

October 4, 2021

Chair Raul Grijalva
Mr. Bruce Westerman, Ranking Member
House Committee on Natural Resources
Congress of the United States
Washington, DC 20515

Mr. Brian Modeste
Staff Director
House Committee on Natural Resources
Congress of the United States
Washington, DC 20515

Mr. Ivan Robles
Policy Aide
Office of Insular Affairs
House Committee on Natural Resources
Congress of the United States
Washington, DC 20515

Written Testimony for Hearing on the PREPA Post Implementation of the LUMA Transmission and Distribution Contract

Dear Chair Grijalva and Members of the House Committee on Natural Resources,

I appreciate the opportunity to testify and submit written comments on PREPA Post Implementation of the LUMA Transmission and Distribution Contract. I am Dr. Agustín Irizarry and I have been studying electric power systems, in general, and the Puerto Rico power system in particular for over 25 years. I believe LUMA Energy's operation of our electric system has been detrimental to the well-being of hundreds of thousands of residents of Puerto Rico.

I join Ruth Santiago's message to this Committee to urge the Federal government to earmark the FEMA funds allocated for the Puerto Rico electric system to be used for rooftop solar and battery systems and energy efficiency programs that will provide resilient electric service, sustainability and economic benefit to the residents of Puerto Rico as shown by many studies.¹

¹ Puerto Rico Low-to-Moderate Income Rooftop PV and Solar Savings Potential, National Renewable Energy Laboratory (NREL), 2020, Puerto Rico Low-to-Moderate Income Rooftop PV and Solar Savings Potential (nrel.gov); We Want Sun and We Want More (Summary), Fact Sheet, Puerto Rico Distributed Energy Resource Integration Study: Achieving a Renewable, Reliable, and Resilient Distributed Grid - Telos Energy, Puerto Rico Distribution Modeling - EE Plus, Puerto Rico Distributed Energy Resource Integration Study: Load, Energy Efficiency, and System Cost - Energy Futures Group, Sol + Techos – Página principal (cambiopr.org); Achievable Renewable Energy Targets ("ARET"), https://www.uprm.edu/aret/docs/Ch_4_Solar_resource_and_solar_thermal.pdf.

I. Deterioration of electric service under LUMA Energy

Under LUMA we have experienced longer and more frequent outages and widespread problems with severe voltage fluctuations.

LUMA publishes on its website², under “service interruption”, a table indicating the number of clients without service, updated every 10 minutes. Note that a “client” is a meter not a person, thus the number of people without electricity is 3 to 4 times the number of clients without electricity.

After processing the data, we estimate that the average number of clients without service at any moment during September 2021 was 4,943.³ This estimate does not include load shed days or outliers. The almost 5,000 average clients without service is two to three times worse what it was during 2012-2014 when I was an elected member of PREPA’s Governing Board. By then the average number of clients without service, on an ordinary day, was between 1500 and 2000.

And service is also much worse than it was compared to the period directly prior to LUMA’s takeover of the system. According to reliability indices filed by LUMA with the Puerto Rico Energy Bureau, the time it takes to restore electric service after an interruption has increased significantly in all regions of the island under LUMA. The average system-wide time to restore electric service after an interruption increased from 2 hours and 18 minutes during March, April and May with PREPA to 5 hours and 23 minutes during June, July and August 2021 under LUMA.

Why is this happening? I believe the problems fundamentally stem from a shortage of skilled and experienced workers. On June 1st, 2021 3,118 PREPA workers were transferred to other government agencies. How many linemen has LUMA hired to replace the ones that left? How well trained are these workers? How much experience, if any, did they have with Puerto Rico’s electrical system prior to June 1?

We do not know the answer to these questions even though the Puerto Rico Legislature asked LUMA weeks ago. LUMA refused to answer and went to court to not answer. All courts in Puerto Rico, including the Puerto Rico Supreme Court, have ordered LUMA to answer. We are still waiting for a resolution of the second reconsideration LUMA filed before the Puerto Rico Supreme Court.

In my opinion a well-trained workforce is the most important part of any infrastructure. Poles, conductors, switches, generators are all bought with money. People must be hired and trained and this is a process that takes more than money; it takes well-trained people to train the newly hired and training takes time. Human capital can not be replaced in a few months and in the case of specialized positions such as power system dispatchers and high-voltage linemen it will take years of training for a

² <https://miluma.lumapr.com/outages/outageMap>

³ During the first half of September, Sept 1st thru 15th, the average number of clients without service was 4,804 and during the last half of September, Sept 16th thru 30th, it was 5,098.

person to become truly proficient. Is the lack of well-trained, and enough, people the cause of worse reliability and voltage surges? I believe it is. ⁴

II. The solution we propose: Queremos Sol proposal and Integration Study of Distributed Solar Energy on Rooftops with Storage

