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

IN RE: Puerto Rico Electric Power Authority Rate Review	**CASE NO.** NEPR-AP-2023-0003 **SUBJECT**: Expert Witness Report

ICSE'S MOTION SUBMITTING EXPERT WITNESS REPORT & PRESENTING THE CONTEXT IN WHICH IT IS FILED

TO THE HONORABLE ENERGY BUREAU:

Comes now the **Institute of Competitiveness and Economic Sustainability ("ICSE" as its Spanish acronym)**, represented by the undersigned, respectfully states and prays:

The present filing has two purposes. First and most important is to file the expert witness report of Dr. Ramón Cao García (the "Cao Report.") Second, is to present ICSE's understanding of the context in which Cao Report filing is done. However, Dr. Cao's report stands on its own.

What does not stand alone is the final rate determination to be approved by this Bureau. Establishing the rate, although a clear legal prerogative of the PREB, cannot ignore economic realities of Puerto Rico, PREPA's bankruptcy proceedings, and FOMB's Fiscal Plan and Plan of Adjustment for PREPA.

The main constraint of any rate adopted by the PREB, we repeat, in the exercise of its clear legal authority, is whether the rate is economically viable and sustainable.

This is not a matter of answering whether particular classes of clients (below certain income levels) can pay or not the new rates and what measures or adjustments can be

made to reduce the rate's impact on such groups. The real issue is to what extent and probability will the rates cause a reduction in energy consumption which could be manifested through clients abandoning the grid seeking cheaper alternatives such as rooftop solar generation[1]. This is already happening (even with 2017-level rates) in such a massive manner that it makes Puerto Rico different from any other US jurisdiction.

It is ICSE's contention that there is a clash between pure theory as exposed by many expert witnesses in this process and the bankruptcy proceeding, the reality of Puerto Rico's energy market, and the naturally occurring movement towards distributed generation.

It is also ICSE's contention that there is a serious lack of Puerto Rico-specific economic analysis. Particularly, there is an absolute absence of elasticity energy demand. This will make it impossible to set a rate which **will produce sufficient revenue** (*i.e.*, its practicability) with ever-growing risks of grid avoidance and reduction in demand.

This issue is separate but certainly related to a larger issue, that is, Puerto Rico's economic capacity to absorb the rate increase with its impact on prices, cascade effect, and the competitiveness of its industries, all of which can bring a further reduction of energy demand. In other words, it must be answered whether Puerto Rico's economy can tolerate the amounts of revenue needed by the system. This is not necessarily something that can be addressed exclusively through rate design.

[1] Take also for example energy efficiency measures which, even though are a part of the energy public policy of Puerto Rico, run afoul PREPA, LUMA and Genera's interest in raising more revenues via having more demand.

A rate should not be approved if it cannot be reasonably concluded that it will be able to produce needed revenues. Affordability considerations are necessary to conclude that a rate is *just and reasonable* and cannot be treated as an isolated matter to be evaluated in a separate proceeding, as LUMA has suggested. In light that it seems the Hearing Examiner has rejected this approach—at least verbally— during the virtual hearing of September 4, 2025, we will refrain from further commenting on this issue. However, we emphasize and caution that if there is a separate proceeding to assess the affordability of the "2026 Final Rate Order," the determination of that proceeding could not amend the new Rate Order. Doing so would contravene article 6.25 of Act 57-2014. LUMA's suggestion, therefore, amounts to counseling regulatory futility.

Lastly, ICSE states that it intends to further reply to Dr. Susan Tierney's testimony given the mischaracterizations of ICSE previous filings and to answer its substance. The testimony simply aims to attack the messenger while not addressing the message, which is Puerto Rico's dire and evident economic state.

WHEREFORE, it is respectfully requested that the PREB take into consideration the foregoing and make the Expert Witness Report of Dr. Ramón Cao García part of the administrative record.

RESPECTFULLY SUBMITTED.

I **CERTIFY** the present document was submitted electronically in the PREB's filing system and copy sent to the Hearing Examiner and the attorneys of record: mvalle@gmlex.net; arivera@gmlex.net; jmartinez@gmlex.net; jgonzalez@gmlex.net; nzayas@gmlex.net; Gerard.Gil@ankura.com; Jorge.SanMiguel@ankura.com;

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[*Signatures in next page*]

In San Juan, Puerto Rico, September 8, 2025.

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SEPTEMBER 8, 2025

A REPORT ON ECONOMIC CONSECUENCES OF July 3, 2025 FILING OF LUMA-GENERA-PREPA

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A REPORT ON ECONOMIC CONSECUENCES OF July, 2025 FILING OF LUMA-GENERA-PREPA

Ramón J. Cao García, Ph.D.
September 8, 2025

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A REPORT ON ECONOMIC CONSECUENCES OF July, 2025 FILING OF LUMA-GENERA-PREPA

Ramón J. Cao García, Ph.D.
September 8, 2025

Introduction

This paper is produced at the request of Instituto de Competitividad y Sostenibilidad Económica (ICSE). Its purpose is to analyze some economic consequences of the request filed by LUMA, Genera and PREPA to revise the fixed electricity tariff rate charged to customers, in order to obtain additional revenues that they argue are required to finance operational and capital expenses they say are needed to operate the Puerto Rico's electric energy system. Their request is presented in the form of two options: (1) revenues required for an "optimal" operation of the system, and (2) revenues required for a "constrained" operation of the system. This paper considers expected economic consequences under both scenarios.

Since what affects economic performance is total tariff charged to customers, the first step in the analysis is to estimate total electricity average tariffs resulting from the request filed by PREPA and its agents. These resulting tariffs are estimated for main customers categories, both for the "optimal" revenue request and the "constrained" one. After that, it is studied the ability of residential customers to pay estimated average electricity bills. The next step is to use data from the Puerto Rico Input-Output matrix to compute expected intermediate production costs by main industrial sectors. The results from that analysis are used to estimate expected consequences on the Consumer Price Index, and the risk of cost-push inflation.

Originally it was intended to estimate the effects of the request filed by PREPA and its agents on real GNP, total employment and the quantity of electricity to be demanded. Time constraints and data availability prevented performing this analysis in an ideal way.

The last topic considered is the effect of the filed request on PREPA's death spiral risk.

The report ends with a summary and concluding remarks section.

Scope and constraints

As previously stated, this paper aims to analyze some economic consequences of the request made by LUMA, Genera and PREPA of revising the fixed electricity tariff rate charged to customers, in order to obtain additional revenues that they argue are required to finance operational and capital expenses they say are required to operate the Puerto Rico's electric energy system. Their request is presented in the form of two options: (1) revenues required for an "optimal" operation of the system, and (2) revenues required for a "constrained"

operation of the system. This paper considers expected economic consequences under both scenarios.

The first step in the analysis is to estimate the change in total electricity rates, in ¢/kWh under both options. These estimates are used to compute their consequences upon the budget of households in Puerto Rico. After that, the island Input/Output matrix is used to compute the effects of the proposed electricity rate increases upon the input costs of production in Puerto Rico by main economic sectors. Expected effects on the general price level is also estimated. Also, a previously estimated GNP forecast equation was evaluated to estimate the effects of the proposed rate increases on economic activity. A previously estimated demand equation for electricity, by main economic sectors is considered to estimate the effects of proposed increased electricity prices on quantity demanded, and a discussion on the risk of death spiral on Puerto Rico Electric Power Authority (PREPA) is presented. This work ends with a section of summary and conclusions.

