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

IN RE:	**CASE NO. NEPR-MI-2021-0002**
REVIEW OF THE PUERTO RICO ELECTRIC POWER AUTHORITY'S 10-YEAR INFRASTRUCTURE PLAN-DECEMBER 2020	**SUBJECT: Informative Motion on Proposal Under the Program 40101(c): Grid Resilience Grants of the U.S. Department of Energy**

INFORMATIVE MOTION ON PROPOSAL UNDER THE PROGRAM 40101(C): GRID RESILIENCE GRANTS OF THE U.S. DEPARTMENT OF ENERGY

TO THE PUERTO RICO ENERGY BUREAU:

COME NOW LUMA Energy, LLC[1], and **LUMA Energy ServCo, LLC**[2], (jointly referred to as "LUMA"), through the undersigned legal counsel and respectfully submits the following:

1. On March 26, 2021, this Honorable Puerto Rico Energy Bureau ("Energy Bureau") issued a Resolution and Order in the instant proceeding, ordering —in pertinent part— that the Puerto Rico Electric Power Authority ("PREPA") submit to the Energy Bureau the specific projects to be funded with Federal Emergency Management Agency ("FEMA") funds or any other federal funds at least thirty (30) calendar days prior to submitting these projects to the Puerto Rico Central Office for Recovery, Reconstruction and Resiliency ("COR3"), FEMA or any other federal agency ("March 26th Order"). This Energy Bureau thereafter determined that this directive applied to PREPA and LUMA. *See* Resolution and Order of August 20, 2021.

[1] Register No. 439372.
[2] Register No. 439373.

2. The Program 40101(c): Grid Resilience Grants of the United States Department of Energy ("DOE") provides funding opportunities focused on improving the resilience of the electric grid against disruptive events due to extreme weather, wildfire, or natural disaster.

3. To benefit from the aforementioned funding opportunities, LUMA plans to submit a proposal under Program 40101(c): Grid Resilience Grants for the following project: "Underground Transmission Hardening for Enhanced Resilience." *See* **Exhibit 1**. This project is highly relevant to LUMA's ongoing efforts to enhance the transmission and distribution system resilience and reliability. LUMA is partnering on this project with the University of Puerto Rico, Mayagüez Campus.

4. Specifically, the "Underground Transmission Hardening for Enhanced Resilience" project aims to repair and harden key elements of the underground transmission system whose potential failures would endanger the reliability and resilience of the system. This includes replacing broken equipment and deploying advanced sensors, control capabilities, and communications systems to allow for industry-leading performance. The proposed project seeks to protect against and recover from any event that would significantly impact the grid by repairing and hardening key transmission system elements that are presently undergrounded but are either not operational or incapable of delivering the resilience goals.

5. In view of the above, LUMA hereby requests the Energy Bureau to take notice of the above-described proposal it intends to submit under Program 40101(c): Grid Resilience Grants of the DOE to explore additional funding opportunities.

WHEREFORE, LUMA respectfully requests that the Energy Bureau **take notice** of the aforementioned.

RESPECTFULLY SUBMITTED.

We hereby certify that we filed this motion using the electronic filing system of this Energy Bureau. We will send an electronic copy of this motion to the attorney for PREPA, Joannely Marrero-Cruz, jmarrero@diazvaz.law.

In San Juan, Puerto Rico, on this 28th day of June 2023.

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Exhibit 1

IIJA Funding Opportunities

Contents

1.0 Introduction

In 2021, President Biden signed the Infrastructure Investment and Jobs Act (IIJA) to encourage significant amounts of incremental spending on a variety of priority infrastructure needs, including energy and power infrastructure. The IIJA is divided into a larger number of funding opportunities, which are overseen by different federal agencies. Of these funding opportunities, some are allocated to the various states and territories on a formulaic basis, with the remainder being distributed competitively.

The Grid Resilience and Innovation Partnerships (GRIP) are a set of funding opportunities focused on enhancing the resiliency and sustainability of the grid. One of the subsets of this larger category is known as Program 40101(c): Grid Resilience Grants. Priorities for this program include improving the resilience of the electric grid against disruptive events due to extreme weather, wildfire, or a natural disaster.

