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

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**IN RE:** OPTIMIZATION PROCEEDING OF MINIGRID TRANSMISSION AND DISTRIBUTION INVESTMENTS CASE NO.: NEPR-MI-2020-0016

**SUBJECT**: Order for PREPA to file 10-Year Infrastructure Plan.

#### PRESENTATION: 10-YEAR INFRASTRUCTURE PLAN

COMES NOW the Puerto Rico Electric Power Authority through its legal representation

and respectfully submits the attached presentation in compliance with the Resolution and Order

entered on December 30, 2020. Attachment A.

RESPECTFULLY SUBMITTED.

In San Juan Puerto Rico, this 8<sup>th</sup> day of January 2021.

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#### Attachment A



### **Puerto Rico Electric Power Authority (PREPA)**

10-Year Infrastructure Plan PREB Overview January 2021

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### Introduction

As part of the \$10.7 billion funding obligation announcement by FEMA, PREPA was required to submit a 10-Year Infrastructure Plan outlining the proposed investments over the next 10 years by December 21, 2020. PREPA met or exceeded all plan requirements articulated by FEMA and submitted the plan ahead of schedule.

The following illustrate key requirements and considerations incorporated in the development the plan:



#### Who was involved?

 Over 60 individuals, including oversight and guidance from PREPA leadership, as well as technical support from professional firms with expertise in the areas of engineering, grant management, and project management. Some of the firms, utility partners, and key stakeholders involved include FEMA, COR3, DOE, LUMA, NYPA, Sargent & Lundy, Burns and McDonnell, ScottMadden, and more



### **Puerto Rico Grid of the Future**

PREPA's strategic vision is one that has a customer-centric, affordable, reliable, resilient, and sustainable electric power system. The execution of PREPA's 10-Year Infrastructure Plan will enable us to achieve that vision for the benefit of the citizens of Puerto Rico.

#### **Growing Renewable Generation**

Working in concert with traditional generation sources and smart grid devices to maximize renewable output and support grid operations

#### Faster Recovery and Restoration Response

Facilitated by a strengthen T&D infrastructure, automation devices, advanced metering, flexible generation, and 21<sup>st</sup> century IT infrastructure

#### **Enhanced Customer Experience**

Enabled by investments in intelligent devices, data analytics, and cleaner energy options at affordable rates





### **Project Benefits**

Projects in the 10-Year Infrastructure Plan will benefit the entire island and are collectively organized into the five investment focus areas. Projects that benefit multiple focus areas are mapped to the focus area where it is considered to have the most impact.



## **Investment Strategy and Project Prioritization**

PREPA identified over 2,000 sub-projects which we consolidated into 256 projects for incorporation in the 10-Year Plan, organized by priority within eight (8) distinct asset categories. FEMA 428 funds obligated by asset category is included within the corresponding boxes below for a total of \$10.7 billion. PREPA also prioritized each project into one of three time-horizons: near-term, mid-term, and long-term.



Includes renewable, grid support centers, thermal retirements, some thermal replacement for grid reliability and stability, emergency and "peaker", and plant improvements



Includes distribution substations and transmission centers, and transmission/generation separation



Includes dam safety and early warning systems, reservoirs, hydroelectric facilities, and irrigation canals



Includes fiber optic and microwave systems, SCADA, VLAN, and two-way and wireless radio systems



Includes transmission line restoration and hardening, transmission reconfiguration



Includes flooded and severely damaged buildings as well as minor damages

**Power Authority** 



Includes feeder, pole, transformer, and conductor replacements, intelligent device and distribution automation installation, and smart meter installation



Includes demolition e.g., for thermal retirements, soil stabilization and restoration projects

Asset Category 428 Obligated Amount



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### **Plan Overview**

PREPA's 10-year Infrastructure Plan includes a total of approximately \$11.8 billion in investment that is needed to rebuild and transform Puerto Rico's electric system. The \$11.8 billion includes projects that qualify for FEMA funding under its 428 and 404 mitigation programs, plus supplemental funding from PREPA's NME Funds. PREPA also expects to submit hardening proposals for FEMA's 406 Public Assistance Mitigation program with each of its applicable 428 proposals.

