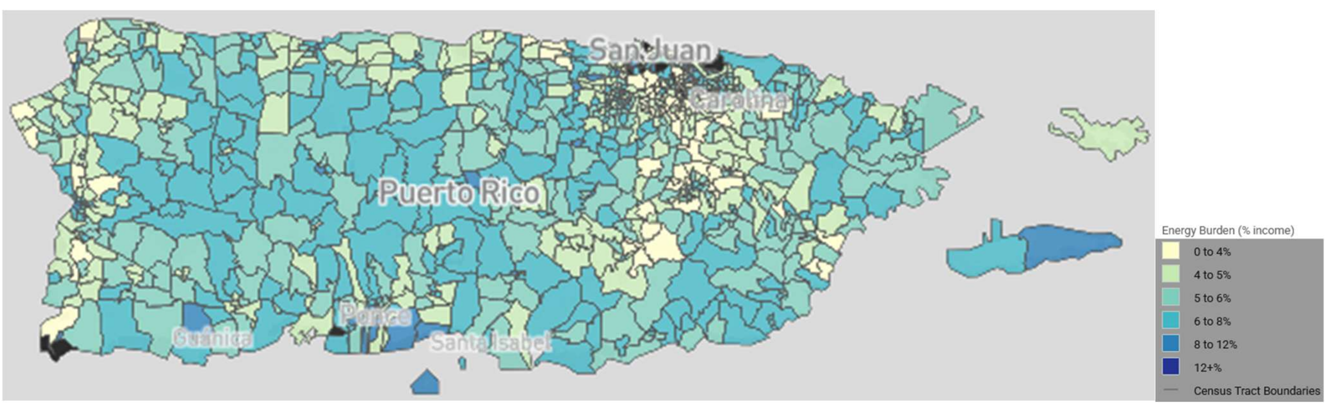

Figure 2. Energy burden, by census track, for Puerto Rico.

Figure 3 shows a comparison between total energy burden, percentage of income, per AMI for Puerto Rico and Hawaii. For very low income. 0-30% AMI, the energy burden in Puerto Rico is three times the energy burden in Hawaii.

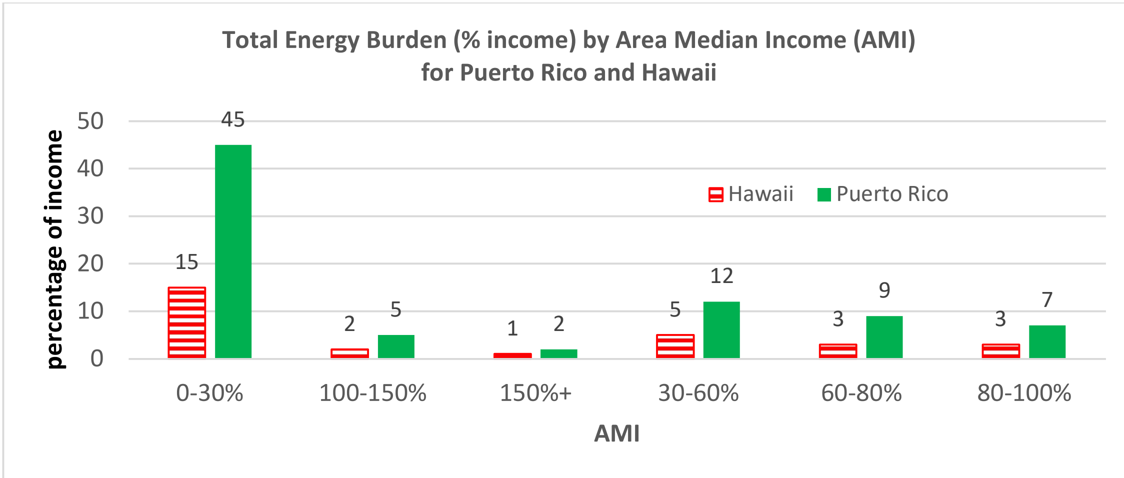

Figure 3. Total energy burden, electricity and gas, per AMI group, for Puerto Rico and Hawaii.

