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JUNTA REGLAMENTADORA DEL SERVICIO PÚBLICO
NEGOCIADO DE ENERGÍA DE PUERTO RICO

IN RE: PLAN PRIORITARIO PARA LA ESTABILIZACIÓN DE LA RED ELÉCTRICA	Caso Núm.: NEPR-MI-2024-0005 Asunto: Presentación de Plan Preliminar de Estabilización del Sistema Eléctrico

MOCIÓN EN CUMPLIMIENTO DE ORDEN Y SOMETIENDO PLAN PRELIMINAR DE ESTABILIZACIÓN DEL SISTEMA ELÉCTRICO

AL HONORABLE NEGOCIADO DE ENERGÍA:

COMPARECE, GENERA PR, LLC ("Genera"), por conducto de la representación legal que suscribe y, muy respetuosamente, expone, argumenta y solicita:

1. El 13 de junio de 2024, el Negociado de Energía de la Junta Reglamentadora del Servicio Público ("Negociado") notificó una *Resolución y Orden* mediante la cual le ordenó a la Autoridad de Energía Eléctrica ("AEE"), a LUMA Energy, LLC y Luma Energy ServCo, LLC ("LUMA"), y a Genera PR, LLC ("Genera"), a "elaborar un plan preliminar agresivo de mejoras al sistema eléctrico". *Resolución y Orden*, en la pag. 1. En cumplimiento con lo ordenado, Genera acompaña como **Anejo 1** de esta Moción copia del *Plan Preliminar* requerido por el Negociado.

2. De otra parte, y en cumplimiento con la orden notificada el viernes 5 de julio de 2024, mediante la cual el Negociado nos requirió mostrar causa por la cual no debemos ser multados por no entregar el *Plan Preliminar* dentro del término establecido, Genera expone, muy respetuosamente, los siguientes fundamentos.

3. *Primero*, Genera reitera que la solicitud de breve extensión de tiempo respondió a razones justificadas y no a desidia o abandono de nuestra parte. Concretamente, la información solicitada en la *Resolución y Orden* de 13 de junio de 2024 es amplia y abarcadora, lo que requirió

a Genera y a sus consultores externos recopilar información y data sobre incidentes recientes en el sistema eléctrico, análisis de procedimientos, costos y estimados de logística y de tiempo para realizar los trabajos de reparación necesarios. Así pues, la breve prórroga solicitada respondió al interés de Genera de cumplir óptimamente con lo requerido por el Negociado.

4. *Segundo*, en un esfuerzo genuino para cumplir con las directrices del Negociado, Genera empleó todos los mecanismos a su disposición para poder presentar un documento completo el día de hoy, el próximo día laborable luego de la orden emitida. Genera comparte el sentido de urgencia que requiere llevar el sistema eléctrico de Puerto Rico a un nivel óptimo, y está comprometida con realizar todas las gestiones que estén a su alcance para lograr oportunamente las metas que le corresponden.

5. *Tercero*, el historial de Genera es uno de cumplimiento con las órdenes y determinaciones del Negociado. Reiteramos que esta ocasión no fue la excepción, y que la extensión solicitada respondió a un interés de cumplir responsable y cabalmente con lo ordenado. Genera afirma que continuará cumpliendo puntualmente con las órdenes y requerimientos del Negociado, y brindando un servicio de calidad a Puerto Rico.

EN MÉRITO DE LO ANTERIOR, Genera solicita muy respetuosamente al Negociado que tome conocimiento de lo aquí expuesto, acepte el *Plan Preliminar* que aquí se acompaña, y no imponga ninguna penalidad a Genera.

CERTIFICO que la presente moción se presentó el día de hoy mediante el sistema de radicación electrónica del Negociado de Energía, el cual notificará el escrito de forma automática a todos los abogados de récord, incluyendo al **Lcdo. Alexis Rivera**, arivera@gmlex.net; **Lcda. Luara T. Rozas**, laura.rozas@us.dlapiper.com; **Lcda. Valeria Belvis Aquino**, valeria.belvis@us.dlapiper.com.

En San Juan, Puerto Rico, el 8 de julio de 2024.

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Anejo 1

Electric System Stabilization Plan

Electric System Stabilization Plan

Version July 8, 2024

INFORMATIONAL USE DISCLAIMER

This document's content is furnished for informational use only and is subject to change without notice. The document should not be construed as a final commitment by Genera to execute all the initiatives listed herein or as a limitation to include additional initiatives. Importantly, this document is designed to be dynamic, subject to changes to adjust to situations in which it is warranted. The initiatives listed herein are part of Genera's plan but shall not be construed as these being the only initiatives. These are the most relevant. In parallel with these projects, Genera is developing or implementing additional initiatives to stabilize the electrical system. Further, this document is focused on the execution of genera's O&M Services under the LGA OMA. Thus, it is mostly focused on the stabilization of the LGA and coordinated efforts to bring reliable generation to the island, including ancillary services.

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Acronyms and Abbreviations

ACRONYM/ABBREVIATION	DEFINITION/CLARIFICATION
428 Guide	Public Assistance Alternative Procedures
Act 83-1941	PREPA's Enabling Act
AG	Aguirre Power Plant
BESS	Battery energy storage system
BOP	Balance of Plant
BTM	Behind the Meter
CC	Combined Cycle
CCGT P3	Combined Cycle Gas Turbine Public-Private Partnership
CMB	Cambalache Power Plant
CMMS	Computerized Maintenance Management System
COR3	Central Office for Recovery, Reconstruction and Resiliency
CS	Costa Sur Power Plant
DG	Daguao Power Plant
DNER	Department of Natural and Environmental Resources
DTOP	Department of Transportation and Public Works
EMT	Electro-Magnetic Transient
Energy Bureau or PREB	Puerto Rico Energy Bureau