Estimated Total Cost by Asset Category and Funding Source (\$ millions)*				Number of Projects by Asset Category and Time Horizon					
Asset Category	FEMA 428	FEMA 404	NME Funds	Estimated Total Cost	Asset Category	Near-Term (2021-2023)	Mid-Term (2024-2027)	Long-Term (2028 +)	Total
Distribution	\$4,387	\$0	\$0	\$4,387	Substations	60	4	3	67
Transmission	\$3,165	\$0	\$0	\$3,165	Hydro, Dams, and Irrigation	35	14	5	54
Generation	\$129	\$853	\$328	\$1,311	Distribution	30	14	0	44
Substations	\$811	\$0	\$340	\$1,151	Generation	27	4	0	31
Hydro, Dams, and Irrigation	\$921	\$0	\$0	\$921	Buildings	14	7	3	24
IT and Telecommunications	\$686	\$0	\$92	\$778	IT and Telecommunications	16	1	0	17
Buildings	\$63	\$0	\$0	\$63	Environmental	10	0	0	10
Environmental	\$15	\$0	\$0	\$15	Transmission	3	3	3	9
Total	\$10,176	\$853	\$760	\$11,789	Total	195	47	14	256

Total estimate includes only costs associated with FEMA 428 and 404 funds, and PREPA's NME funds. It therefore excludes infrastructure hardening work that is eligible for funding through **FEMA's 406 Public Assistance Mitigation** program.

These hardening proposals will add cost that is not currently included in this plan; however, this additional cost will be offset by a commensurate level of 406 funding.

#### **Management Notes**

- All illustrated costs are based on class 4/5 cost estimates and are expected to change over time.
- In addition, PREPA will seek to leverage funds from FEMA 406 and Community Development Block Grant Disaster Recovery (CDBG-DR) which can provide a 10% cost share allocation.

### **Implementation Status**

PREPA has already begun to prepare and submit initial Scopes of Work (SOWs) to COR3 and FEMA, in alignment with the 10-Year Infrastructure Plan.

The following bar chart shows the estimated timeline for submittal of individual projects to COR3 and FEMA for review and approval:



- As of January 8<sup>th</sup>, PREPA has submitted 17 initial SOWs to COR3 and FEMA for entry into FEMA's Grants Management System and assignment of FEMA project numbers
- These initial SOWs represent the first step in the process of performing 30% architecture and engineering (A/E) design and developing and submitting more detailed SOWs and Cost Estimates for FEMA review and approval



### **Alignment with the IRP**

#### Each project in the PREPA 10-Year Plan was aligned to the IRP and references the appropriate section in the IRP as shown below.

**Project Descriptions in 10-Year Plan** 



#### Transmission - Near-Term (2021-2023) Table 4.5 – Near-Term Transmission Projects Dams and Hydro - Near-Term (2021-2023) Transmissio Project Name Table 4.4 – Near-Term Dams and Hydro Projects Transmission Substations - Near-Term (2021-2023) Existing (38 Hydro Project star kV) infra Table 4.7 - Near-Term Substations Projects rest Guajataca The tran Dam -Dar incl Study/Assess and Est. Cost IRP tota Est. COR3 ment Substation Brief Description /FEMA (M USD) Reference Project Name Detailed dam 12-The Design -Corr Transmission and Procurement Existing (115 and San Juan This project will expand, modernize, and harden San 2021 Q1 \$64.60 Section III & 230 kV) infra Diversion 115kV GIS Juan SP 115kV TC by replacing existing Air Insulated Note: rest Canal and Guai Substation (AIS) with Gas Insulated Substation (GIS), tran Forebay Moca funded installing substation inside a building(s), expanding incl syste through substation capacity to allow future generation and to to the tota 428 and complete San Juan 115kV Underground Transmission syste PREPA Loop, and replacing aging infrastructure including six (6) along 14-The NMF inacc Oil Circuit Breakers (OCBs). In addition, PREPA will Transmission or c clogg install new protection and controls in substation, rather New Lines leve cod clean The s of Qu (38kV, 115 & than power plant control room and install revenue grade 230 kV) relia metering to measure power flows for billing. exis and The Costa Sur Generation and Switchyard project will \$52.00 Costa Sur 2021 Q2 N/A back Generation & install new prefabricated control enclosures in the by at Note: Necessary Moca Transmission switchyards to house the new equipment along with the funded PREPA could Modernization new associated cables upgrade the protective relays at through Maintenance and the remote ends, and install new switchvard revenue PREPA Early Warning The Hardening metering, auxiliary power and DC Systems. This project NME will improve system reliability and operations, modernize and harden the generation and transmission assets, and ensure compliance with consensus-based codes and standards including IEC 61850