I am part the Queremos Sol (“We Want Sun”), multi-sectoral coalition of Puerto Rican community, environmental and labor organizations, that put forward in 2018 a policy proposal for the renewable energy transformation of Puerto Rico’s electrical system under a reformed public ownership model. The proposal emphasized efficiency and distributed renewable electric energy, particularly rooftop solar and behind-the-meter storage, as a strategy to provide resilience to households, to reduce the impact on agricultural and ecologically valuable lands from utility-scale renewable energy projects, and to reduce the island’s dependence on imported fossil fuels and extensive transmission systems.⁵

In early 2021 we completed a study where we used advanced modeling tools to make detailed simulations of the electrical grid and modelled, probably for the first time, most of the distribution system. We used data obtained from PREPA, to perform in depth modelling of scenarios with increasing penetration of renewable energy, up to 75% (with over half of that from residential installations) of total electricity consumption by 2035. The results were used to estimate the costs of achieving the Queremos Sol goals.⁶

Our study shows that a grid with distributed generation based on rooftop solar and storage for homes and businesses CAN OPERATE SAFELY AND RELIABLY, SAVING MONEY AND STABILIZING PRICES. The distribution system can support high levels of penetration of such systems with minimal investment.

The main results of our study show:

- **100% household resiliency can be achieved** with 2.7 kW rooftop solar systems and 12.5 kWh batteries and with commercial installations. This will reduce household and community vulnerability after hurricanes;
- **It is cost-effective to use \$9.6 billion in federal funds to implement this plan**, which would reduce electric system costs to less than 15 cents/kWh by 2035;
- Puerto Rico could achieve 75% renewable energy in 15 years and **spend only \$430 million annually on fuel** (fuel costs exceed \$1.4 billion in 2019 and 2020);

⁴ And we have seen it happening for a good while now. In 2016 a report was presented, by Fisher and Horowitz, to the Puerto Rico Energy Bureau (in case no. CEPR-AP-2015-0001) on problems PREPA was facing. From page 30 of the report, on the subject of staff availability and competence:

“Ms. Miranda’s panel discusses that forced outages are due, in part to “skilled labor leaving operational roles and not being replaced.” PREPA’s own internal documentation backs up and expands this contention, blaming the outages on a “loss of significant number of experienced personnel,” and that “new employees do not have the required expertise and knowledge.”

⁵ <https://www.queremossolpr.com/>

⁶ <https://cambiopr.org/solmastechos/>

- **There is no need for investment in new fossil fuel-based power plants** or conversion of existing plants to natural gas;
- **CO₂ emissions can be reduced nearly 70%, placing Puerto Rico at the forefront** of addressing climate change with urgency;
- **It is possible to retire fossil fuel-based generation**, starting with the AES coal plant;
- **With modest investments in the distribution system** - \$650 million – the grid can support the reliable integration of 75% rooftop renewable energy and battery storage;
- **The proposal is more economical** than PREPA’s proposed plans such as the Integrated Resource Plan (and the cost of the current system);

III. Conclusion

For the reasons summarized in this testimony, we urge the Committee to investigate PREPA’s Agreement with LUMA Energy, LLC and in particular the lack of trained personnel to properly operate the electric system. We request that the House Committee on Natural Resources include an inquiry on the status of FEMA funds for Puerto Rico electric system work to ensure that the funds are used in a cost-effective manner to provide affordable, distributed, renewable and resilient electric energy to Puerto Rico.

– End of oral testimony –

Written testimony continues --

IV. Comparison of reliability indices as reported by LUMA to the Puerto Rico Energy Bureau

Reliability metrics – SAIDI, SAIFI and CAIDI - reported by LUMA to the Puerto Rico Energy Bureau show the deterioration of the system under LUMA’s management.

SAIDI is the "System Average Interruption Duration Index". SAIDI is the average, non-momentary⁷, outage duration for each customer served over a defined period of time (usually 1 year) and is usually measured in minutes or hours. The average SAIDI during 2019 for US electric utilities was 92 minutes. This SAIDI does not consider major interruption events caused by hurricanes, earthquakes, etc.

LUMA reported, from June thru August 2021, a SAIDI which is worse than the one reported by PREPA from March thru May 2021. LUMA’s performance is worse than PREPA’s, in most cases by a factor of 2, in every distribution system region in Puerto Rico.

SAIFI is the "System Average Interruption Frequency Index". SAIFI is the average number of interruptions that a customer would experience over a defined period of time (usually 1 year) and is usually measured in interruptions per customer. In the US the average SAIFI is 1.1 interruptions per year without including major events.

During June thru August 2021 LUMA reported that fifteen (15) out of 26 distribution system regions experience more interruptions under LUMA.

⁷ A momentary service interruption last for less than 5 minutes.