ACRONYM/ABBREVIATION	DEFINITION/CLARIFICATION
EPA	U.S. Environmental Protection Agency
EQB	Environmental Quality Board
FEMA	Federal Emergency Management Agency
FOMB	Fiscal Oversight and Management Board
GDP	Gross Domestic Product
Genera	Genera PR, LLC as operator or the LGA
GNP	Gross National Product
GSU	Generator Step-Up Transformers
GTGs	Gas Turbine Generators
HMGP	404 Hazard Mitigation Grant Program
HRSGs	Heat Recovery Steam Generators
HUD	Housing and Urban Development
IRP	Integrated Resource Plan
JB	Jobos Power Plant
LGA	Legacy Generation Assets
LGA OMA	*Puerto Rico Thermal Generation Facilities Operation and Maintenance Agreement*
LNG	Liquefied Natural Gas
LOLE	Loss of Load Expectation
LUMA	LUMA Energy, LLC and LUMA Energy ServCo, LLC as T&D System Operator

ACRONYM/ABBREVIATION	DEFINITION/CLARIFICATION
MATS	Federal Mercury and Air Toxic Standards
MW	Megawatt
NEX	U.S. National Aeronautics and Space Administration Earth Exchange
NME	Necessary Maintenance Expense
No. 2	Diesel
O&M Services	Operation and Maintenance Services
OEM	Original Equipment Manufacturers
P3A	Public-Private Partnership Authority
POI	Points of Interconnection
POU	Publicly Owned Power Utility
PREPA	Puerto Rico Electric Power Authority
PRFC	Puerto Rico Firefighter's Corps
PRM	Planning Reserve Margin
PRPB	Puerto Rico Planning Board
PS	Palo Seco Power Plant
PTF	Performance Task Force
PV	Photovoltaic
RFPs	Requests for Proposals
RICE	Reciprocating Internal Combustion Engine

ACRONYM/ABBREVIATION	DEFINITION/CLARIFICATION
SFM	Single Family Housing Mitigation Program
SHPO	State Historic Preservation Office
SJ	San Juan Power Plant
STG	Steam Turbine Generator
T&D	Transmission and Distribution System
T&D OMA	Puerto Rico Transmission and Distribution System Operation and Maintenance Agreement
T&D System	Transmission and distribution system and related facilities
T&D System Operator	LUMA
TM / TM Units	GE TM 2500 Gas Turbine Units
TWh	Terawatt-hours
ULSD	Ultra-low Sulfur Diesel
USACE	United States Army Corps of Engineers
VB	Vega Baja Power Plant
YB	Yabucoa Power Plant

I. INTRODUCTION

Over the past five years, Puerto Rico's electrical system has been subjected to the unprecedented and historic transformation of its energy sector. Puerto Rico's economic recovery and social stability hinge on the ultimate success of this comprehensive change. The efforts leverage regulated, private-sector expertise, free from political interference, to enhance and stabilize Puerto Rico's electricity system while supporting its resident's quality of life and the island's long-term economic growth. Once fully implemented, these initiatives will allow Puerto Rico to achieve a safe, reliable and resilient electrical system.

In a world where energy is the cornerstone of progress, electric systems must stand for innovation and stability. The Electric System Stabilization Plan of Genera is designed to ensure the continuous, reliable generation of energy in tandem with the integration of renewable energy sources. At its heart, this plan encompasses a multifaceted approach that reconfigures existing power plants into new, multi-purpose grid support centers that include generation and energy storage equipment at strategic locations across the island; allocates space for future equipment expansion to improve efficiency, reduces production costs and/or grow with the island's needs; and utilizes operational features that are necessary to provide flexibility, responsiveness, and state-of-the-art control systems to manage and integrate the large, influx of renewable generation and energy storage projects planned in the near future. By leveraging these innovations, Genera can swiftly respond to fluctuations in power system supply or demand needs, mitigate the impacts of unforeseen outages, and enhance the grid's resilience to natural and unanticipated disruptions. Furthermore, the Electric System Stabilization Plan promotes the adoption of distributed energy resources, enabling localized generation and consumption that alleviates stress on the central grid. This proactive strategy not only safeguards the stability and reliability of the power supply, but also addresses hazard mitigation—supported and funded by FEMA as described herein—and, at the same time, provides a more sustainable energy future by seamlessly incorporating sustainable energy solutions and fostering a more adaptable, robust, and efficient generation of energy.

II. PUERTO RICO'S ELECTRIC POWER SYSTEM

A. History

PREPA created through Act 83-1941[1] has served throughout its history as the sole franchise utility electricity provider in Puerto Rico. PREPA's Enabling Act established PREPA as a public corporation with a legal existence separate from and independent from the Puerto Rico government.

PREPA is the largest POU in the US, based on the number of customers served, and it currently produces an annual net generation of 8 MWh/customer.[2] For decades the utility worked as a vertical monopoly, amassing debt beyond its means and failing to operate and maintain the electrical system up to appropriate standards. In FY2022 the utility generated approximately $4.1 billion in revenues from 16.3 TWh of electricity sales.[3]

Until 2014, to ensure accountability in long-term planning and rate setting, PREPA was self-regulated and operated without an independent regulatory body. Currently, PREPA is regulated by the Energy Bureau as well as the FOMB since the implementation of PROMESA[4] in 2016.

Today, LUMA, as the operator of the T&D System[5] and Genera, as the LGA operator[6] serve approximately 1.5 million customers on PREPA's behalf.

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[1] *Puerto Rico Electric Power Authority Act*, as amended.

[2] Based on publicly available data sourced from either EIA 412 or annual reports and the EIA 861 filings for FY2021. Utilities surveyed include Los Angeles Department of Water and Power; Long Island Power Authority; Salt River Project; City Public Service of San Antonio, Sacramento Municipal Utility District; Austin Energy; Jacksonville Electric Authority; Seattle City Light; Memphis Light, Gas and Water; Omaha Public Power District. Net Generation includes energy purchases as well as generated energy on a net basis.

[3] Monthly Report to PREPA's Governing Board, June 2022 (interim unaudited financial results).

[4] *Puerto Rico Oversight, Management and Economic Stability Act*, Public Law 114-187.

[5] Pursuant to the *Puerto Rico Transmission and Distribution System Operation and Maintenance Agreement* (T&D OMA) executed on June 22, 2020.

[6] Pursuant to the *Puerto Rico Thermal Generation Facilities Operation and Maintenance Agreement* (LGA OMA) executed on January 25, 2023.