It is important to make the reader aware of the constraints encountered in performing the analysis required for this paper. The principal constraints faced are:

1. Available time: This work was requested by Instituto de Competitivad y Sostenibilidad Económica (ICSE) on August 25, 2025, and most requested documents from LUMA were finally accessed on September 2, 2025. In consequence, there was no time to compute GNP forecasting and electricity demand equations, in consequence, previously estimated equations were considered.[1] It is recognized that these equations do not take into account important developments that recently happened in Puerto Rico, such as the rapid growth of photovoltaic electric generation (PG) particularly by residential PREPA customers, the increased development of work at distance, particularly after the COVID-19 pandemic, fast adoption of CHP by large enterprises, and the recent increased rise in temperatures due to global heating, among other variables.
2. PREPA's expected revenues and most operation costs are contingent to load forecasts. In her testimony, Ms. Estrada correctly stated: "Load forecast is an essential empirical analysis used to predict consumption, generation, and peak demand. The forecasted consumption forms the basis for determining: (1) revenue based on the current cost of each kWh; (2) revenue required to cover operational and maintenance expenses; and (3) ultimately, the establishment of each rate ($/kWh)."[2] Unfortunately, LUMA's load forecasts are not valid. Appendix 1 to this document shows the large forecasting errors resulting from LUMA's forecast equations, as well as the serious lack of information and methodological pitfalls in these forecasting

[1] Refer to Ramón J. Cao García, *An independent economic evaluation of the definitive restructuring support agreement for outstanding PREPA's debt, of PREPA Fiscal Plan and a modest proposal,* San Juan, PR: Asesoría y Consulta, Inc., August 27. 2019.

[2] Government of Puerto Rico, Puerto Rico Public Service Board. In Re: PUERTO RICO ELECTRIC POWER AUTHORITY RATE REVIEW, CASE NO.**:** NEPR-AP-2023-0003, *Direct Testimony of Joseline N. Estrada-Rivera*, Director, Tariff & Budgets, Load Forecasting and Research, LUMA Energy Serv. Co, LLC, July 2, 2025, p. 18.

models. Given that situation, it was decided that LUMA's load forecasts are not used in this analysis. Instead, load data for FY2025 is used. It is recognized that electricity load shows a downward trend, which results in the use of FY2025 data to somewhat overestimate load, but this expected error is lower that what results from LUMA's load forecasts.

3. The documents examined did not provide a series of historical data on revenues and expenditures; in consequence, it is not possible to *a priori* evaluate the reasonability of the requests under consideration by the Puerto Rico Energy Bureau (PREB). Nevertheless, some particular items appear that require attention:

    a. Justification given for privatizing the administration of electric power generation, transmission, distribution and commercialization was to increase efficiency over previous PREPA administration. Documents examined did not mention how efficient the performance present administrators, neither how they are going to improve efficiency and reduce operational costs over the next three years,

    b. Pension expenses. It is agreed that PREPA retirees have a right to enjoy their earned pension benefits. Having said that, it is noted that, according to LUMA's request, pension expenses appear on three different lines of the spreadsheet, and curious differences happens between the "optimal" and the "constrained" scenarios. Maybe there may be explanations in documents that the time constraint did allow to be examined, but this category of expenses should be revised.

OPTIMAL REVENUE REQUIREMENT FY2026, 2027, 2028

		FY 2026	FY2027	FY2028
	Expenses			
line 32	Pension & Benefits	141,939,687	155,680,399	166,577,335
line 41	Retiree Medical Benefits	7,950,000	8,347,500	8,764,875
line 70	HoldCo ERS Pension Funding Requirement	307,475,422	298,658,581	298,438,608
	Total	457,365,109	462,686,480	473,780,818

CONSTRAINED REVENUE REQUIREMENT FY2026, 2027, 2028

		FY 2026	FY2027	FY2028
	Expenses			
line 32	Pension & Benefits	122,663,209	128,508,151	131,420,288
line 41	Retiree Medical Benefits	7,950,000	8,347,500	-
line 70	HoldCo ERS Pension Funding Requirement	307,475,422	298,658,581	
Total		438,088,631	435,514,231	131,420,288

Source: Government of Puerto Rico, Puerto Rico Public Service Board. In Re: PUERTO RICO ELECTRIC POWER AUTHORITY RATE REVIEW, CASE NO.**:** NEPR-AP-2023-0003, PC-of-LUMA-FIN-2_Attachment 1:2-Excel.

    c. It is known that demand for electricity shows a downward trend in Puerto Rico. Indeed, LUMA load and expected revenues forecasts decline over fiscal

years under consideration. Then, it is to wonder why forecasted expenses in "professional & technical outsources services" increase over the period.

OPTIMAL REVENUE REQUIREMENT FY2026, 2027, 2028

line 48	Professional & Technical Outsourced Services	303,317,828	343,813,093	368,105,711
line 12	Total Revenues from Sales of Electric Energy	3,935,993,527	3,837,785,148	3,771,154,832
	Ratio of expense to revenue	7.7%	9.0%	9.8%

CONSTRAINED REVENUE REQUIREMENT FY2026, 2027, 2028

		FY 2026	**FY2027**	**FY2028**
line 48	Professional & Technical Outsourced Services	240752066.8	277180855	285373517.4
line 12	Total Revenues from Sales of Electric Energy	3,935,993,527	3,837,785,148	3,771,154,832
	Ratio of expense to revenue	6.1%	7.2%	7.6%

d. Vegetation management expenses. LUMA blames many blackouts to vegetation interference with transmission and distribution lines. Vegetation management appears to be critical, but it is an area where LUMA has been far from successful. It usually contracts mainland companies for the task of vegetation control. It is not required any formal training to realize that in most part of the continental USA, with the obvious exception of Hawaii, vegetation characteristics are quite different from those prevalent in Puerto Rico, a tropical island with a sizeable portion of its territory covered by mountains. Many municipal governments had offered themselves to be contracted by LUMA for the task of vegetation management, allegedly at a lower cost than mainland companies. It appears that LUMA has refused to consider that option. It also surprises the low expense requested for this task in FY2026 "constrained" scenario.

OPTIMAL REVENUE REQUIREMENT FY2026, 2027, 2028

line 49	Vegetation Management	125,000,000	131,250,000	137,812,500
line 12	Total Revenues from Sales of Electric Energy	3,935,993,527	3,837,785,148	3,771,154,832
	Ratio of expense to revenue	3.2%	3.4%	3.7%

CONSTRAINED REVENUE REQUIREMENT FY2026, 2027, 2028

		FY 2026	**FY2027**	**FY2028**
line 49	Vegetation Management	70,700,000	125,000,000	131,250,000
line 12	Total Revenues from Sales of Electric Energy	3,935,993,527	3,837,785,148	3,771,154,832
	Ratio of expense to revenue	1.8%	3.3%	3.5%

Effect of the request on total electricity rates

Economic consequences of an increase in electricity tariffs depend upon the total change they face in their electricity bills, i.e., on total rates by categories of consumers. In this paper are only considered the three main customer categories: residential, commercial and industrial. They account for 97.8% of total electricity consumption in FY2025. [See Appendix 2]

In Appendix 3 is computed the required percent increase in electricity tariff rates to obtain proposed required revenues under the "optimal" and "constrained" scenarios.[3] It is estimated that the request to NEPR is to increase electricity tariff rates by 59.5% in the "optimal" scenario, and by 37.7% in the "constrained" scenario.

Next table reports average monthly electricity rates paid by the main categories of customers in FY2025 and computes the average annual electricity tariff rates for each of these categories.