Figure 4 shows a comparison between electric energy burden, percentage of income, per AMI for Puerto Rico and Hawaii. For very low income. 0-30% AMI, the electric energy burden in Puerto Rico is 2.64 times the energy burden in Hawaii. During 2022 the average residential cost of electricity in Hawaii was 40 ¢/kWh.

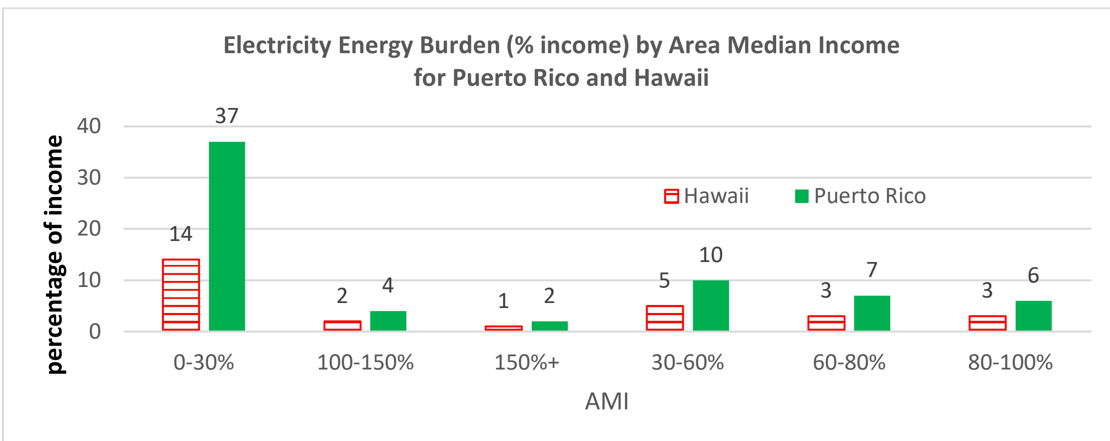

Figure 4. Electric energy burden, per AMI group, for Puerto Rico and Hawaii.

Do the citizens of Puerto Rico have an alternative to electricity from the grid? Yes, close to 200,000 households in Puerto Rico already have a rooftop solar photovoltaic system, most of them with batteries, to supply their energy needs. Is the energy burden of supplying a household electric need with a rooftop solar photovoltaic system higher or lower than the energy burden from the grid? It is lower as shown in the next section.

III. Households that rely solely on rooftop solar plus storage systems, have lower energy burden than households connected to the grid.

Using the 2022 Census data from NREL's LEAD tool and the average cost of electricity for 2022 (high, 29.7 cents/kWh per data from monthly reports to PREPA's Governing Board) we estimated the average kWh demand per area median income (AMI) group as shown in column 2 of Table 3.

We also estimated the capacity of a solar rooftop PV system needed to supply the average demand of a household on each AMI group (column 3 Table 3) and calculated its Levelized Cost of Energy (LCOE) with the current cost of installing solar rooftop PV + batteries (lithium-ion batteries) in Puerto Rico.

The US Department of Energy (NREL) defines the levelized cost of energy (LCOE) as "LCOE is a summary metric that combines the primary technology cost and performance parameters: capital expenditures, operations expenditures, and capacity factor."[3] LCOE can be useful to assess the effect of technology advances in future projections because it accounts for primary cost (e.g., up-front capital costs, financing cost) and key performance parameters (e.g., capacity factor) when comparing different technology innovation scenarios. But LCOE does not capture the full value to the user of reliable electric service, i.e., the electricity worth.

Furthermore, LCOE does not capture the economic value of a particular generation type to the system and therefore may not serve as an appropriate basis for comparisons between technologies. This is so because LCOE ignores attributes that can vary significantly across different technologies (both in terms of capability and cost) such as ramping, startup, and shutdown that could be relevant for more detailed evaluations of generator cost and value to the system.

In this report we use LCOE as an indicator, an index that quantifies the relative cost of electricity when comparing rooftop solar photovoltaic systems with batteries and disconnected from the grid, vs the current cost of electricity from the grid or the estimated cost of electricity under the proposed rate increase.