B. Role of the Energy Bureau

Act 57-2014 established the Energy Bureau[7] as an independent and technical regulatory body to promote and enable the transparent implementation of Puerto Rico's energy policy. Act 57-2014 also established standards and procedures for the Energy Bureau to assess and approve electricity rates, requiring that rates be "just and reasonable, as well as consistent with sound fiscal and operational practices which result in a reliable service at the lowest reasonable cost."[8]

Pursuant to Act 57-2014 the Energy Bureau is responsible for promoting prudent investments practices, assuring increased quality of service to customers, and ensuring industry trends and technological advancements are appropriately incorporated into Puerto Rico's energy system.[9]

Several legislative acts, including, but not limited to, the following: (1) Act No. 83 of May 2, 1941, as amended, known as the "*Puerto Rico Electric Power Authority Act*"; (2) Act No. 114-2007, as amended, known as the "*Electric Power Authority Net Metering Program*"; (3) Act No. 83-2010, as amended, known as the "*Green Energy Incentives Act of Puerto Rico*"; (4) Act No. 82-2010, as amended, known as the "*Public Policy on Energy Diversification by Means of Sustainable and Alternative Renewable Energy in Puerto Rico Act*"; (5) Act No. 57-2014, as amended, known as the "*Puerto Rico Energy Transformation and RELIEF Act*"; (6) Act No. 120-2018, known as the "*Puerto Rico Electric Power System Transformation Act*" and (7) Act No. 17-2019, known as the "*Puerto Rico Energy Public Policy Act*" have strengthened the regulatory framework, granting the Energy Bureau greater authority and an independent administrative budget. Stakeholders and regulators, such as FOMB, have always emphasized the importance of the PREB, its expertise and its independence, as a critical part of the energy sector transformation. These measures set forth ambitious goals to enhance private sector operations and revitalize the energy sector whilst incorporating a strong regulator with the authority to ascertain compliance with Puerto Rico's energy goals.

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[7] *Puerto Rico Energy Transformation and RELIEF Act*, as amended.
[8] *Id.*
[9] *Id.*

C. Role of the FOMB

With the enactment of PROMESA by the United States Congress in 2016, the FOMB was established to provide Puerto Rico with a method to achieve fiscal responsibility, through pro-growth fiscal reforms and access to the capital markets. The FOMB is an independent entity within the Puerto Rico government and neither the government nor the Legislature may exercise any control, supervision, oversight, or review over it or its activities. The FOMB represents PREPA in the Title III debt restructuring process and has approval authority over its fiscal plan and all initiatives contemplated in the fiscal plan. Given that LUMA and Genera act on behalf of PREPA, those initiatives related to the electrical system that are contemplated in the fiscal plan must be approved by the FOMB as a condition to their execution and pursuant to FOMB's Contract Review Policy.

III. COMPONENTS OF THE ELECTRICAL SYSTEM

A. Transmission and Distribution System

Puerto Rico's T&D System is comprised of three major transmission loops that move electric generation from power plants concentrated along the southern coast of the main island to load centers concentrated in the northeast. The system's original transmission loop is the Central Loop, connecting CS, EcoEléctrica, and AG power plants in the south with the SJ power plant in the north via transmission centers at Aguas Buenas, Manatí, and Bayamón. The Western Loop, which began providing services in 2002, connects CS and EcoEléctrica power plants in the south with PREPA Mayagüez plant in the west, and the CMB plant in the north. The Eastern Loop, which entered service in 2006, connects AG and AES power plants in the south through transmission centers at Yabucoa in the east and Aguas Buenas and Sabana Llana in the north.[10]

The transmission system in Puerto Rico consists of 50 centers operating at 230 kV, 115 kV, and 38 kV, with over 1,100 miles of transmission lines and 1,500 miles of sub-transmission lines. The distribution system serves approximately 1.5 million customers and includes 1,100 circuits, with LUMA maintaining over 42,000 miles of distribution lines. The majority of both the transmission and distribution systems use overhead lines, with a small percentage of underground lines primarily in urban centers. Overall, the systems consist of various substations, poles, and service transformers to support the electrical infrastructure in Puerto Rico.

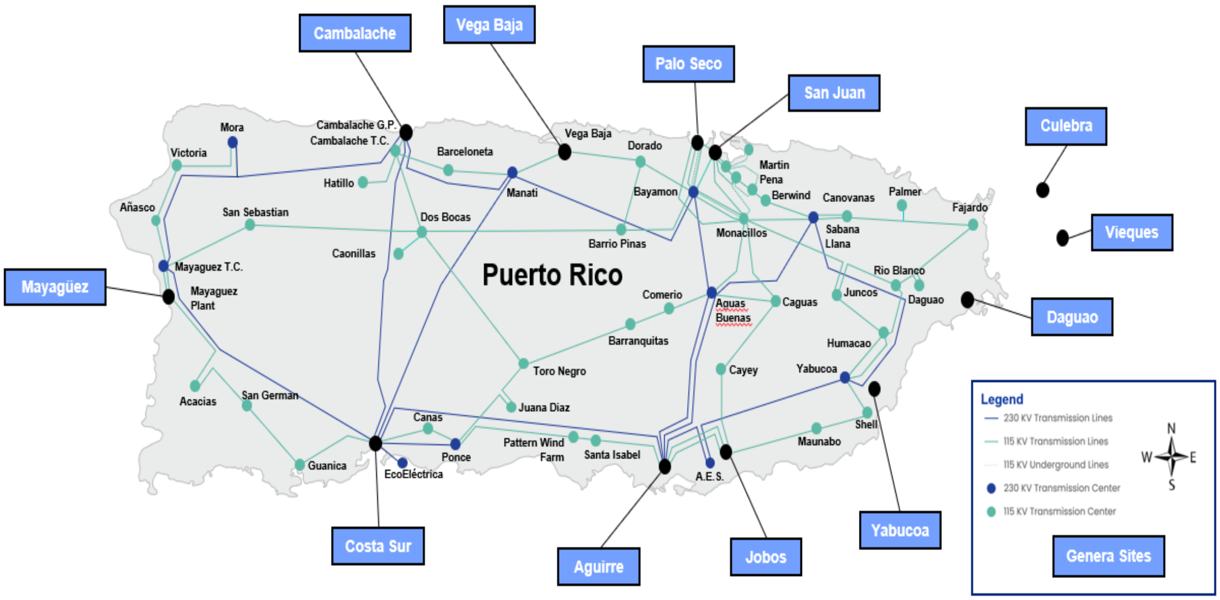
B. Generation System

Puerto Rico's electricity mainly comes from the following sources:

1. thermal power plants, or power plants that consume fossil fuels;
2. utility-scale renewable power plants, such as solar, wind, and hydroelectric;
3. BTM generators, such as solar panels on residential homes, or other similar sources.