Table 1

Average electricity tariff rates by customers categories ¢kWh

Month	Residential	Commercial	Industrial
06/01/2025	22.86090558	26.51903888	24.22124403
05/01/2025	23.59076904	26.68027691	26.48017428
04/01/2025	21.43987189	24.07227037	23.19800365
03/01/2025	26.22180711	29.05802112	28.92929096
02/01/2025	25.58090994	27.48831674	27.29253365
01/01/2025	27.59516759	30.46999089	30.15878204
12/01/2024	20.74303866	23.13589568	22.54373104
11/01/2024	17.9999991	20.06459251	19.37567975
10/01/2024	20.20233863	22.4438201	21.79959718
09/01/2024	23.12001592	24.813412	26.58911415
08/01/2024	24.95740427	24.13767153	24.58203342
07/01/2024	25.17376328	27.04001539	27.15625621
Mean AF2025	23.29049925	25.49361018	25.19387003

Source: PREPA. Aee-meta-ultimo.Excel [downloaded August 27, 2025]

If the proposed increase in the fixed rate to get the requested additional revenues, under both scenarios, it results in the following total rates by customers categories in ¢kWh:

[3] It should be recalled that "required revenues" asked are based on LUMA's load forecasts. Appendix 1 to this paper raises serious doubts about the precision of these forecasts, as well as to the procedures used to compute them.

Table 2

Resulting tariff rates	Residential	Commercial	Industrial
"Optimal" scenario	37.14489974	40.65853564	40.18049447
"Constrained" scenario	32.06211982	35.09496191	34.68233423

Effect of the request on residential customers ability to pay

The FOMB has stated that, at the maximum, residential electricity customers should not pay more than 6% of their household income. The US Census Bureau[4] estimates that median household income in year 2023 was $25,621.[5] From PREPA published data it can be seen that, in FY2025, it had an average of 1,389,799 customers. If total electricity consumption of residential customers is divided by the total number of customers in that category, an average annual electricity consumption of residential customers is 5,043/6 kWh, and monthly average consumption is 420.3 kWh. Multiplying annual consumption in FY2025 by the corresponding average tariff rate charged that year it is found that, in average, residential customers faced an annual bill of $1,174.68. This is equivalent to 6.3% of median household income in 2023, i.e., even after the proposed increase in electricity tariff rates more than half of residential PREPA customers faced an electricity bill that exceeds the 6% margin that the FOMB consider as a reasonable maximum.[6] When the proposed increase in electricity tariff charges is taken into account it is found that, under the "optimal" request, the electricity bill is going to increase to 10.1% of median household income; while, under the "constrained" request, the electricity bill is going to increase to 8.7% of median household income.

Hence, the proposal has a significant negative effect on equity, making the poor even poorer. Moreover, it also increases the incentives for residential customers, who can afford installing photovoltaic generation, to substitute PREPA's electric energy by trying to generate their own electricity at home. This has relevant expected consequences of long-term PREPA's finances, since it may well accelerate a death spiral for the electric utility. This issue will be considered in more detail later in this paper.

[4] U.S. Census Bureau, *American Community Survey – Puerto Rico 1-Year Estimates* https://data.census.gov/all?q=Puerto+Rico+Income+and+Poverty

[5] It should be noted that household income includes earned income, passive income. Social Security and PAN benefits.

[6] It is recognized that some low-income households receive a subsidy for the electricity expenses, but no adjustment is made to take in account such subsidy, because no adequate data has been made available to compute the distribution of this subsidy among households.

Table 3

Residential customer average expense in electricity as a percentage of annual median household income (2023)	
FY2025	6.3%
"Optimal"	10.1%
"Constrained"	8.7%

Expected economic consequences by industrial sectors

This section of the report informs results of expected economic consequences from electricity rate increases resulting from the request made by LUMA, Genera and PREPA to revise fixed electricity tariff rates, with the purpose of increasing revenues to allegedly finance operational, capital and pension costs. The analysis considers the two scenarios presented to the PREB: the "optimal" and the "constrained" revenue requests. The analysis is focused on eight major industrial sectors:

Agriculture

Mining & Construction

Manufacturing

Wholesale & Retail Trade

Hospitals & Health Serv.

Electricity & Irrigation Serv.

Other Services

Government

To compute effects of rates changes, as presented in the two scenarios under consideration, on the cost of intermediate inputs, the 2013 Input-Output Matrix (I/O Matrix) for Puerto Rico was aggregated into eight sectors. The resulting I/O Matrix is reported on Appendix 4. Electricity rate increases were computed in the vector electricity and irrigation services for all sectors, except PREPA's vector, under the assumption that PREPA does not actually pay for the electricity it consumes. The estimates are made for the two scenarios considered in this report.

Table 4 summarizes estimated consequences of the different scenarios analyzed on the costs of intermediate inputs, by industrial sectors. Some important considerations can be inferred from the results in the table.

Table 4

	Change Intermediate Costs	
	"Optimal"	"Constrained"
Agriculture	0.3%	0.05%
Mining & Construction	0.7%	0.09%
Manufacture	1.2%	0.19%
Wholesale & Retail Trade	3.6%	0.22%
Hospitals & Health Serv	0.7%	0.04%
Electricity & Irrigation Services	0%	0%
Other Services	1.0%	0.06%
Government	2.4%	0.15%

In the first place, it can be seen that, in all scenarios, the most affected sectors by increases in electricity rates are:

1. Wholesale and retail trade
2. Government
3. Manufacturing
4. Mining and construction
5. Other services

It should be noted that these sectors are particularly critical for its consequences upon the local economy.

1. Increases in the operating costs in the commerce sector are usually translated to customers, reducing the purchasing power of the general population, and increasing incentives for emigration.
2. In the case of government, it should be remembered that the Government of Puerto Rico still faces a fiscal crisis and is under the control of the FOMB, which imposes serious restrictions on its spending capacity. An increase in operation costs is going to aggravate its present fiscal crisis.
3. Manufacturing is critical for local economic performance. The Puerto Rican economy is predicated on exporting manufactured goods, and increases in operation costs reduce its (already diminished) capacity to compete in world markets. It should be remembered that employment in manufacturing has been declining for more than a decade.

4. Construction has increased its activity in past recent years, because of federal transfers directed to reconstruction and mitigation of physical damages caused by recent past hurricanes and earthquakes. Increased demand resulted in cost increases, that has been augmented by the new import tariff imposed by the federal government. Resulting price reduces fiscal government and private sector ability to finance needed construction investments. Expected increases in construction input costs are going to promote further adverse effects over the real estate sector of the economy, with the aggravation that electricity rates increase also adversely affects everyday home maintenance and use. It should also be recalled that Puerto Rico faces a serious deficit of residential facilities, and intermediate cost increases worsen the deficit.

Identified increases in inputs costs reduces the ability for local firms to compete, both in the export markets, as well as with imports. This could result in a negative effect on the economy's ability to generate income and employment, that should be carefully considered before making any decision on electricity rate increases, particularly when they are so significative in most of the scenarios considered in this report.

Effects on general price level

Increases in intermediate costs for all industrial sectors in the economy have a direct effect on general price level, or Consumer Price Index (CPI). It also has a potential to promote a cost push inflation over the local economy. Disruptive effects of inflation on economy and society are well-known. Inflation distorts resource allocation in production, creates adverse incentives to investment and savings, tends to increase inequality in income distribution, (making particularly worse-off the persons with fixed income, such as retirees,) and promotes instability in the labor market (promoting labor strikes and unrest) as well as in society.