We calculate LCOE for rooftop solar photovoltaic systems with batteries to supply the average monthly electric demand per AMI group of households in Puerto Rico. Appendix A of this report includes 2024 data of representative rooftop solar photovoltaic systems with batteries.

Table 2 summarizes the parameters used in the calculation of LCOE for all cases. The parameters specific to each case are presented in subsequent tables.

Table 2. Parameters, and values, used in the calculation of the Levelized Cost of Energy

parameter and units	**parameter value**
capacity factor, dimensionless	0.174 (17.4%)
discount rate, dimensionless	0.435 (4.35%)
ideal annual energy yield, kWh	7621.2
annual energy yield reduction, dimensionless	0.05 (5%)
system lifetime, years	25
total annual operation and maintenance (O&M) cost, $	83

We define three scenarios based on the average installed cost of a solar photovoltaic systems with lithium batteries in Puerto Rico in 2024; $3.326/W. We define a low-cost scenario (-15% of average) at $2.827/W installed, intermediate (average) cost at $3.326/W and high cost (+15% of average) at $3.825/W. Table 3 shows the LCOE including the cost of replacing batteries in year 12.

The annual cost of supplying electricity to the households decreases significantly considering the average residential cost of electricity from the grid in 2022 was 29.7 cents/kWh.

[3] *Levelized Cost of Energy,* National Renewable Energy Lab, https://atb.nrel.gov/electricity/2021/definitions.

Table 3. Area Median Income, average energy demand (2022 data) and LCOE for low, intermediate and high-cost (2024 cost data) solar rooftop photovoltaic systems with batteries for Households in Puerto Rico.

Area Median Income	Average monthly electricity demand (kWh)	Solar rooftop photovoltaic system capacity (kW)	Solar PV system energy yield (kWh/month)	Battery bank capacity (kWh)	LCOE (¢/kWh) @$2.827/W	LCOE (¢/kWh) @$3.326/W	LCOE (¢/kWh) @$3.825/W
0-30%	268	3	375	10.24	17.3	19.6	21.9
30-60%	294	3	375	10.24	17.3	19.6	21.9
60-80%	314	3	375	10.24	17.3	19.6	21.9
80-100%	355	4	501	10.24	16.2	18.5	20.8
100-150%	334	4	501	10.24	16.2	18.5	20.8
150%+	568	6	751	20.48	16.3	18.6	20.9

The energy burden per AMI group decreases significantly, as shown in Table 4, when using a solar rooftop photovoltaic system with batteries to supply the electric needs of the household.

Table 4. Area Median Income, average energy demand (2022 data), electric energy burden and LCOE for intermediate cost solar rooftop photovoltaic systems with batteries for Households in Puerto Rico.

Area Median Income	Average monthly electricity demand (kWh)	Solar rooftop photovoltaic system capacity (kW)	Battery bank capacity (kWh)	electricity cost/month PV @$3.326/W	electricity cost/yr PV @$3.326/W	electricity burden from solar PV rooftop system	electricity burden (electricity from the grid, from Table 1)
0-30%	268	3	10.24	$52.58	$631.01	23%	37%
30-60%	294	3	10.24	$57.63	$691.61	6%	10%
60-80%	314	3	10.24	$61.53	$738.35	4%	7%
80-100%	355	4	10.24	$65.58	$787.02	4%	6%
100-150%	334	4	10.24	$61.70	$740.37	2%	4%
150%+	568	6	20.48	$105.63	$1,267.56	2%	2%

Table 5 shows that **the adoption of solar rooftop photovoltaic systems with batteries for households in Puerto Rico reduce the electric energy for all families with AMI below 150%.**

Table 5. Area Median Income, Electric Energy Burden reduction due to adoption of solar rooftop photovoltaic systems with batteries for Households in Puerto Rico.