[10] FY2023 PREPA Fiscal Plan at page 29.

Figure 1: Generation sites operated by Genera



Pursuant to the latest *Puerto Rico Electric System Adequacy Analysis Report* submitted by LUMA to the Energy Bureau on December 11, 2023, Puerto Rico's electric system has an installed nameplate, front-of-the-meter generating capacity of approximately 5,400 MW[11] of which only about 4,600 MW are currently operational. Of these, 92% of the operating generating capacity comes from dispatchable fossil fuel-fired generators (also known as thermal generators), including power plants that consume natural gas, oil, coal, and diesel fuel. The remaining generating capacity comes from renewable resources, predominantly solar, which adds to approximately 400 MW of nameplate capacity. In addition, as of March 2024, Puerto Rico has approximately 800 MW of installed BTM generation, primarily from rooftop solar PV energy sources.

[11] As per LUMA's Resource Adequacy Report, dated December 11, 2023 ("Resource Adequacy Report"), this value includes utility scale renewables, but excludes any BTM generating capacity. (for example, solar panels on the roofs of residential homes.)

Table 1: Summary of Expected Operating Thermal Generators in FY2024[12]

Generator Name	Start of Operations	Fuel	Nameplate Capacity (MW)	Available Capacity (MW)	Historic Force Outage Rate (%)
AES 1	2002	Coal	227	227	5
AES 2	2002	Coal	227	227	5
AG Combined Cycle 1	1977	Diesel	296	220	40
AG Combined Cycle 2	1977	Diesel	296	100	30
AG Steam 1	1971	Bunker	450	350	20
AG Steam 2	1971	Bunker	450	330	15
CS 5	1972	Natural Gas	410	350	12
CS 6	1973	Natural Gas	410	350	15
EcoEléctrica	1999	Natural Gas	535	535	2
PS 3	1968	Bunker	216	190	12
PS 4	1968	Bunker	216	190	18
SJ 7	1965	Bunker	100	70	30
SJ 9	1968	Bunker	100	90	8
SJ Combined Cycle 5	2008	Diesel / Natural Gas	220	200	12
SJ Combined Cycle 6	2008	Diesel / Natural Gas	220	200	12

[12] *Id.* Page 26-27.

Generator Name	Start of Operations	Fuel	Nameplate Capacity (MW)	Available Capacity (MW)	Historic Force Outage Rate (%)
CMB 2	1998	Diesel	82.5	75	10
CMB 3	1998	Diesel	82.5	75	10
Mayagüez 1	2009	Diesel	55	50	30
Mayagüez 2	2009	Diesel	55	25	30
Mayagüez 3	2009	Diesel	50	50	30
Mayagüez 4	2009	Diesel	50	50	30
PS Mobile Pack 1-3	2021	Diesel	27 each (81 total)	81	9
7 Gas Turbines (Peakers)	1972	Diesel	21 each (147 total)	147	40
Total			4,976	4,182	---

Table 2: Summary of Operating Renewable Generators[13]

Generator Name	Commercial Operation Date	Fuel	Nameplate Capacity (MW)
AES Ilumina	2012	Sun	20
Fonroche Humacao	2016	Sun	40
Horizon Energy	2016	Sun	10
Yarotek (Oriana)	2016	Sun	45
San Fermin Solar	2015	Sun	20
Windmar (Cantera Martino)	2011	Sun	2.1
Windmar (Vista Alegre / Coto Laurel)	2016	Sun	10
Pattern (Santa Isabel)	2012	Wind	75
Fajardo Landfill Tech	2016	Methane Gas	2.4
Toa Baja Landfill Tech	2016	Methane Gas	2.4
Punta Lima	2023	Wind	26
CIRO 1[14]	2023	Sun	90
Xzerta	2024	Sun	60
Total			402.9

[13] *Id. Page 28.*
[14] It is Genera's understanding that the CIRO and Xzerta projects are not in operation.

Table 3: Summary of BTM Generation by Area[15]

Area	BTM Generation
Caguas	108
Bayamon	119
Ponce	82
Carolina	75
Mayagüez	63
San Juan	79
Arecibo	54
Total	580

PREPA also generates less than 1% of electricity through its hydropower assets portfolio which consists of ten hydroelectric power plants around Puerto Rico and four irrigation facilities, two in the CS District (one in the east and one in the west), one in the Isabela District and one in the Lajas Valley District. In total, the ten hydroelectric units have an installed capacity of approximately ~100 MW, with an available capacity of ~24%.[16] PREPA HoldCo[17] is currently responsible for the operation of the hydroelectric units at 15 sites, three irrigation systems, and 20 dams and reservoirs.

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[15] *Id.* Page 29. As of March 30, 2024, there were a total of 800 MW of BTM generation. https://energia.pr.gov/wp-content/uploads/sites/7/2024/04/20240425-MI20190016-Motion-Submitting-Interconnections-Progress-Report-for-January-through-March-2024-and-Supporting-Materials.pdf.

[16] Daily Generation Availability Report 6/23/2024: https://lumapr.com/wp-content/uploads/2024/06/20240623-Daily-Availability-Report.pdf.

[17] As part of the requirements of Act 17-2019, PREPA was prohibited from continuing to operate as a vertical monopoly, mandating the unbundling of T&D and generational operations into separate and distinct entities that would operate under PREPA HoldCo.