This section of the report studies the consequences of possible electricity rates increases on the general price level faced by consumers (CPI). For this analysis, it is used the expenditure weights computed by the Puerto Rico Department of Labor and Human Resources to estimate the Consumer Price Index (CPI).[7] Table 5 reports expected increases in CPI for each of the two rate increase scenarios under consideration.

[7] These weights refer to consumers expenses by consumptions categories in year 2006, the latest available information. The weights were computed by the Puerto Rico Department of Labor and Human Resources, with the assistance of the US Bureau of Labor Statistics. Appendix 5 reproduces the values of the weights used in this report.

Table 5
Effects of the request on CPI

	CPI 2024	CPI under "optimal" scenario	CPI under "constrained" scenario
	135.1	139.2	137.5
Percent change in price level		3.0%	1.8%

Source: Appendices 4, 5 and author computations.

It is estimated that the CPI is going to rise by 3.0% under the "optimal" request scenario, and 1.8% under the "constrained" request scenario. The average rate of inflation in Puerto Rico from FY2015 TO FY2024 was 1.5%.[8] In consequence, granting the "constrained" more than doubles the local average rate of inflation, while the "optimal" request triple it. It is also relevant to recall that any local decision increasing prices comes at an improper time, because recent increases in federal import tariffs is going to have very serious consequences on local prices, since being Puerto Rico an island, it imports almost all of the merchandise that is locally consumed.

GNP and employment

Electricity is a required input for production of goods and services. Any increase in its price is going to have adverse effects on the level of economic activity, and, if production declines, total employment is also reduced. This is an important consequence to be considered. Time constraints do not allow for developing a forecasting model of GNP that includes the effects of electricity tariff rates. It was tried to use a previous forecasting model on this matter,[9] but resulting forecasting errors were statistically unacceptable. The forecasting model available was developed in year 2019. Important economic conditions have changed from that date. Since FY2007 the Puerto Rican economy has been facing a structural contraction, showing negative rates of growth every year. Such situation changed from FY2019, when the local economy began to exhibit annual low rates of growth, not because the structural contraction of the economy was solved, but because of an extensive availability of federal transfers for projects related reconstruction and mitigation of damages caused by hurricanes and earthquakes suffered by the island since September 2017. Also, federal policies directed to alleviate the population and the economy of adverse effects from COVID-19 pandemic resulted in a sizeable injection of federal funds to the island. That phenomena were not included in the GNP forecasting equation developed in 2019.

[8] Government of Puerto Rico, PR Planning Board, *Tables of the statistical appendix to the economic report to the Governor and the Legislative Assembly 2024*. San Juan: Puerto Rico. March 2025. Table 1.

[9] Ramón J. Cao García [2019], *An independent economic evaluation of the definitive restructuring support agreement for outstanding PREPA's debt, of PREPA Fiscal Plan and a modest proposal,* San Juan, PR: Asesoría y Consulta, Inc., August 27. 2019.

Another relevant factor is the rapid growth of PG particularly (but not exclusively) by residential PREPA customers, the increased development of work at distance, particularly after the COVID-19 pandemic, fast adoption of CHP by large enterprises. These developments partially isolate consumers and enterprises from changes in electricity tariff rates, reducing their response levels to these changes. Any GNP forecasting equation must take into account this development. Since it mostly happened after 2019, the available equation did not take factor into account.

The previous discussion allows us to understand why the available GNP is not able to produce estimates with adequate precision and cannot be responsibly used. And, since the effects of electricity tariff rates on GNP, at constant prices, cannot be forecasted, neither can be estimated expected effects on unemployment.[10]

Demand for electricity

A demand equation is essential to estimate how much is going to be the quantity demanded or consumed of a good or service when there are changes in the price of the merchandise, the income of the consumer, or the price of substitute or complementary goods or services. Knowing the demand function for a good or service is quite relevant to forecast or predict what is going to happen with sales revenues when there is a change in the price of merchandise. Unfortunately, LUMA documents revised on load forecast do not include any information about estimated demand functions of electricity by customer categories. If does not know the relevant demand equations for relevant consumer groups, it cannot know what it is going to happen to expected quantities of electricity to be consumed if requested ("optimal" or "constrained") increases in fixed tariff rate is granted. In consequence, LUMA's load and requested additional revenues forecasts are not reliable or valid.

In the past, I estimated electricity demand function for residential, commercial and industrial customers of PREPA.[11] These estimations were made in year 2019. An evaluation of these equations show that they result in unreliable estimates of point price elasticities of demand, i.e., they are not valid at present market conditions. As previously established in this paper, electricity market conditions have experienced important transformations over past recent years, particularly with regard to substitutes for PREPA's supplied electricity, including customers' investments in PG and CHP technologies.

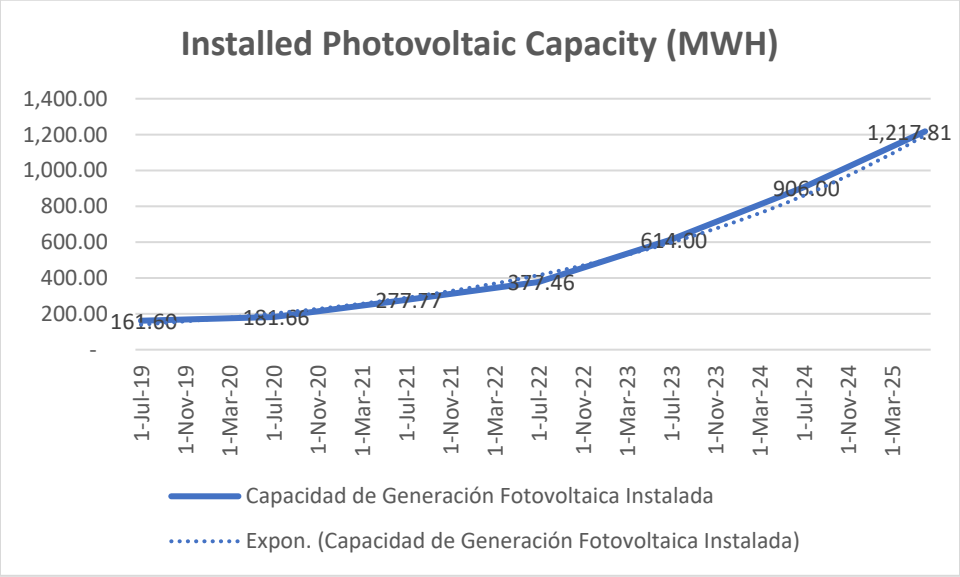
[10] Expected total employment after any economic policy or change condition is estimated by applying expected real GNP to long-term Labor-Output ratio (L/O). Since it was it was not possible to forecast real GNP under the two request scenarios, it is also not possible to estimate their expected effects on total employment.

[11] Ramón J. Cao García [2019], *An independent economic evaluation of the definitive restructuring support agreement for outstanding PREPA's debt, of PREPA Fiscal Plan and a modest proposal,* San Juan, PR: Asesoría y Consulta, Inc., August 27. 2019.

Risk of utility death spiral

Death spiral risk of an electric power utility happens when it increases the price charged to its customers and some of them drop out from the service of the utility. A reduced number of customers and diminished levels of consumption by remaining customers, given the large fixed costs characteristic of electric power utilities, induces the utility to further raise price, fueling a spiral of increasing price, reduced quantity demanded, rising prices again and so on, until the utility goes bankrupt.