IRP Reference<br/>Options Include:Section III, C: ANALYSIS AND FINDINGS BY TOPIC AREA, Existing Resource Options<br/>Section III, D: ANALYSIS AND FINDINGS BY TOPIC AREA, New Resource Options<br/>N/A: Necessary PREPA Maintenance



GOVERNMENT OF PUERTO RICO

PUBLIC SERVICE REGULATORY BOARD PUERTO RICO ENERGY BUREAU

FINAL RESOLUTION AND ORDER

ON THE PUERTO RICO ELECTRIC POWER AUTHORITY'S

INTEGRATED RESOURCE PLAN

CASE NO.: CEPR-AP-2018-0001

SUBJECT: Final Resolution and Order on

the Puerto Rico Electric Power Authority's Integrated Resource Plan.

IN REPREVIEW OF THE PUERTO RICO.

ELECTRIC POWER AUTHORITY

INTEGRATED RESOURCE PLAN

### Alignment with the IRP: Transitional Needs

Much of PREPA's generation, transmission and distribution system is fragile, distressed, and antiquated. Therefore, restoration and modernization efforts, particularly for thermal generation systems, are necessary for the reasons that follow:

- Most of the oil-fired generation plants are neither reliable enough, or suitable for frequent cycling, starts and stops expected with the future grid.
- FEMA funded equipment will provide new, modern, and flexible power generation equipment to replace retired oil-fired units; these designs will be tailored to suit the future.
- Hazard mitigation is managed with the FEMA funded equipment to provides emergency backup power generation at vulnerable locations and in the populated San Juan area.
- Grid inertia and stability must be maintained, and can be accomplished with multi-function, clutched generation units and/or dedicated synchronous condensers.
- Reconfigured peaker sites and black start systems, as defined in the S&L Thermal Plan, will provide benefits in near, mid and long terms and evolve with PREPA's needs.



#### Alignment with the IRP:

### **Design Factors and Complexities Shaping Generation Planning**



### Alignment with the IRP: Complex and Extensive Transformation to PREPA's Electrical System

#### Typical Additions and Deletions Shown for Discussion.





### Alignment with the IRP: Transmission Lines

In general terms, Transmission Line projects in the 10-Year Plan consider both existing and proposed new lines.

- *Existing lines* include all PREPA overhead transmission lines currently in service for the three voltage levels of 38 kV, 115 kV, and 230 kV; existing transmission lines that are listed in the IRP as necessary to support mini-grid development are included.
  - ✓ Specifically, existing 115 kV and 38 kV lines requiring hardening as defined in the following IRP Exhibits are included: Exhibits 2-11, 24, 36, 44, 52, 62, 71 and 84.
  - ✓ The Plan considers the hardening and rebuild of all existing overhead PREPA transmission lines to comply with new consensus-based codes and standards. It also considers the replacement of certain existing underground cables such as segments from the 115 kV San Juan underground loop and the submarine cables to Vieques and Culebra.
  - Priorities for existing lines were established considering system limitations, feasible operational line outages, and PREPA Operations and T&D recommendations.
- Proposed new lines include construction of new overhead and underground lines necessary for improved system reliability, stability, and to allow eventual mini-grid development. New transmission lines listed in the IRP as necessary to support mini-grid development are included.
  - ✓ Specifically, new 115 kV and 38 kV lines as defined in the following IRP Exhibits are included: Exhibits 2-09, 23, 35, 43, 51, 61, 69 and 83.
  - ✓ The Plan considers construction of these new lines to comply with new consensus-based codes and standards.
  - ✓ Priorities for development of new lines were assigned per IRP and Grid Analysis Constraints guidelines.



### Alignment with the IRP: Transmission Lines (Cont'd)

Transmission line projects (**Existing and New**) have been assigned for development in the 10-Year Plan according to the nature of the projects when they are planned for initiation:

#### • Project nature: three categories

- ✓ Hardening and Rebuild of 115 & 230 kV existing lines (including lines needed to support mini-grid development)
- ✓ Hardening and Rebuild of 38 kV existing lines (including lines needed to support mini-grid development)
- Development of new overhead and underground lines (all 3 voltages, including new lines needed to support mini-grid development)

#### • Timeframe for development: three terms

- ✓ Short-term (2021-2023),
- ✓ Intermediate-term (2024-2027),
- ✓ Long-term (2028 and beyond).