IV. TRANSFORMATION OF THE ENERGY SECTOR: NEW OPERATORS

On January 22, 2018, after Hurricane Maria, the Government of Puerto Rico, in coordination with the FOMB, outlined a public policy vision for the energy sector's transformation. The policy's purpose was intended to represent the need for a customer-centric, safe, reliable, resilient, sustainable, and cost-efficient electric power service that met environmental, regulatory, and statutory requirements. This development would be enabled by competent and experienced third-party operators for the generation and T&D System along with improved independent regulatory oversight and insulation from political interference. In response to this policy, on April 11, 2019, the Governor of Puerto Rico signed into law Act 17-2019[18] which establishes, among other things, the regulatory framework for Puerto Rico's energy sector and PREPA's transformation. As a result of this effort on June 22, 2020, PREPA and the P3A executed the T&D OMA with LUMA[19] as the private operator for PREPA's T&D System operations and on January 24, 2023, both PREPA and P3A executed the LGA OMA with Genera.[20]

A. LUMA

The T&D OMA establishes the roles and responsibilities of PREPA, the P3A and LUMA in what involves the transition of the operation and management of the T&D system into a private third-party operator. Under this agreement, PREPA retains ownership of the T&D assets, while P3A serves as the contract manager overseeing LUMA's performance. In exchange for a fixed fee and performance metrics incentives, LUMA is tasked with operating, managing, maintaining, repairing, and restoring the

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[18] *Puerto Rico Energy Public Policy Act*, as amended.

[19] *Operation and Maintenance of the Transmission and Distribution System Agreement* dated as of June 22, 2020, by and among PREPA, LUMA Energy, LLC, LUMA Energy Servco, LLC and the P3A, (hereinafter "T&D OMA"). The execution copy of the OMA is available at https://assets.website-files.com/6669ee6957f820065525f6c1/6669ee6957f820065525fbf4_executed-consolidated-om-agreement-td.pdf. (Last verified June 19, 2024).

[20] *Thermal Generation Facilities Operation and Maintenance Agreement* dated as of January 24, 2023, by and among PREPA, Genera PR LLC and the P3A (hereinafter "LGA OMA"). The execution copy of the OMA is available at https://assets.website-files.com/6669ee6957f820065525f6c1/6669ee6957f820065525fabb_230124-LGA-OM-Agreement.pdf.

electric grid. The agreement outlines a 15-year partnership with provisions for service quality, performance metrics, and penalties for non-compliance, ensuring accountability and promoting modernization of Puerto Rico's electric infrastructure.

LUMA is responsible for coordinating the dispatch, scheduling, and coordination of power and electricity from various generation assets, as well as managing load requirements and implementing system operation principles.[21] Further, it must ensure resource adequacy through new generation procurement, based on an Integrated Resource Plan and in accordance with applicable law, and subject to approval by the relevant regulatory body and prepare risk assessments, and meet with the regulatory body annually to review demand projections and assess the need for additional power supply sources.[22] LUMA has been doing so through the Resource Adequacy reports, which are discussed in more detail in a subsequent section. LUMA is also responsible for preparing a proposed Integrated Resource Plan for review and approval by PREB.[23]

B. Genera

On January 24, 2023, PREPA, P3A and Genera executed the LGA OMA which provides for the LGA O&M Services of certain baseload generation plants and combustion turbine peaking units defined therein as LGA. With the intent of leading the way to a more reliable energy future, Genera was selected, through a competitive bidding process implemented by the P3A for a 10-year operation and maintenance agreement intended for the management, operation, and maintenance of LGA fuel supply, and decommissioning, where applicable, of the generation assets. The O&M Services provided by Genera are:

- Management, operation, maintenance, repair, and other related services with respect to the LGA.
- Managing and maintaining all assets of the LGA, including machinery, equipment, structures, improvements, and condition assessment of the components.

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[21] T&D OMA, *O&M Services,* Article 5, Section 5.13(a)(i).
[22] *Id*. Section 5.13(d).
[23] *Id.* Section 5.6(f).

- Conducting government, community, and media relations regarding the management, operation, and maintenance of the LGA.
- Conducting the Annual Performance Test for each LGA, in coordination with the T&D System Operator, P3A, and PREB.
- Finance, accounting, budgeting, longer-term financial forecasting, and treasury operations related to the LGA.
- Responding to emergency conditions, including curtailments and shutdowns, and implementing the Legacy Generation Emergency Response Plan.
- Performing all normal and ordinary maintenance (including any major maintenance) of all property constituting the LGA.

Genera will stabilize and optimize the operations of Puerto Rico's LGA[24] until replacement baseload, renewable and distributed energy generation is installed and the LGA are decommissioned.

Consistent with the preceding, through the services rendered in accordance with the LGA OMA, Genera will:

- Transform PREPA's generation facilities into a modern, sustainable, reliable, efficient, cost-effective, and resilient infrastructure with technologically and operationally prudent practices to improve and increase power generation.
- Deliver cost-effective power generation to the transmission and distribution system.
- Increase resiliency, achieving performance in line with codes, specifications, and standards consistent with U.S. mainland power generation facilities.
- Increase generation reliability; and
- Implement industry best practices and operational excellence through managerial continuity and long-term planning.

[24] PREPA FY2023 Fiscal Plan at page 63.

V. ELECTRIC SYSTEM CHALLENGES

A. Geography

Puerto Rico is a tropical island with many inherent complexities in providing electricity including mountainous geography, yearlong vegetation growth as well as infrastructure challenges adding the fact that most generation production is in the south of the island while most generation demand is in the north. Additionally, Puerto Rico cannot rely on access to a larger, regional, and interconnected power grid for regulation and power generation like most parts of the U.S. mainland. Other complexities and issues such as availability and access to materials, personnel, and equipment affect the cost of delivering electricity. Lastly, decades of operational, maintenance, and financial mismanagement have exacerbated the difficulties of operating an electrical system on the island resulting in the system lagging far behind national standards.[25]

B. Financial

PREPA's ongoing financial deficits are largely due to decades of fiscal and operational mismanagement and a historical inability to set energy rates high enough to cover costs and necessary capital investments for modernizing its energy system. Since 2004, PREPA has operated with a structural financial deficit, which has only worsened over time. To cut costs, PREPA historically reduced or stopped investing in system upgrades, resulting in an energy system that is vulnerable to frequent and prolonged outages and voltage fluctuations.[26]

Over the past decade, revenues have declined due to out-migration, economic downturns, and the increased adoption of distributed generation and energy efficiency measures. As the revenue base shrank, higher rates and associated volatility led to an increase in outstanding collections and bad debt, prompting customers to invest more in energy efficiency and reduce their reliance on the grid, which further decreased PREPA's revenues. To address liquidity challenges, PREPA

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[25] *Id* at page 30.
[26] Statement of Motives Act 120-2018.

financed its fuel procurement through credit lines, exacerbating its unsustainable debt.