The risk of utility death spiral for PREPA should not be discharged. For one, for almost a decade PREPA has been operating under bankruptcy rules, although it went broke for reasons different to utility death spiral. Nevertheless, quantity demanded of electricity show a long-term decline while customers, in all main categories, increase investment in substitute electric energy sources, particularly in PV and CHP technologies. Figure 1 shows PREPA's statistical data on installed Photovoltaic Capacity (PV) in MWh. It shows that, without any increase in fixed tariff rate, it has an exponential rate of growth from June 2019 to July 2025.[12] No doubt that any increase in tariff rates is going to stimulate customers investments in PV, increasing the risk of utility power spiral. This is an important consideration in evaluating the request for additional revenues issued by LUMA, Genera and PREPA.



Source: PREPA. Aee-meta-ultimo.Excel [downloaded August 27, 2025]

Figure 1

[12] Over the period considered, the average annual growth rate of installed photovoltaic capacity is a huge 40.2%

Summary and concluding remarks

Summary

This paper is produced at the request of ICSE. Its purpose is to analyze some economic consequences of the request filed by LUMA, Genera and PREPA to revise the fixed electricity tariff rate charged to customers, in order to obtain additional revenues that they argue are required to finance operational and capital expenses they say are needed to operate the Puerto Rico's electric energy system. Their request is presented in the form of two options: (1) revenues required for an "optimal" operation of the system, and (2) revenues required for a "constrained" operation of the system. This paper considers expected economic consequences under both scenarios.

Since what affects economic performance is total tariff charged to customers, the first step in the analysis is to estimate total electricity average tariffs resulting from the request filed by PREPA and its agents. These resulting tariffs are estimated for main customers categories, both for the "optimal" revenue request and the "constrained" one. Computed tariff rates by main customers categories, under both scenarios included in the filing, are as follows:

Resulting tariff rates	Residential	Commercial	Industrial
"Optimal" scenario	37.14489974	40.65853564	40.18049447
"Constrained" scenario	32.06211982	35.09496191	34.68233423

After that, it is studied the ability of residential customers to pay estimated average electricity bills. The FOMB has stated that, at the maximum, residential electricity customers should not pay more than 6% of their household income. It was found that in FY2025 average yearly expenses of residential customers of electricity was 6.3% of median household income in 2023, i.e., even after the proposed increase in electricity tariff rates more than half of residential PREPA customers faced an electricity bill that exceeds the 6% margin that the FOMB consider as a reasonable maximum.[13] When the proposed increase in electricity tariff charges is taken into account it is found that, under the "optimal" request, the electricity bill is going to increase to 10.1% of median household income; while, under the "constrained" request, the electricity bill is going to increase to 8.7% of median household income. Hence, the proposal has a significate negative effect on equity, making the poor even poorer. Moreover, it also increases the incentives for residential customers, who can afford installing photovoltaic generation (PV), to substitute PREPA's electric energy by trying to generate their own electricity at home. This has relevant expected consequences of long-term PREPA's finances, since it may well accelerate a death spiral for the electric utility.

[13] It is recognized that some low-income households receive a subsidy for the electricity expenses, but no adjustment is made to take in account such subsidy, because no adequate data has been made available to compute the distribution of this subsidy among households.

The next step used data from the Puerto Rico Input-Output matrix to compute expected intermediate production costs by main industrial sectors. Obtained results are summarized below.

	Change Intermediate Costs	
	"Optimal"	"Constrained"
Agriculture	0.3%	0.05%
Mining & Construction	0.7%	0.09%
Manufacture	1.2%	0.19%
Wholesale & Retail Trade	3.6%	0.22%
Hospitals & Health Serv	0.7%	0.04%
Electricity & Irrigation Services	0%	0%
Other Services	1.0%	0.06%
Government	2.4%	0.15%

It can be seen that, in all scenarios, the most affected sectors by increases in electricity rates are:

1. Wholesale and retail trade
2. Government
3. Manufacturing
4. Mining and construction
5. Other services

It should be noted that these sectors are particularly critical for its consequences upon the local economy.

1. Increases in the operating costs in the commerce sector are usually translated to customers, reducing the purchasing power of the general population, and increasing incentives for emigration.
2. In the case of government an increase in operation costs is going to aggravate its present fiscal crisis.
3. Manufacturing is critical for local economic performance. Manufacturing is the leading sector of the local economy which is critically based on exporting manufactured goods. Increases in operation costs reduces its (already diminished) capacity to compete in world markets.
4. Construction has increased its activity in past recent years, because of federal transfers directed to reconstruction and mitigation of physical damages caused by recent past hurricanes and earthquakes. Increased demand resulted in cost increases, that has been augmented by the new import tariff imposed by the federal

government. Resulting price reduces fiscal government and private sector ability to finance needed construction investments. Expected increases in construction input costs are going to promote further adverse effects over the real estate sector of the economy, with the aggravation that electricity rates increase also adversely affects everyday home maintenance and use It should also be recalled that Puerto Rico faces a serious deficit of residential facilities, and intermediate cost increases worsen the deficit.

Identified increases in inputs costs reduces the ability for local firms to compete, both in the export markets, as well as with imports. This could result in a negative effect on the economy's ability to generate income and employment, that should be carefully considered before making any decision on electricity rates increase.

The results from the previously summarized analysis are used to estimate expected consequences on the Consumer Price Index, and the risk of cost-push inflation.

Originally it was intended to estimate the effects on real GNP, total employment and the quantity of electricity to be demanded expected to happen due to the request filed by PREPA and its agents. Time constraints and data availability prevented the performance of this analysis.

The last topic considered is the effect of the filed request on PREPA's death spiral risk. It is noted that the quantity demanded of electricity show a long-term decline; while customers, in all main categories, increasingly invest in substitute electric energy sources, particularly in PV and CHP technologies. Figure 1 showed PREPA's statistical data on installed Photovoltaic Capacity (PV) in mWh. It shows that, without any increase in fixed tariff rate, it has an exponential rate of growth from June 2019 to July 2025.[14] No doubt that any increase in tariff rates is going to stimulate customers' investments in PV, increasing the risk of utility power spiral. This is an important consideration in evaluating the request for additional revenues issued by LUMA, Genera and PREPA.

Concluding remarks

- LUMA's load forecasts are extremely deficient. The design of its forecasting equations raises relevant questions and forecasting errors show an extremely large range, making them unreliable. If load forecasts are deficient, so are revenue and most expenditures presented in the filing. I consider that this invalidates the request filed.
- Some of the forecasted expenditures in the file raise doubts about their reasonableness. [Refer to pages 4 and 5 in this report.]
- Demand equations for three main consumer groups (residential, commercial and industrial) should be designed and properly estimated. This is the reasonable way to estimate electricity consumption when its price change.

[14] Over the period considered, the average annual growth rate of installed photovoltaic capacity is a huge 40.2%

- It has been reported in the newspapers that FOMB approved a $683 million reserve in the PR Treasury Department to finance expenses to be incurred by PREPA in the payment of pensions and its bond debt.[15] This fact should be included in the pension expenses estimated in the request filed.
- Any modification of electricity tariffs should seriously consider the risk of utility death spiral.

[15] Manuel Guillama Capella, "No saben nada de una reserva millonaria". *El Nuevo Día*, March 7, 2025, p. 8.