LUMA's strategic objectives based on Puerto Rico public energy policy aligns with the objectives of the IIJA and includes projects that:

- Increase capacity of the transmission system.
- Increases the reliability of the system.
- Enable greater renewable energy integration.
- Facilitate the aggregation and integration of Electric Vehicles (EVs) and other grid-edge devices.
- Reduce CO_2 emissions.
- Provide equitable impact for low-income communities.

Under Program 40101(c), $2.5 billion has been allocated of which $918 million will be distributed this year. These funds are divided into 10 projects, with the maximum for each individual project being no more than the total amount the entity has spent on resiliency in the prior 3 years. The awarded applicant would need to provide an equivalent amount in cost share.

In the first year of this program being active, LUMA is submitting one complete application for underground transmission hardening for enhanced resilience, which is described in more detail below.

2.0 Underground Transmission Hardening for Enhanced Resilience

2.1 Introduction

The electric power infrastructure in Puerto Rico suffers from decades of insufficient maintenance, as well as continued exposure to natural environmental challenges. The proposed project aims to repair and harden key elements of the underground transmission system whose potential failures would endanger the reliability and resilience of the system. This project includes replacement of broken equipment, deployment of advanced sensors, control capabilities, and communications systems to allow for improved performance. LUMA is partnering with the University of Puerto Rico, Mayagüez Campus to execute this critical project.

This improved transmission path will support general grid resilience in the face of the increasing frequency of natural hazards, including hurricanes. Additionally, the targeted segments of the transmission system will support effective black-start processes, which have been needed twice in Puerto Rico in the preceding 12 months. Moreover, this project will increase the capacity of the system to integrate renewable generation, in alignment with the goals of Puerto Rico energy policy, the Federal Emergency Management Agency (FEMA), and the United States Department of Energy (DOE). DOE is carrying out a comprehensive study, titled Puerto Rico Grid Resilience and Transitions to 100% Renewable Energy (PR100)[1], to outline options for implementing the policy objectives of the Puerto Rico Public Energy Act (Act 17).

2.2 Existing Conditions

The frequency of outages experienced in Puerto Rico is greater than many other similarly sized portions of the United States. The underground system in particular faces issues such as sea salt and coastal flooding. Puerto Rico is also susceptible to a range of hazards including hurricanes and earthquakes, leading to severe resilience challenges. In 2017, it was devastated by both Hurricanes Maria and Irma, resulting in an island-wide blackout that left some customers without power for more than a year. In the five years since Hurricanes Maria and Irma, there were seven large-scale outages, each of them affecting at least 500,000 customers. Most recently, in September 2022 Hurricane Fiona caused an island-wide blackout affecting all 3.4 million Puerto Ricans, providing a significant reminder of the urgent need to plan for increased natural hazards associated with major weather events. This project aligns with the objectives of the Electric Power Outage Data Initiative Nationwide (ODIN), an effort led by the DOE and the Oak Ridge National Laboratory to streamline the accurate provision of reliability data across electric customers nationwide. LUMA is a participant in and advocate of this initiative.

[1] https://www.energy.gov/oe/puerto-rico-grid-resilience-and-transitions-100-renewable-energy-study-pr100

2.3 Project Goals

The Institute of Electrical and Electronics Engineers (IEEE) defines electrical resilience[2] as "the ability to protect against and recover from any event that would significantly impact the grid."[3]The proposed project aims to address both facets of the issue through the repair and hardening of key elements of the transmission system that are presently undergrounded but are either not operational or not capable of delivering the resilience goals. Both Act 17 and the PR100 project have already identified the critical importance of strengthening the transmission infrastructure, with the latter specifically flagging the San Juan underground transmission loop.[4]

An effective black start[5] capability is key to a rapid recovery of an electric grid. An inadequate black start capability can delay re-energizing significant portions of the grid, if not the whole island, after of a disruptive event. Although every utility requires a black start process, the situation in Puerto Rico is unique — the electric grid has relatively little inertia due to being on an island and experiences frequent disruptive events such as hurricanes. The consequence is that black start is required more frequently, including twice in the past twelve months. This project will enable additional black start options that would remain available even under adverse conditions.