By FY2014, PREPA's financial condition had deteriorated so much that it had to enter into forbearance agreements with creditors due to insufficient funds to service its debt. PREPA has faced several macroeconomic challenges in recent years. Since 2007, Puerto Rico's economy has declined, with GNP falling by 20% over this 15-year period.[27] Concurrently, increasing out-migration has led to a population decline of over 15% since 2004, reducing PREPA's revenue base. As a result, by 2022, energy sales had dropped by 21% from their peak in 2007. Throughout this period, existing customers have had to pay higher rates to cover overall system costs, including fuel and operations and maintenance, as these costs are spread over fewer total kWh sales. In the future, assuming continued population decline, and GDP contraction projected in Puerto Rico's certified fiscal plan, customer rates will need to keep increasing to generate the same level of revenues.[28]

As of May 2017, PREPA had accumulated approximately $9 billion in debt and over $4 billion in pension liabilities, of which $3.6 billion was unfunded.[29] In response, on July 2, 2017, the FOMB filed a petition on PREPA's behalf for bankruptcy relief under Title III of PROMESA before the U.S. District Court for the District of Puerto Rico. Since filing for bankruptcy relief, PREPA has improved its cash flow and liquidity monitoring, reporting, controls, and communications. These improvements have been instrumental in preserving PREPA's financial stability through the significant disruptions caused by hurricanes Maria and Fiona, the earthquakes of January 2020, the COVID-19 pandemic and current geopolitical situations impacting fuel supply and prices.

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[27] Puerto Rico Department of Labor and Human Resources, 2022: https://www.dol.gov/sites/dolgov/files/eta/Performance/pdfs/annual_economic_reports/PY2021/PR PY21 Economic Analysis Report.pdf.

[28] PREPA FY2023 Fiscal Plan at page 34.

[29] 2023 PREPA Fiscal Plan at page 21.

C. Age of Generation Fleet

The electric power generation system in Puerto Rico is approximately thirty (30) years older than the electric power industry average in the United States.[30] Efforts to diversify and maintain generation resources have failed, resulting in an aging and inefficient generation fleet. Aging assets present operational challenges, such as reduced operational flexibility due to slower ramp-up capacity, a higher likelihood of outages, increased costs per megawatt-hour generated, and non-compliance with environmental and health regulations. Furthermore, PREPA-owned generation plants experience high unavailability due to ongoing deratings and both forced and planned outages, leading to only 40-50% of PREPA-owned generation being available for service on average during FY2022, considering the full 8,760 hours.[31] Despite significant investment in NME in recent years, the availability of PREPA's generation fleet has decreased, making the combination of an aging and inefficient fleet a considerable challenge to the stability of the electrical system.

D. Natural Disasters and Climate Change

Puerto Rico's electricity system and operation are at a considerable risk of being affected by the constant threat and consequences of climate change. Even though it is difficult to estimate and quantify the ultimate risk climate change poses, experience has demonstrated that increased wind, rain events and hurricanes result in higher costs of repair and reduced demand due to outages on a per-event basis.[32] Puerto Rico is no stranger to the effects of climate change on our environment. Studies show that our Island's climate is changing and that the coastal communities, sea level, infrastructure, fauna, and ecosystems are vulnerable to such changes. From 1980–2024 (as of June 10, 2024), there have been 8 confirmed weather/climate disaster events with losses exceeding $1 billion, each affecting Puerto Rico. These events included 8 tropical cyclone events. The 1980–2023 annual average is 0.2 events (CPI-

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[30] Statement of Motive Act 17-2019.

[31] LUMA June Generation Stabilization Plan Report – May 28, 2023- Docket: NEPR-MI-2022-0003.

[32] Statement of Motives "Puerto Rico Climate Change Mitigation, Adaptation, and Resilience Act", Act 33-2019.

adjusted); the annual average for the most recent 5 years (2019–2023) is 0.4 events (CPI-adjusted).[33]

Figure 2: Impact of Climate Effects on PREPA

Impact Level	Climate Effects	Description	Impact on PREPA
	Damage from extreme wind	• **Frequency** of extreme wind days have **increased 28%** since 1980 • While average intensity has remained stable since 1980, **maximum wind speeds have increased**	• **Loss of revenue** due to outages • **Increased costs** to repair storm damage • **Increased intensity** of individual severe weather events suggest **greater repair and lost demand costs** on a per-event basis
	Damage from extreme precipitation	• Projections suggest a 15% to 25% **decrease in extreme precipitation days** • Projected increased in intensity of extreme precipitation days suggest a shift toward less frequent, more severe events (i.e., hurricanes)	
	Damage from coastal flooding	• Projected 1 to 2 ft sea level rise by 2050 expected to **increase risk of coastal inundation and flooding** • **Greatest risk** posed to **Northeast regions** (i.e., San Juan)	
	Wildfire risk	• Natural **forests** cover **significant share** of PR land mass • Rising temperatures can **increase wildfire potential** and subsequent risk of **fire hazard** and **powerline damage**	
	Heat stress	• Higher average temperatures could **increase surges in demand for A/C (currently 27% of total energy demand for hot-humid climates)** • **Heat waves** and **droughts**, however, pose risks to **infrastructure**	• **Increased demand** for electricity • **Potential increase in revenue** due to increased demand
	Decreased transmission efficiency	• **Energy loss** in transmission and distribution is **positively correlated with temperature**	• **Increased generation required to meet equivalent demand** due to increased energy loss • **Increased costs** to increase generated load and generation capacity

GeneraPR

1. Hurricanes

Puerto Rico's location in the Caribbean makes its energy system vulnerable to the wide-ranging impacts of climate change, such as hurricanes, heat stress, and coastal flooding. Additionally, the island is prone to earthquakes and hurricanes, which severely affect PREPA's fragile grid, causing island-wide blackouts and extensive damage to the transmission and distribution network. Climate projections indicate that Puerto Rico may face significant climate events over the next 30 years, including: (1) less frequent but more intense extreme precipitation events, and (2) a potential sea level rise of one to two feet, posing risks from coastal flooding and inundation, especially in the densely populated northeastern areas of the island. [34]

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[33] https://www.ncei.noaa.gov/access/billions/state-summary/PR.