Appendix 1: An evaluation of the precision of LUMA's load forecasts

Tables 2 to 7 are reproduced from the testimony of Ms. Joseline Estrada Rivera.[16] They compare LUMA's load forecasts with actual load values, over various years. On the basis of the information provided by LUMA, it can be seen that load forecasting errors,[17] has a range that goes from -12.2% to 18.7%. Such error margin it is usually not acceptable in forecasting, resulting in making LUMA's forecasts unusable to estimate revenues and expenditures associated to electricity load.

Table 2. Load Forecast[18]

Customer Class	Jul - Feb 2025	Jul - Feb 2024	Variance (2025 vs 2024)	Forecast (March 2024/FP)	Variance (Actual vs Forecast)
Residential	4,805.6	4,845.9	-0.8%	4,289.0	12.0%
Commercial	5,245.7	5,324.5	-1.5%	5,145.0	2.0%
Industrial	1,004.8	1,117.3	-10.1%	1,134.4	-11.4%
Smaller Classes	247.9	247.8	0.0%	218.6	13.4%
Total	**11,304.1**	**11,535.5**	**-2.0%**	**10,786.9**	**4.8%**

Table 3. Comparisons of Actual Consumption FY2024 to FY2023[19]

Customer Class	FY 2024	FY 2023	Variance (2024 vs 2023)	Forecast (March 2023/FP)	Variance (Actual vs Forecast)
Residential	7,321.3	6,315.9	15.9%	6,166.8	18.7%
Commercial	8,022.9	7,204.7	11.4%	7,124.2	12.6%
Industrial	1,641.0	1,680.2	-2.3%	1,864.0	-12.0%
Smaller Classes	373.4	343.8	8.6%	310.7	20.2%
Total	**17,358.5**	**15,544.6**	**11.7%**	**15,465.7**	**12.2%**

[16] Government of Puerto Rico, Puerto Rico Public Service Board. In Re: PUERTO RICO ELECTRIC POWER AUTHORITY RATE REVIEW, CASE NO.: NEPR-AP-2023-0003, *Direct Testimony of Joseline N. Estrada-Rivera*, Director, Tariff & Budgets, Load Forecasting and Research, LUMA Energy Serv. Co, LLC, July 2, 2025.

[17] In the tables and in the testimony, forecasting errors are called "variance". Variance is a well-known statistical concept that refers to the arithmetic mean of the deviations of observed values in a data set from its mean, while forecasting error is the difference between an actual observation and its forecasted value; i.e., they are two different statistical concepts.

[18] *Ibid.,* p. 17.

[19] *Ibid.,* p. 19.

Table 4. Comparison of Up to February 2025 Actual Consumption versus Forecast[20]

Customer Class	Jul - Feb 2025	Jul - Feb 2024	Variance (2025 vs 2024)	Forecast (March 2024/FP)	Variance (Actual vs Forecast)
Residential	4,805.6	4,845.9	-0.8%	4,289.0	12.0%
Commercial	5,245.7	5,324.5	-1.5%	5,145.0	2.0%
Industrial	1,004.8	1,117.3	-10.1%	1,134.4	-11.4%
Smaller Classes	247.9	247.8	0.0%	218.6	13.4%
Total	**11,304.1**	**11,535.5**	**-2.0%**	**10,786.9**	**4.8%**

Table 5. Comparison of FY2025 Estimate versus FY2024 Actual and Forecast[21]

Customer Class	FY 2025 Estimated	FY 2024	Variance (2025 vs 2024)	Forecast (March 2024/FP)	Variance (Actual vs Forecast)
Residential	7,092.8	7,321.3	-3.1%	6,371.4	11.3%
Commercial	7,887.4	8,022.9	-1.7%	7,762.0	1.6%
Industrial	1,510.8	1,641.0	-7.9%	1,720.0	-12.2%
Smaller Classes	373.5	373.4	0.0%	326.1	14.6%
Total	**16,864.5**	**17,358.5**	**-2.8%**	**16,179.5**	**4.2%**

Table 6. Load Forecast for FY2026, FY2027 and FY2028[22]

Customer Class	FY 2017 *	FY 2026	FY 2027	FY 2028	Variance FY 2026/FY 2017	Variance FY 2027/FY 2017	Variance FY 2028/FY 2017
Residential	6,242.8	6,581.3	6,199.6	5,869.5	5.4%	-0.7%	-6.0%
Commercial	8,322.2	7,634.4	7,629.2	7,660.4	-8.3%	-8.3%	-8.0%
Industrial	2,333.1	1,459.2	1,367.3	1,330.8	-37.5%	-41.4%	-43.0%
Public Lighting	308.7	286.0	268.6	275.8	-7.3%	-13.0%	-10.7%
Agriculture	26.1	23.1	23.1	23.2	-11.5%	-11.5%	-11.3%
Other Authorities	35.4	38.3	38.3	38.4	8.2%	8.2%	8.5%
Total	**17,268.3**	**16,022.3**	**15,526.2**	**15,198.0**	**-7.2%**	**-10.1%**	**-12.0%**

* Forecast Rate Case

[20] *Ibid.,* p. 19.

[21] *Ibid.,* p. 20.

[22] *Ibid.,* p. 21.

Table 7. 2026 Forecasted Consumption versus FY2017-FY2024 Consumption[23]

Consumption (GWh)

Customer Class	FY 2026	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025 Estimated
Residential	6,581.3	6,392.3	4,764.4	6,074.5	6,457.0	6,926.3	6,875.1	6,315.9	7,321.3	7,092.8
Commercial	7,634.4	8,036.7	6,427.6	7,535.4	7,209.1	7,184.1	7,209.5	7,204.7	8,022.9	7,887.4
Industrial	1,459.2	2,187.5	1,745.7	2,069.9	1,957.9	1,881.9	1,868.9	1,680.2	1,641.0	1,510.8
Smaller Classes	347.4	379.3	363.9	370.1	380.0	338.8	328.3	344.3	373.4	373.5
Total	**16,022.3**	**16,995.8**	**13,301.6**	**16,049.8**	**16,004.0**	**16,331.2**	**16,281.9**	**15,545.1**	**17,358.5**	**16,864.5**

Variance

Customer Class	2026/2017	2026/2018	2026/2019	2026/2020	2026/2021	2026/2022	2026/2023	2026/2024	2026/2025e
Residential	3.0%	38.1%	8.3%	1.9%	-5.0%	-4.3%	4.2%	-10.1%	-7.2%
Commercial	-5.0%	18.8%	1.3%	5.9%	6.3%	5.9%	6.0%	-4.8%	-3.2%
Industrial	-33.3%	-16.4%	-29.5%	-25.5%	-22.5%	-21.9%	-13.2%	-11.1%	-3.4%
Smaller Classes	-8.4%	-4.5%	-6.1%	-8.6%	2.5%	5.8%	0.9%	-6.9%	-7.0%
Total	**-5.7%**	**20.5%**	**-0.2%**	**0.1%**	**-1.9%**	**-1.6%**	**3.1%**	**-7.7%**	**-5.0%**

The reason for the large forecasting errors in LUMA's exercises could better understood when the load forecasting models used are examined. They are described in Exhibit 4.01 of the testimony of Ms. Joseline N. Estrada-Rivera. The first thing to be noticed is that the load forecasting equations ignore the basic fact that the amount that anyone consumes of electricity (or of anything) is what they want and can afford, i.e., income of the entity and the price of the good or service are relevant variable in the determination of the amount of the merchandise consumed. The load forecasting equation for residential customers does not include electricity price and disposable personal income among the independent variables. The equation for commercial customers includes GNP, while it should use Net Income generated in the commercial and services sector, and does not include electricity price. Finally, the equation for industrial customers includes GNP, but does not include electricity price. Moreover, since a very large proportion of manufacturing in Puerto Rico is produced to be exported to the USA, any equation to forecast industrial electricity use must include a variable that indicates the demand for Puerto Rico's merchandises in the USA.
It should also be noted that all three load forecasting equations include a myriad of binary or dummy variables. The use of dummy variables is an acceptable and useful practice in econometrics, but it involves the risk of dummy variables trap, i.e., that an excessive use of dummy variables could result in multicollinearity, which results in the violation of the regression assumptions and, consequently, estimation error. When more than two or three dummies are used in an equation, it is necessary to test for the independence of the independent variables. Ms. Estrada testimony does not mention that the required test was performed and its result.