CAIDI is the "Customer Average Interruption Duration Index". CAIDI gives the average outage duration that any given customer would experience over a period of time, usually 1 year. CAIDI can also be viewed as the average restoration time, the time it takes to the electric utility to restore service once an interruption occurs. In the US the average CAIDI is about 82 minutes (81.6 minutes).

Again, for all distribution system regions, the restoration time after an interruption increased significantly during June thru August 2021 under LUMA. The average system-wide time to restore electric service after an interruption increased from 2 hours and 18 minutes during March, April and May with PREPA to 5 hours and 23 minutes during June, July and August 2021 under LUMA.

V. The LUMA contract, even if properly executed, will create a 20th Century utility, we want a 21st Century utility

Puerto Rico Law 120 was enacted with the objective to “transform the Puerto Rico energy system into a **modern, sustainable, reliable, efficient, cost-effective, and resilient system**”. The contract between LUMA and PREPA on its Recitals quotes the purpose of this Law 120 that gives rise to the contract:

WHEREAS, in accordance with Act 120, Owner⁸ desires to transform Puerto Rico’s energy system into a modern, sustainable, reliable, efficient, cost-effective and resilient system;

In a traditional, 20th Century, electric power system the architecture was based on large-scale generation; centralized, a one-way control strategy of the system; and passive loads. The traditional system was not designed to meet many emerging trends, such as greater adoption of relatively low inertia generation sources, increasing penetration of distributed generation resources, and the need for greater resilience.

A modern electric power system must be flexible, robust, agile. It must have the ability to dynamically optimize grid operations and resources, rapidly detect and mitigate disturbances, integrate diverse generation sources, on both the supply and demand sides, integrate demand response and energy-efficiency resources, enable consumers to manage their electricity use, and provide strong protection against physical and cyber risks.⁹

A modern electric power system must include more distributed control, two-way flows of electricity and information, more energy storage, more energy justice, more sustainable sources of energy, and consumers as energy producers thru assertive deployment of resilient and distributed renewable energy resources and as participants of demand management and efficient use of electricity programs.¹⁰

Even a casual read of the LUMA contract shows that the contract aims at achieving, if LUMA performs admirably - a condition that is not happening - a 20th Century utility.

⁸ In the contract PREPA is identified a “Owner”.

⁹ Quadrennial technology review: An assessment of Energy Technologies and research opportunities, Chapter 3: Enabling Modernization of the Electric Power System, US Department of Energy, September 2015.

¹⁰ International Energy Agency. “Technology Roadmap: Smart Grid.” OECD/IEA. Paris, France, 2011. http://www.iea.org/publications/freepublications/publication/smartgrids_roadmap.pdf.

VI. Generation problems

In recent weeks, Puerto Rico has experienced a series of problems at its power plants – including both those owned by PREPA and privately-owned plants – that have led to large-scale power outages. These outages come on top of the worsened reliability of the transmission and distribution system, as described above.

The problems at PREPA’s power plants result from a longstanding failure to adequately fund the maintenance of the plants. An expert report to the Puerto Rico Energy Bureau in 2016 described the “reliability crisis” that the power plants were already experiencing five years ago. The report noted that the outage rate of PREPA’s power plants had increased directly in proportion to the decline in spending on operation and maintenance.¹¹ PREPA’s budgets for generation system maintenance have not increased since that time. In the most recent 13 weeks for which data is available from the Puerto Rico Fiscal Agency and Financial Advisory Authority (from mid-June to mid-September), PREPA has apparently spent only 51% of its maintenance budget.¹²

I am deeply concerned that the privatization of PREPA’s power plants – the solution proposed by the government of Puerto Rico – will not resolve the generation problems. What is needed is a financial commitment to improve the reliability of the plants, which the ratepayers of Puerto Rico will pay for regardless of whether the plants are publicly or privately owned. Indeed, if privatization results in the loss of competent and experienced workers and mid-level managers at the plants, similar to what has occurred with the LUMA contract, there is every reason to expect plant availability to deteriorate further.

In San Germán, Puerto Rico



s/ Agustín A. Irizarry-Rivera

Agustín A. Irizarry-Rivera
Carretera 348 km9 hm9, Poblado Rosario
San Germán, Puerto Rico 00636
T: (787) 448-2553
E: agustinirizarry@gmail.com

This testimony is presented by Agustín A. Irizarry Rivera as his testimony and it does not represent the testimony of the Universidad de Puerto Rico, employer of Dr. Irizarry Rivera.

¹¹ Expert Report of Jeremy Fisher and Ariel Horowitz, Puerto Rico Energy Bureau Case No. CEPR-AP-2015-0001, November 23, 2016, pp. 11 and 30.

¹² Fiscal Agency and Financial Advisory Authority. PREPA 13-Week Cash Flow Updates dated May 19, July 21 and September 15, 2021.