Area Median Income	Electric Energy Burden from the grid (% income)	Electric Energy Burden from solar rooftop PV (% income)	Electric Energy Burden reduction due to adoption of solar rooftop PV (% income)	Average Household Annual Income ($)
0-30%	**37**	**23**	**14**	$2,714
30-60%	**10**	**6**	**4**	$10,960
60-80%	**7**	**4**	**3**	$16,669
80-100%	**6**	**4**	**2**	$21,858
100-150%	**4**	**2**	**2**	$30,915
150%+	**2**	**2**	**0**	$79,647

A significant electric energy burden reduction can be achieved for very low-income households, 30% or below of area median income, thru the adoption of small solar rooftop photovoltaic systems with batteries. Previous studies show that similar size systems can provide resilience and continuity of energy service after hurricanes.

Are there other alternatives to reduce energy burden? Yes, a reduction in fuel expenditure and heat rate improvements will also reduce the energy burden as discussed in section .

IV. Grid defection is a probable result of increasing the electric energy base rate

On page 7 of 33, Table 2 of his report to the Energy Bureau for these proceedings, economist Ramón J. Cao García estimates that, if a rate increase is approved by the Energy Bureau, the final residential electric energy cost will be 37 ¢/kWh for the "optimal" scenario and 32 ¢/kWh for the "constrained" scenario ("optimal and constrained" scenarios as presented by LUMA, Genera and PREPA). Our estimate is in agreement with Cao Garcia's estimates.

If such significant increase on the electric energy base rate is approved it will create a strong incentive for customers to permanently disconnect from the electric grid. This is called "grid defection". Why? Because the price increase will be for unreliable electric power while the declining prices of rooftop solar photovoltaic systems plus batteries offer a reliable power alternative at a reduced price.

On page 12 of 33 of his report Cao García indicates, in the context of determining elasticity to electric price, that "… electricity market conditions have experience important transformations over past recent years, particularly with regard to substitutes for PREPA's supplied electricity. …". Cao correctly identifies that for residential customers the "substitute" is rooftop solar PV generation plus batteries.

Cao summarizes the risk of massive grid defection as "risk of utility death spiral", a phenomenon where a utility increases the price for its services prompting customers to drop out of the service of the utility and leaving less customers to pay for these services. If the utility, facing reduced revenue, continues to increase the price of services more customers drop out and a "death spiral" occurs.

LUMA, Genera and PREPA are ignoring the risk of massive grid defection by incorrectly assuming that customers do not have a "substitute" for the electric energy from the grid.

V. Necessary fuel expenditure reduction and heat rate improvements to reduce energy burden

We studied the fuel cost and heat rate data reported by LUMA and Genera to the NEPR, specifically the San Juan combined cycle plant operated by Genera and connected to the New Fortress terminal. We compare this data to LNG import export prices reported in the US Natural Gas Import/Export Monthly report[4].

[4] https://www.energy.gov/hgeo/listings/natural-gas-imports-and-exports-monthly-reports

The October 2025 report indicates that the price of LNG export from the US to the Dominican Republic is $7.20/MMBTU[5]. This is the export price, it includes the liquified methane and profit. To this we must add transportation cost and re-gasification.

The October 2025 report indicates the average landing price of LNG in Puerto Rico is $8.79/MMBTU. This includes transportation cost but does not include re-gasification cost.

A reasonable transportation cost to the Caribbean from the US will be around $0.50/MMBTU considering the transportation cost reported from US to Brazil and similar destinations. Regasification (plus port storage) is about $1.70/MMBTU for an estimated total cost of $9.4/MMBTU of LNG delivered to the Dominican Republic from the US.

The average price of LNG from New Fortress to the combined cycle San Juan plant in 2025 was $10.15/MMBTU. We are overpaying New Fortress.

Worse is the heat rate situation at the combined cycle San Juan plant.

Heat rate is a measure of a power plant's thermal efficiency. It is defined as the amount of fuel energy input (in BTU or MJ) required to generate one unit of net electrical output (kWh or MWh). It is calculated as

$$Heat\ Rate = \frac{Heat\ Input}{Power\ Output}$$

A heat rate of say, 8,334 BTU/kWh signifies that the power plant requires an input of 8,334 BTU of fuel to generate 1 kWh. A lower heat rate signifies higher efficiency and lower fuel costs.