It is also noted that LUMA's forecasting equations:

1. Do not include intercepts. This is not usual in forecasting models.
2. Do not provide the estimated values for regression coefficients, not their standard deviations.
3. Do not provide the standard goodness of fit statistics.

[23] *Ibid.,* p. 22.

Given the inadequate nature of the specification of the load forecast equations, it is not surprising the large load forecasting errors incurred by LUMA.

LUMA Ex. 4.01

Load Forecasting Models

Model Specifications:

Residential Model:

$$y_t = \sum_{m=1}^{M=12} \beta_{1,m} month_{m,t} + \beta_2 CDD_t + \beta_3 Pop_t + \beta_4 COVIDwin_t + \sum_{m=6}^{M=9} \beta_{5,m} month_{m,t} \cdot post2019_t \cdot CDD500_t + \beta_6 month_{m\in(5,10),t} \cdot post2019_t \cdot CDD500_t + \varepsilon_t$$

y_t	=	Class-level billed consumption (GWh) of Residential customers in month of sample *t*.
$month_{m,t}$	=	A set of twelve binary variables capturing monthly seasonality. This variable is equal to 1 when month of sample t is the *m*-th month of the calendar year and zero otherwise. For example, variable $month_{1,t}$ is equal to one when month of sample t is January, and zero otherwise.
CDD_t	=	Monthly cooling degree days (based 65 degrees Fahrenheit) observed in month of sample *t*. These are drawn from the National Weather Service as a monthly series for the San Juan Area.
Pop_t	=	Estimated total population by month, derived from annual values obtained by LUMA from the U.S. Census.
$COVIDwin_t$	=	A binary variable capturing the impact of COVID on consumption in the winter after the emergence of COVID to account for forecast over-prediction during the winter months. This variable is equal to one in the period beginning November of calendar year 2020 running through to the end of April of calendar year 2021, and zero otherwise.
$post2019_t$	=	A binary variable capturing the step-change in Residential consumption starting in calendar year 2020. This variable is equal to one in calendar years 2020 and later, and zero otherwise. This variable is always multiplied by $CDD500_t$ and a monthly binary variable in the equation above. It controls for the observation by Guidehouse and the LUMA LFR team that after 2019, Residential

customers appear to be more sensitive to higher temperatures. In combination with the monthly binary and $CDD500_t$ it acts as a spline. When the monthly CDD is higher than 500 in the month identified by the monthly binary, then there is an incremental increase in consumption.

$CDD500_t$ = The number of monthly cooling degree days observed in month of sample *t* higher than 500. This variable takes a zero in months with cooling degree days under 500. These are drawn from the National Weather Service as a monthly series for the San Juan Area. This variable captures the observation that the relationship between consumption and CDD changes at higher values of CDD, and that (for example) an increase of one CDD from 450 to 451 will result in a smaller consumption increase than an increase of one CDD from 550 to 551.

$month_{m\in(5,10),t}$ = A binary variable to account for differences in consumption in May or October after the start of COVID. This variable is equal to one if a month of sample *t* is either the fifth or the 10th month of the calendar year (May or October), and zero otherwise. That is, the parameter associated with the group of variables that begins with this one captures the post-2019 temperature-sensitive "bump" to residential consumption for the months of May and October. The model assumes that this relationship is the same for both May and October.

$\beta_{1,m}, \beta_2, \beta_3, \beta_4, \beta_{5,m}, \beta_6$ = Regression-estimated parameters (coefficients).

Commercial Model:

$$y_t = \sum_{m=1}^{M=12} \beta_{m,1} month_{m,t} + \sum_{m=1}^{M=12} \beta_{m,2} month_{m,t} \cdot CDD_t + \beta_3 CDD_t + \beta_4 GNP_t + \beta_5 COVIDCOMtrans_t + \varepsilon_t$$

Where:

GNP_t = A 12-month moving sum of the gross national product. This monthly series is derived from an annual series provided by the Junta de Planificación de Puerto Rico, supplemented (as necessary) by the FOMB.[24]

[24] The annual series is converted to monthly by dividing year-over-year (fiscal years) change in GNP by 12 and apply this increment in each month of the year.

$COVIDCOMtrans_t$ = A variable equal to one in March, April, and May of calendar year 2020, and zero otherwise.

Industrial Model:

$$y_t = \sum_{m=1}^{M=12} \beta_m month_{m,t} + \beta_2 GNP_t + \beta_3 indBinary_t + \varepsilon_t$$

Where:

y_t = Industrial consumption in month of sample *t*.

$month_{m,t}$ = Twelve binary variables, equal to one when month of sample *t* is the *m*-th month of the calendar year, and zero otherwise.

GNP_t = Gross National Product in month of sample *t*.

$indBinary_t$ = A variable equal to one if month *t* is March of calendar year 2022 or later, and zero otherwise.

Appendix 2: Electricity consumption by customer classes

Table 2.1

Electricity consumption by customer classes

Month	Residential (mkWh)	Commercial (mkWh)	Industrial (mkWh)	Public Lights (mkWh)	Agriculture (mkWh)	Others (mkWh)	Total Consumption (mkWh)
06/01/2025	638.89619	666.300695	125.954164	26.002172	2.005336	3.269241	1462.427798
05/01/2025	532.989437	628.963744	114.763681	25.85147344	1.79705377	3.10974	1307.475129
04/01/2025	517.390331	639.785722	106.519113	26.08219725	1.88183128	3.002578	1294.661772
03/01/2025	514.774782	639.409764	127.459922	26.37973228	2.10097244	3.109659	1313.234831
02/01/2025	444.974098	579.912814	114.727243	25.63070149	1.77788022	2.82721	1169.849947
01/01/2025	478.749184	556.876111	95.7090948	25.74287225	1.68120351	2.908669	1161.667135
12/01/2024	542.272182	648.961829	139.728262	38.03949494	1.77180658	2.806782	1373.580357
11/01/2024	582.646412	656.045381	122.842082	24.03065986	1.844941	3.755294	1391.16477
10/01/2024	694.365066	727.517285	152.639224	23.75404942	1.83154529	3.406875	1603.514044
09/01/2024	647.706493	668.074111	112.12446	23.34598056	1.70858862	3.3786006	1456.338234
08/01/2024	692.907867	703.539815	136.500467	23.91633675	2.00868521	3.5488902	1562.42206
07/01/2024	721.949047	704.790822	130.558652	22.67271999	2.02089772	3.5238712	1585.516009
Mean	7009.62109	7820.17809	1479.52636	311.4483902	22.43074164	38.64741	16681.85208
% AF2025	42.0%	46.9%	8.9%	1.9%	0.1%	0.2%	100.0%

Source: PREPA. Aee-meta-ultimo.Excel [downloaded August 27, 2025]