[34] U.S. National Aeronautics and Space Administration Earth Exchange ("NEX") down-scaled climate model data, historical for 1976-2005 and future Representative Concentration Pathways ("RCP") 4.5 scenario for 2021-2050. U.S. National Oceanic & Atmospheric Administration National Centers for Environmental Information & Cooperative Institute for Climate & Satellites-North Carolina. Intermediate sea-level rise scenario.

In September 2017, Hurricanes Irma and Maria caused most of the T&D system in Puerto Rico to collapse, leading to one of the most extended blackouts in U.S. history and leaving residents in some parts of the territory without electricity for almost a year. Communications, water and wastewater, transportation, healthcare, and critical manufacturing sectors similarly experienced severe disruptions, in most cases caused by electricity infrastructure damage or exacerbated by the underlying instability of the grid. Puerto Rico estimates that $132 billion will be needed to repair and reconstruct infrastructure and services through 2028.[35]

In September 2022, Hurricane Fiona hit Puerto Rico, causing significant impacts: parts of the island recorded 100 mph winds, up to 30 inches of rain, and widespread flooding. As in 2017, Fiona damaged the electrical grid, leaving Puerto Rico in a full blackout. Hurricane Fiona resulted in more than $4 billion in damage to critical T&D assets. It also resulted in approximately $20 million in damages to PREPA's generation fleet, dams, hydroelectric systems, irrigation systems, and reservoirs.[36]

2. Earthquakes

Earthquakes have caused significant damage to utility infrastructure in Puerto Rico, also posing risks to generation assets and transmission lines due to falling trees and branches. Managing and mitigating these seismic risks is crucial for future system improvement plans. On January 7, 2020, a 6.4 magnitude earthquake struck Puerto Rico's southwest coast, damaging the CS Power Plant and causing notable, albeit less severe, damage to EcoEléctrica.[37] In the immediate aftermath, about two-thirds of the island's population was left without power for several days. The loss of these two natural gas power plants increased the system's reliance on more costly oil-fired power plants. As a result, PREPA dispatched its diesel peaking plants to balance the load. Consequently, the share of total monthly generation from natural

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[35] *Puerto Rico Disaster Recovery FEMA Actions Needed to Strengthen Project Cost Estimation and Awareness of Program Guidance*, United States Government Accountability Office, Report to Congressional Requesters: https://www.gao.gov/assets/gao-20-221.pdf.

[36] PREPA FY2023 Fiscal Plan at page 31.

[37] Between December 28, 2019, and mid-April 2020, more than 2,000 earthquakes hit the island of Puerto Rico, of which 30 were of magnitude above 4.5 and five of a magnitude above 5.5 on Richter Scale.

gas declined by about 70% from December 2019 to January 2020, while the share of generation from diesel nearly tripled.

VI. PUERTO RICO ENERGY POLICY AND LEGAL MANDATES

A. Legal Mandates and the Integrated Resource Plan

Puerto Rico's energy public policy and regulatory framework includes, but is not limited, to the following laws: (a) Act 83-1941; (b) Act 114-2007[38]; (c) Act 83-2010[39]; (d) Act No. 82-2010[40]; (e) Act 57- 2014, as amended; (f) Act 120-2018, as amended; and (g) Act 17-2019[41]. Currently, and as required by these legislations, the principal legal mandates applicable to the electric system's transformation are the termination of PREPA as a monopoly; all non-renewable-based generation plants (whether new or existing) must be capable of operating on two or more fuels (being natural gas the primary); and, to reach the Renewable Portfolio Standards of forty percent (40%) on or before 2025; sixty percent (60%) on or before 2040; and one hundred percent (100%) on or before 2050. Act 57-2014 mandates the creation of the IRP by PREPA. The IRP considers various scenarios, load forecasts, and necessary improvements over a 20-year period. It is a strategic roadmap for Puerto Rico's electric grid development. It ensures reliability, efficiency, and transparency in the power system.

The operative version of the IRP was approved on August 24, 2020. It outlines a comprehensive strategy for the island's energy future, focusing on resilience, reliability, and sustainability. This plan aims to transition Puerto Rico's energy system from its heavy dependence on fossil fuels to a more diverse and renewable energy portfolio. Key objectives include the retirement of older, less efficient fossil fuel plants, the integration of substantial renewable energy sources, and the modernization of the electrical grid. The IRP emphasizes the importance of distributed energy resources,

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[38] *Electric Power Authority Net Metering Program*, as amended.
[39] *Green Energy Incentives Act of Puerto Rico*, as amended.
[40] *Public Policy on Energy Diversification by Means of Sustainable and Alternative Renewable Energy in Puerto Rico Act*, as amended.
[41] *Puerto Rico Energy Public Policy Act*, as amended.

such as rooftop solar and battery storage, to enhance grid stability and reduce the vulnerability of the energy system to natural disasters.[42]

B. Procurement of Renewable Energy

With the IRP, the Energy Bureau recognized the new structure envisioned by the Puerto Rico Legislature regarding the need for the electric system to have a new competitive power-generation market not subject to the exercise of monopoly power.[43] The Modified Action Plan considers specific power generation capacity additions[44] it established a competitive procurement process for implementation of six (6) tranches for the procurement of up to 3,370 MW of renewable energy and 1,500 MW of storage resources from third parties.[45] Even though new power generation assets will not be owned by PREPA, the Modified Action Plan recognizes that PREPA will continue the operation of the older, oil-fired power generation assets until their retirement.[46]

C. Peaker Replacement and Large Boilers Retirement

In terms of peaker replacement, the IRP approved a limited replacement of the worst-performing Frame 5 peaking units' capacity through a competitive bidding process, agnostic of technology. Regarding retirements, the plan calls for the retirement within the next five years of a portion of the Frame 5 peaking units, and the following steam units: AG Steam 1 and 2; AG CC 1 and 2; SJ 7, 8, 9 and 10; Palo Seco 3 and 4; and CS 5 and 6. Retirement is subject to availability of new generation resources as detailed in the Approved Modified Action Plan. Furthermore, the plan mandates the retirement of the AES plant by the end of 2027.