The 2025 San Juan combined cycle plant has an average heat rate of 10,159 BTU/kWh. But the average heat rate from March 2023 through January 2024 for the same plant was 8,334 BTU/kWh. Thus, Genera is not investing enough resources to keep this plant operating at an achievable higher efficiency.

For every 985 BTU/kWh above 8,334 BTU/kWh every kWh generated at this plant cost an additional 1 cent/kWh.

Table 6 shows AMI, average monthly electricity demand (based on 2022 data, with an average electricity cost of 29.7 ¢/kWh) and illustrates the electric energy burden increase caused by operating fossil fired generation plants at a higher heat rate. Table 6 shows the percentage electric energy burden produced by an increase of 1 cent per kWh.

[5] Dollars per million BTU, or $/MMBTU, is a common unit for pricing liquefied natural gas, liquefied methane, in the United States. BTU stands for British Thermal Unit. One BTU is the amount of heat required to raise the temperature of one pound of liquid water by one degree Fahrenheit.

Table 6. Area Median Income and average energy demand (2022 data) for Households in Puerto Rico.

Area Median Income	Average monthly electricity demand (kWh)	monthly electricity cost @ 1¢/kWh	annual cost	Electric energy burden change per 1¢/kWh	Average Household Annual Income ($)
0-30%	268	$2.68	$32.19	1.19%	$2,714
30-60%	294	$2.94	$35.29	0.32%	$10,960
60-80%	314	$3.14	$37.67	0.23%	$16,669
80-100%	355	$3.55	$42.54	0.19%	$21,858
100-150%	334	$3.34	$40.02	0.13%	$30,915
150%+	568	$5.68	$68.15	0.09%	$79,647

Genera's inefficient operation of this plant during 2025, with an average heat rate of 10,159 BTU/kWh, is costing Puerto Rico's households an additional 1.85 cents per kWh of fuel cost.

If the cost of LNG delivered to the San Juan combined cycle plant were $9.40/MMBTU and if its heat rate were as, it was, on average, from March 2023 thru January 2024, 8,334 BTU/kWh the fuel cost of electricity generated at the San Juan combined cycle plant would be 7.834 cents/kWh.

Instead, the average 2025 fuel cost of electricity generated at this plant has been 10.31 cents/kWh. The CC SJ plant generates 20% of the electricity in Puerto Rico.

VI. Percentage of income payment plans

The Rocky Mountain Institute (RMI)[6] advocates for percentage of income payment plans (PIPP) for 0 - 60% of state median income households.

"Percentage-of-income payment plans cap bills at a set proportion of household income, ensuring that customers are not charged more than they can reasonably afford and preventing arrears from accumulating. For participating households, this means predictable bills that fit within their monthly budgets, reducing the likelihood of falling behind and facing disconnection." - RMI

Several states do offer these programs. Examples are: New Jersey, Ohio, Illinois and Pennsylvania.

New Jersey's PIPP is the Universal Service Fund[7], a program described as a "fixed credit percentage of income payment plan under which participants are required to pay no more than six percent of their annual income toward electric and gas bills."

Ohio describes eligibility for its PIPP[8] program saying "Ohioans with a household income at or below 175% of the federal poverty guidelines and have utility service from an electric or natural gas company regulated by the Public Utility Commission of Ohio are eligible for the program."

[6] https://rmi.org/how-low-income-customer-programs-lower-energy-costs-for-everyone/

[7] https://www.nj.gov/dca/dhcr/offices/usf.shtml

[8] https://development.ohio.gov/individual/energy-assistance/2-percentage-of-income-payment-plan-plus

Illinois' PIPP is implemented thru its Department of Commerce, Office of Community Assistance,[9] and Pennsylvania[10] does it through the utilities.

We recommend that the Puerto Rico Energy Bureau study these programs and in turn mandate the creation of a similar program in Puerto Rico.