Appendix 3: Computation of percentage increase in total electricity tariff rates under "optimal" and "constrained" revenues scenarios

Table 3.1

	OPTIMAL REVENUE REQUIREMENT FY2026, 2027, 2028			CONSTRAINED REVENUE REQUIREMENT FY2026, 2027, 2028		
	FY2026	**FY2027**	**FY2028**	**FY2026**	**FY2027**	**FY2028**
Total Net Revenue	**3,700,319,923**	**3,605,048,810**	**3,541,457,977**	**3,700,319,923**	**3,605,048,810**	**3,507,447,930**
Total Operating & Maintenance Expenses	**5,633,689,875**	**5,779,272,674**	**5,886,120,922**	**5,017,875,815**	**5,082,922,682**	**4,797,128,031**
Deficiency	(1,933,369,952)	(2,174,223,864)	(2,344,662,945)	(1,317,555,892)	(1,477,873,872)	(1,289,680,100)

Source: Government of Puerto Rico, Puerto Rico Public Service Board. In Re: PUERTO RICO ELECTRIC POWER AUTHORITY RATE REVIEW, CASE NO.: NEPR-AP-2023-0003, PC-of-LUMA-FIN-2_Attachment 1:2-Excel.

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Average forecasted revenue deficiency AF2026 to AF2028

Additional revenue required – optimal scenario	- 2,150,752,253
Additional revenue required – constrained scenario	- 1,361,703,288
Total net revenue [average FY2026 to FY2028]	3,615,608,903

Percentual increment in tariff rates

Optimal scenario	59.49%
Constrained scenario	37.66%

Appendix 4: Expected economic consequences of the proposal by industrial sectors

To analyze economic effects, by industrial sectors, the Puerto Rico Input-Output matrix was condensed to eight sectors. The results are informed below.

Table 4.1

PUERTO RICO 2013 INPUT-OUTPUT MATRIX
Eight Sectors Transaction Matrix
($ million)

	Agriculture	Mining & Construction	Manufacture	Wholesale & Retail Trade	Hospitals & Health Serv	Electricity & Irrigation Services	Other Services	Government	Total Intermediate
Agriculture	357.8	41.5	918.6	51.9	4.2	0.1	203.0	40.6	1,617.6
Mining & Construction	7.2	80.7	716.2	307.4	64.4	0.0	1,433.2	73.3	2,682.4
Manufacturing	340.2	1,591.5	19,722.3	801.3	1,137.3	312.3	4,520.1	1,606.8	30,032.0
Wholesale & Retail Trade	153.1	194.9	5,201.7	0.0	268.8	1.1	1,362.6	306.4	7,488.5
Hospitals & Health Serv.	0.0	0.0	0.0	0.0	384.3	0.6	9.1	337.7	731.6
Electricity & Irrigation Serv.	4.9	34.3	563.7	369.4	33.2	218.1	490.5	144.9	1,858.9
Other Services	26.2	1,014.0	1,554.1	4,539.4	1,026.3	51.5	20,054.7	976.7	29,243.0
Government	0.6	74.8	109.2	55.0	4.6	0.0	374.5	80.7	699.3
Intermediate Inputs	890.0	3,031.7	28,785.9	6,124.4	2,923.0	583.6	28,447.6	3,567.0	74,353.3
Output	2,128.7	6,656.2	92,152.0	14,915.6	6,993.7	2,354.1	56,935.7	13,746.2	
I/O Ratio	0.4181	0.4555	0.3124	0.4106	0.4180	0.2479	0.4996	0.2595	

Source: PR Planning Board and computations by the author.

Table 4.2

"OPTIMAL" REQUEST

	Agriculture	Mining & Construction	Manufacture	Wholesale & Retail Trade	Hospitals & Health Serv	Electricity & Irrigation Services	Other Services	Government	Total Intermediate
Agriculture	357.8	41.5	918.6	51.9	4.2	0.1	203.0	40.6	1,617.6
Mining & Construction	7.2	80.7	716.2	307.4	64.4	0.0	1,433.2	73.3	2,682.4
Manufacturing	340.2	1,591.5	19,722.3	801.3	1,137.3	312.3	4,520.1	1,606.8	30,032.0
Wholesale & Retail Trade	153.1	194.9	5,201.7	0.0	268.8	1.1	1,362.6	306.4	7,488.5
Hospitals & Health Serv.	0.0	0.0	0.0	0.0	384.3	0.6	9.1	337.7	731.6
Electricity & Irrigation Serv.	7.9	54.6	899.1	589.1	52.9	218.1	782.3	231.1	2,835.2
Other Services	26.2	1014.0	1554.1	4539.4	1026.3	51.5	20054.7	976.7	29,243.0
Government	0.6	74.8	109.2	55.0	4.6	0.0	374.5	80.7	699.3
Intermediate Inputs	892.9	3,052.1	29,121.3	6,344.2	2,942.8	583.6	28,739.4	3,653.3	75,329.6
Ouput	2,128.7	6,656.2	92,152.0	14,915.6	6,993.7	2,354.1	56,935.7	13,746.2	
I/O Ratio	0.4195	0.4585	0.3160	0.4253	0.4208	0.2479	0.5048	0.2658	
Percent Change in Inputs Cost	0.3%	0.7%	1.2%	3.6%	0.7%	0.0%	1.0%	2.4%	

Table 4.3

"CONSTRAINED" REQUEST

	Agriculture	Mining & Construction	Manufacture	Wholesale & Retail Trade	Hospitals & Health Serv	Electricity & Irrigation Services	Other Services	Government	Total Intermediate
Agriculture	357.8	41.5	918.6	51.9	4.2	0.1	203.0	40.6	1,617.6
Mining & Construction	7.2	80.7	716.2	307.4	64.4	0.0	1,433.2	73.3	2,682.4
Manufacturing	340.2	1,591.5	19,722.3	801.3	1,137.3	312.3	4,520.1	1,606.8	30,032.0
Wholesale & Retail Trade	153.1	194.9	5,201.7	0.0	268.8	1.1	1,362.6	306.4	7,488.5
Hospitals & Health Serv.	0.0	0.0	0.0	0.0	384.3	0.6	9.1	337.7	731.6
Electricity & Irrigation Serv.	6.8	47.2	776.2	508.6	45.7	218.1	508.6	150.3	2261.5
Other Services	26.2	1014.0	1554.1	4539.4	1026.3	51.5	20054.7	976.7	29,243.0
Government	0.6	74.8	109.2	55.0	4.6	0.0	374.5	80.7	699.3
Intermediate Inputs	890.4	3,034.6	28,840.9	6,138.1	2,924.3	583.6	28,465.7	3,572.4	74,450.0
Ouput	2,128.7	6,656.2	92,152.0	14,915.6	6,993.7	2,354.1	56,935.7	13,746.2	
I/O Ratio	0.4183	0.4559	0.3130	0.4115	0.4181	0.2479	0.5000	0.2599	
Percent Change in Inputs Cost	0.05%	0.09%	0.19%	0.22%	0.04%	0.00%	0.06%	0.15%	

Appendix 5: Relevant Weights Used to Compute the Consumer Price Index

Table 5.1

EXPENDITURE WEIGHTS IN CPI

	Weights (Dec. 2006)
Apparel	4.24%
Education & communications	5.10%
Foods & beverages	22.78%
Other goods and services	9.79%
Housing & housing services	25.09%
Electricity	2.84%
Health services	5.47%
Entertainment	3.27%
Transportation	24.25%

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