The project also supports the larger goals of system stability supported by federal policy, including the FEMA Accelerated Awards Strategy (FAASt) and the Power System Stabilization Task Force, a US Army Corps of Engineers and FEMA led effort to deploy controllable generation to Puerto Rico to reduce the likelihood of a wide-scale outage.

2.4 Proposed Approach

2.4.1 Implementation Approach

This project will proceed in four phases with some overlapping in the deployment timeframes.

Phase One

The first phase will assess the current condition of the eight underground transmission lines by doing visual inspections and performing electrical tests.

Phase One is expected to take 9 to 12 months, and will include detailed assessments, as well as offline and online testing to identify issues and limitations with the above 8 underground 115 kV transmission lines. It will also include IEC standard 60840 and IEEE standard 48 cable testing training for project team staff and additional training in the use of advanced testing/monitoring instrumentation. Furthermore, technical specifications will be developed/updated, as required for procurement of new cables.

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[2] "Resilience Framework, Methods, and Metrics for the Electricity Sector" IEEE Technical Report TR83, Oct. 2020 (https://resourcecenter.ieee-pes.org/publications/technical-reports/PES_TP_TR83_ITSLC_102920.html)

[3] "Resilience Framework, Methods, and Metrics for the Electricity Sector" IEEE Technical Report TR83, Oct. 2020 (https://resourcecenter.ieee-pes.org/publications/technical-reports/PES_TP_TR83_ITSLC_102920.html)

[4] "New Palo Seco Combined Cycle Power Generation Scoping & Feasibility Report", July 2022; https://energia.pr.gov/wp-content/uploads/sites/7/2022/07/20220715-Motion-to-Submit-Feasibility-Study-and-July-2022-Status-Report.pdf

[5] Black start is a process of reenergizing the grid, or part of the grid, after a complete blackout.

Phase Two

The second phase will target the rebuilding of two key transmission lines. Two lines are currently out of service because of cable failures. These two lines will be targeted for hardening and real-time condition assessment, by:

- Replacing the cables
- Using modern cables with integrated distributed fiber optic temperature sensing
- Increasing transfer capacity (ampacity) from 1160 A to 2000 A
- Updating the associated switchgear (e.g., breakers) and protection (relaying) equipment
- Installing instrumentation and sensors (e.g., thermal, fault-indication, strain) for real-time condition monitoring
- Installing fiber optic communication cables in parallel with the power cables for differential protection of the lines, and providing additional value through available resilient communication infrastructure, especially during natural disasters.

This is expected to be carried out by external contractors and is expected to take approximately 2 to 3 years, starting in the second year of the project. With today's supply chain challenges, cable delivery lead times will determine how soon cable replacement work can begin. This work will be scoped during Phase One, and it will entail removing old cables, repairing various junction locations and manholes, placing, and splicing the new power cables, and installing communications and protection equipment, and performing upgrades to any substation breaker or other protection equipment needed.

Other key lines will be supported with the deployment of instrumentation and sensors (e.g., thermal, strain, leakage current, wideband voltage and current, or electric and magnetic field, sensors) for real-time condition monitoring. Amongst other operational efficiency benefits, this capability will provide important input regarding the state of the system and the expected time when a more significant rebuild might be necessary to continue the enhancement of the transmission system in Puerto Rico.

For each of these efforts, the project team will execute enhanced training for the commissioning crews, who will be required to conduct the underground cable testing, as well as the provision of equipment to support the testing.

Phase Three

Phase three, which will overlap in timing with Phase two, will focus on installing sensors and monitoring equipment for two lines being monitored. These sensors will include temperature sensors, preferably integrated optical temperature sensors in the new cables, as well as other fiber optic spot temperature sensors for every splice point on both the new cables and the existing cables. Wideband voltage and current sensors (preferably, non-intrusive optical sensors) for defect detection (and fault location) will be installed at the two ends of the cables. Online partial discharge sensors will also be considered for monitoring the quality of cable insulation somewhat continuously during operations. Strain sensors will also be included for new cables, and most likely for the splice points on the existing cables too. The work in this phase will also include deployment of a monitoring data management system, including time-series data storage and advanced analytics extracting actionable value from the data.