VII. Reject a permanent base rate increase, approve a temporary and limited rate increase

We acknowledge that capital improvements, as well as maintenance, is urgently needed to improve the reliability of electric service from the electric grid. If a significant rate increase will create an unbearable energy burden in low- and moderate-income households and will prompt grid defection, what shall we do? Perhaps the best alternative is to reject a permanent basic rate increase and adopt a temporary, and limited, rate increase to be applied only to those that can afford it.

Why temporary? It shall require a rigorous review before it can be extended. The default condition should be that the rate increase ceases at a specific date and the current rate shall apply after that date.

Limited, how? The funds collected by this temporary and limited rate increase shall be in the custody of the Puerto Rico Energy Bureau and deposited in a restricted use fund. The funds shall be restricted in the sense that LUMA, Genera or PREPA must apply to the Energy Bureau to access these funds. The funds shall only be available to fund essential portions of projects that will not be funded by FEMA, or similar, funds and for emergency repairs.

In the case of emergency repairs LUMA, Genera and PREPA must apply for reimbursement, from FEMA or other sources, if these reimbursement funds are available. Any and all reimbursements must deposit into the restricted fund.

To be applied only to those that can afford it? The temporary, and limited, rate increase should only apply to energy consumed above 550 kWh per month for residential customers. As Table 3 shows this measure should exempt low- and medium income households from the temporary rate increase as their average demand is lower than 550 kWh/month.

---

[9] https://dceo.illinois.gov/content/dam/soi/en/web/dceo/communityservices/utilitybillassistance/documents/pipp-brochure-2019.pdf

[10] https://www.nationalfuel.com/utility/your-account-overview-pa-home/payment-assistance-programs-pa-home/

Appendix A – 2024 cost data of representative rooftop solar PV systems with batteries

Table 1A shows representative real 2024 costs of rooftop solar photovoltaic residential systems, with LiFePO4 batteries, installed in Puerto Rico.

Table 1A. Representative real costs of rooftop solar photovoltaic residential systems, with LiFePO4 batteries, in Puerto Rico (2024)

ID	Total Cost	PV Capacity kW	LiFePO4 Storage kWh	$/W with storage
1	$25,500	8.64	18.5	$2.951
2	$19,995	3.24	13.5	$6.171
3	$21,500	8.1	20.96	$2.654
4	$23,795	7.3	13.5	$3.260
5	$15,899	5.5	10	$2.891
6	$16,999	6.6	10	$2.576
7	$18,999	7.7	14.34	$2.467
8	$19,999	8.8	14.34	$2.273
9	$21,995	4.36	10	$5.045
10	$24,995	8.8	20	$2.840
11	$17,495	4.25	10	$4.116
12	$20,595	5.3	20	$3.886
13	$14,995	3	5	$4.998
14	$17,995	4	10	$4.499
15	$21,995	4.36	10	$5.045
16	$28,995	11	20	$2.636
17	$10,499	3.95	15	$2.658
18	$25,500	8.64	15	$2.951
19	$18,999	7.7	14.34	$2.467
20	$15,899	5.5	10	$2.891
21	$22,500	9.9	20	$2.273
22	$16,999	6.6	10	$2.576
23	$29,995	14	20	$2.143
24	$26,995	9.72	15	$2.777
25	$22,690	5.265	13.5	$4.310
26	$24,690	6.075	13.5	$4.064
27	$24,995	8.8	20	$2.840
28	$14,995	3	5	$4.998
29	$26,995	9.72	15	$2.777
30	$19,900	3.9	14	$5.103
31	$25,995	11	20	$2.363
32	$22,495	11	15	$2.045
33	$16,995	7.7	10	$2.207
average	**$21,178**	**7.1**	**14.1**	**$3.326**
min	$10,499	3.0	5.0	$2.045
max	$29,995	14.0	21.0	$6.171

These costs are real cost of installed systems in Puerto Rico as reported by University of Puerto Rico investigators[11] , it is an update of data used in “The Puerto Rico 100 Study”[12]. In Table 1A:

[11] Data provided by Lionel Orama, PhD, PE, Professor of Electrical Engineering at Universidad de Puerto Rico – Mayagüez (UPRM).
[12] PR 100 Study - https://www.energy.gov/gdo/puerto-rico-grid-resilience-and-transitions-100-renewable-energy-study-pr100

Total cost includes: equipment (solar panels, inverter, charge controllers (if not included within the inverter), batteries), "balance of system" items (mounting racks, nuts and bolts, electrical tubing, wires, electric protection, electrical boxes) design, installation, retrofit (if needed) and profit.