### Alignment with the IRP: 10 Year Plan Formulation: Distribution Lines

In general terms, Distribution Line projects in the 10-Year Plan consider hardening and potential mitigation for existing feeders.

#### • Project Identification

- ✓ PREPA has more than 1,100 distribution feeders in its system; all sustained damages during Hurricane María.
- $\checkmark$  The primary voltages of these feeders are 13.2, 8.32, 7.2, and 4.16 kV.
- ✓ PREPA identified all feeders in its system as potential hardening (or mitigation) candidates.
- Feeders will be hardened up to current codes and standards for their entire backbone length, as per PREPA MOR Document definition.
- As a mitigation alternative, feeders that have critical loads could be converted to underground express feeders from the substations up to the critical load areas.
- ✓ Distribution Automation features will be incorporated in all feeder projects as well as system integration requirements.
- ✓ Feeder projects consider potential integration of DER.



### Alignment with the IRP: 10 Year Plan Formulation: Distribution Lines (Cont'd)

#### • Project Grouping / Prioritization

- ✓ All feeders were assigned to the three project initiation time periods (shown below), and subsequently into two priority Tiers per time period.
- ✓ Feeders in each Tier were divided into the seven PREPA regions, for a total of 42 distribution feeder projects.
- ✓ Projects for Distribution Automation and Streetlights were also added for a total of 44 Distribution projects.
- Projects include hardening and mitigation of lines necessary for improved system reliability, stability, and to allow eventual development and interconnection of mini-grids.
- ✓ Priorities for lines were assigned as per performance (operational) and structural conditions.

#### • Timeframe for development: 3 Terms

- ✓ Short-term (2021-2023),
- ✓ Intermediate-term (2024-2027),
- ✓ Long-term (2028 and beyond).



- + Minimize the use of inefficient simple-cycle generation, such as peaking plants
- + Natural gas fuel must be primary fuel for new thermal generation
- + New generation projects to be configured to support mini-grids
- + Must include a broad range of dispatchable generation for hazard mitigation
- + Renewable energy generation must be a diverse mix and achieve RPS targets
- + Unreliable and inefficient oil-fired units must be removed from service
- + New thermal generation plants must be highly efficient, flexible, and preferably combinedcycle, tailored to work with the influx of renewables
- + Grid reliability and stability must improve
- + The overall production costs for electricity must remain stable with a target to decline
- + The use of more expensive diesel fuel must be minimal



# **Questions?**







### Regional Benefits Summary: Reliability & System Resiliency EXAMPLE PROJECTS Distribution (2021-2023 Project Start)



Legend

20

Impacted municipalities by projects in Carolina region

ion Impacted municipalities by projects in Caguas region

Impacted municipalities by projects in Ponce region

Note: All estimated investments and costs are subject to change once detailed inspections and engineering assessments are completed.

Impacted municipalities by projects in Mayaguez region

Mayaguez region Impacted municipalities by projects in Arecibo region

Impacted municipalities by projects in Bayamon region Impacted municipalities by projects in San Juan region

### Regional Benefits Summary: Reliability & System Resiliency EXAMPLE PROJECTS Distribution (2024-2027 Project Start)



Legend

Impacted municipalities by projects in Carolina region

Impacted municipalities by projects in Mayaguez region

region Impacted municipalities by projects in Caguas region

Impacted municipalities by projects in Arecibo region

Impacted municipalities by projects in Ponce region Impacted municipalities by projects in Bayamon region

Note: All estimated investments and costs are subject to change once detailed inspections and engineering assessments are completed.

Puerto Rico Electric Power Authority

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#### **Regional Benefits Summary: Reliability & System Resiliency EXAMPLE PROJECTS** Transmission, Generation, & Substation (2021-2023 Project Start)



22 \* Note: denotes a project within a municipality that is also impacted by the Transmission projects

Impacted municipalities by Substation projects

**Power Authority** 

### Regional Benefits Summary: Regulatory Compliance and Hazard Mitigation (2021-2030+ Project Start)

#### **EXAMPLE PROJECTS**





### **Regional Benefits Summary: Renewable Integration** (2021-2030+ Project Start)



### **Regional Benefits Summary: Automation and Modernization** (2021-2030+ Project Start)