The data and analytics platform deployment not only benefits the assets addressed in this project but also accelerates data-informed active asset management and situational awareness across the grid in Puerto Rico. These tools help optimize maintenance and asset life, as well as enabling reliable integration of larger amounts of renewables in the grid.

Phase three also includes building a training facility for educating project team staff (and others, e.g., collaborating university students and contractors) in using test equipment, etc.

Phase Four

Phase four focuses on the evaluation of data collected in the previous three phases, and the evaluation of the impact of the deployed projects.

2.5 Potential Impact

2.5.1 Outcome - Improved capability of integrating renewables

Transitioning Puerto Rico into 100% renewable energy supply will require potentially thousands of additional megawatts of renewable generation to be deployed – a massive increase for an island electric grid with approximately 3,000 MW peak load. This penetration of renewables requires additional capabilities including advanced sensors to provide improved situational awareness.

As more renewable generation is deployed, additional transmission capacity in the region will be required. These transmission lines will play an instrumental role in increasing the hosting capacity for utility-scale renewable generation. Additionally, it will improve the economic case of the additional deployment of utility-scale renewable generation by improving the grid resilience and allowing for more up-time for the renewable generation. Furthermore, the deployment of advanced sensors will support dynamic line rating capabilities and real-time situational awareness. This will be used to validate the potential of these sensors to help enable the integration of additional renewable generation.

2.5.2 Outcome – Improved black start resources

It is important to ensure that Puerto Rico has sufficient black start capability, since the electric grid has little inertia due to being on an island. Moreover, effective black start capability is key to the rapid recovery of the electric grid after experiencing a disruptive event such as hurricanes. This project will enable additional black start options that would remain available even under adverse conditions. Specifically, this project aims to rebuild critical transmission lines (cranking path) that will help support restoration plans, enabling black start options that would remain available. Furthermore, the deployment of advanced sensors will support the detection of faults that might otherwise prevent the operation of critical lines that are essential to the effective restoration of electric service. Moreover, this capability will help ensure that generation resources can used to re-energize the system following disruptive events which will decrease the time in which customers suffer from loss of power. This is especially crucial to address the restoration of service to Critical Facilities. This capability will greatly enhance the ability of the electric grid to manage the results from disruptive events on the system and will likely reduce the resulting public, economic and health impacts.

2.5.3 Outcome – Increased reliability and availability

The work proposed in this project will yield increased grid capability to withstand natural hazards while continuing to provide service. One of the targeted lines provides additional redundancy to the 115 kV transmission supply in the San Juan area. A second targeted line is a key interconnect between two major transmission hubs in the area. Rebuilding these lines will help LUMA go towards meeting NERC reliability standards for the transmission system, which will help mitigate the likelihood of cascading outages and maintain the security of the system.

2.5.4 Outcome – Building for the future

Puerto Rico, as the rest of the U.S., will see major changes over the next few decades, impacting both how energy is generated and how it is used. To respond to this, it is necessary to both harden the existing infrastructure, as well as deploy emerging technologies and capabilities, including advanced sensors and associated data analytics. The deployment of these advanced solutions will have an immediate impact on grid resilience in the region, but perhaps as importantly, the learnings and experience with newer technology through this project will help future grid improvement decisions. The sensors and monitoring technology being deployed to improve situational awareness will support data-informed active asset management and situational awareness across the grid. These techniques not only can help optimize maintenance and asset life, but also enable reliable integration of large amounts of renewables into the grid.

2.6 Project Budget

Table 1 - Project Budget by Role

Task	Total ($M)
LUMA Funding from DOE	$88.7
LUMA Portion Cost-Share	$89.3
Remaining DOE portion/partners' cost share	$2.0
Total	$180.0

2.7 Project Timeline

If awarded, the project is projected to be completed by the fourth quarter of FY2028.