PV capacity refers to the total installed generating capacity of the solar photovoltaic array, in thousands of Watts (kW).

Lithium-ion batteries (specifically LiFePO4) are used in every installation. The storage capacity shown in Table 1A is in kWh.

A "dollar per installed W" ($/W) index is calculated for systems with batteries. The average installed cost of a system with batteries is $3.326/W. Figure 3. summarizes this comparison graphically.

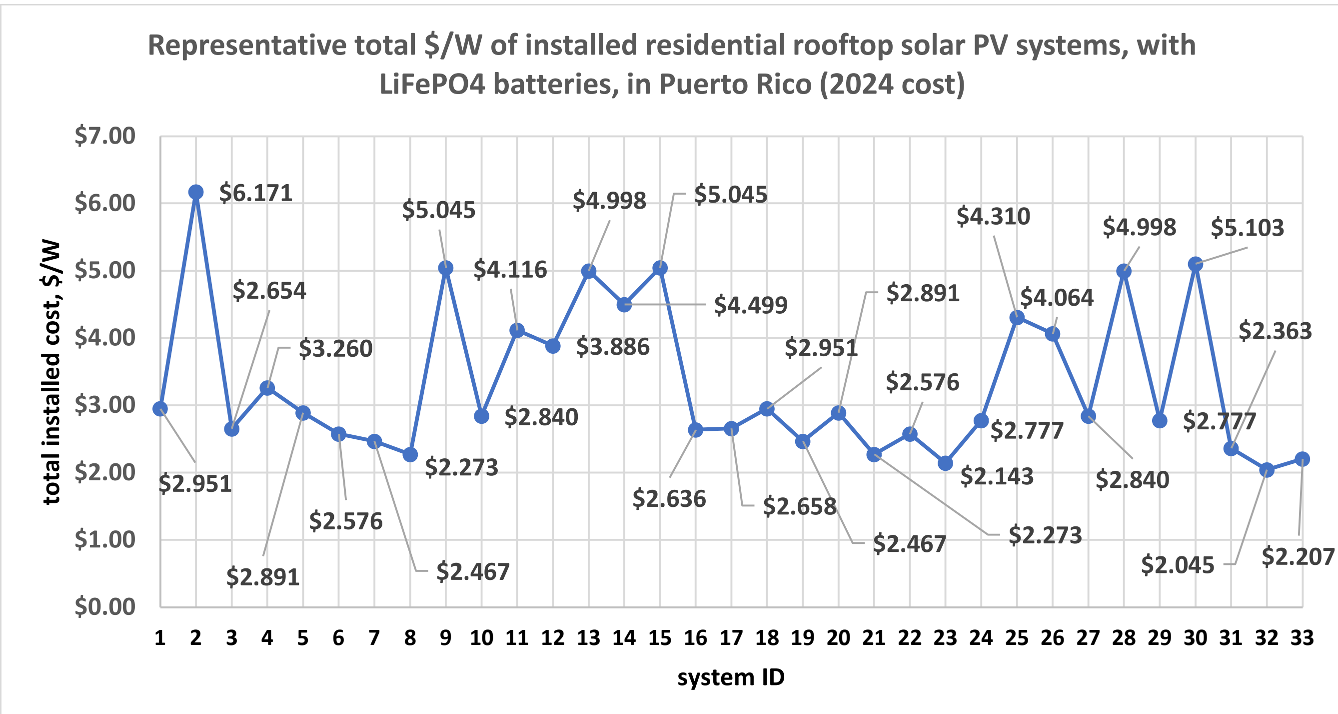

Figure 1A. Representative total $/W of installed residential rooftop solar photovoltaic systems, with LiFePO4 batteries, in Puerto Rico (2024 data).