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[42] Final Resolution and Order on the *Puerto Rico Electric Power Authority's Integrated Resource Plan*, In Re: Review of the Puerto Rico Electric Power Authority Integrated Resource Plan, Case No. CEPR-AP-2018-0001, August 24, 2020 ("Approved IRP"): https://energia.pr.gov/wp-content/uploads/sites/7/2020/08/AP20180001-IRP-Final-Resolution-and-Order.pdf.

[43] *Id.*, pp. 23-25.

[44] *Id.*, ¶¶847-867, pp. 263-269.

[45] *Id.*, ¶ 860, pp. 266-268.

[46] Approved IRP, ¶¶869-873, pp. 270-271.

D. Conversion to Dual-Fuel

Another of Act 17-2019's objectives is "[t]o promote the use of small-scale electric power plants with capacity to operate with a diversified fuel mix, one of which shall be natural gas, that reduce greenhouse gas emissions, with more modern technology and associated infrastructure and high-efficiency capacity, as defined by the Energy Bureau and capable of integrating distributed generation and renewable energy into the electric power grid."[47]. It also provides that "[e]very new or existing electric power plant, as of [April 11, 2019], other than those operating exclusively on renewable energy sources shall have the capacity to generate power from two (2) or more fuels, one of which shall be natural gas[.]"[48] Dual fuel swaps offer several significant benefits including adding fuel flexibility, allowing operators to switch between fuels based on cost and availability, thus optimizing fuel expenses. They also reduce reliance on a single fuel source, enhancing energy security and operational resilience. Additionally, dual fuel systems can lower emissions, as natural gas burns cleaner than diesel, contributing to reduced environmental impact and compliance with stringent emission regulations whilst the transition to renewables ensues.

VII. INVESTMENT SOURCES

The operation of PREPA is financed by rates paid by consumers. The rates are divided between base rates (which are amended during a rate case) and riders to recover certain costs, like fuel. The latter are pass-through expenditures that customers pay only for the expenses incurred. Nevertheless, over the last five years, PREPA has received a substantial influx of funds stemming from grants by the Federal Government in response to hurricanes Irma and Maria in 2017 and the 2019 and 2020 earthquakes.

A. Rates

In a rate proceeding, the regulator determines the total revenue needed to provide service, allocates among customer classes the responsibility for paying that revenue, and then establishes rates for each class so that, when those rates are paid, the utility receives the revenue it needs from the customer classes responsible for

[47] Act 17-2019 at Sec. 1.6 (2).
[48] *Id.* at Sec. 1.11(a).

providing that revenue. In the case of Puerto Rico, Act 57-2014 establishes the procedures and standards for evaluating and establishing electric rates to be charged by PREPA and grants PREB the authority to implement those processes. In furtherance of this process, PREB is to take into account (i) the state of PREPA's infrastructure; (ii) the costs it incurs in providing electricity services; (iii) its level of debt and debt service responsibilities; (iv) its ability to improve services and reduced costs; (v) the adoption of energy conservation and efficiency measures; (vi) the impact legal requirements, such as subsidies and grants, have on PREPA's revenue needs; and (vii) input from intervenors and general public.

The current rate structure, in accordance with Act 57-2014, was established and approved within PREB's Resolution and Order in case CEPR-AP-2015-0001 dated January 10, 2017. At the time PREPA's rates had been unchanged since 1989. The order mandated several key actions, including the implementation of new rates that reflected the actual costs of providing electricity services, the introduction of mechanisms to encourage efficiency and accountability within PREPA, and the promotion of transparency in its operations. Additionally, the resolution highlighted the importance of modernizing the electric grid and investing in renewable energy sources to create a more resilient and sustainable energy system for Puerto Rico. The Energy Bureau emphasized the need for ongoing oversight and periodic reviews to ensure that the established rates remain aligned with the evolving energy landscape and the needs of the consumers. This rate structure is anticipated to stay in effect until the next rate case which started with PREB Resolution and Order in case NEPR-AP-2023-0003 dated June 30,2023.

B. Federal funds

While both the hurricanes and earthquakes caused unimaginable devastation on the island, part of the Federal Government response was the authorization of historical amounts of Federal recovery funding. As of June 2023, FEMA had awarded about $23 billion in Public Assistance to Puerto Rico's permanent recovery work related to hurricanes Irma and Maria and the 2019 and 2020 earthquakes, as of June 2023.[49]

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[49] "Puerto Rico Disasters Progress Made, but the Recovery Continues to Face Challenges" United States Government Accountability Office, Report to Congressional Requesters dated February 2024.https://www.gao.gov/assets/gao-24-105557-highlights.pdf.

Of those, $12.8 billion have been specifically earmarked for the energy sector from both FEMA and HUD because of the hurricanes and $416 million have been earmarked for earthquake related damages. Part of the funds assigned to Puerto Rico were provided under the HMGP. Having funds allocated under hazard mitigation status allows for work to be performed for long-term benefits as it allows "any sustained action taken to reduce or eliminate long-term risk to people and property from natural hazards and their effects. This definition distinguishes actions that have a long-term impact from those more closely associated with immediate preparedness, response, and recovery activities. Hazard mitigation is the only phase of emergency management specifically dedicated to breaking the cycle of damage, reconstruction, and repeated damage."[50]

In February 2020, FEMA published the 428 Guide.[51] This guide applies to large permanent works projects in Puerto Rico, particularly for critical service facilities. According to the guide, FEMA will develop cost estimates for eligible projects. In some cases, these estimates may be validated by a third-party independent expert panel. USACE Cost Engineering Center of Expertise serves as this Expert Panel. To support these efforts, the COR3 has hired various third-party experts with extensive global experience in disaster recovery and reconstruction. These experts bring skills in project formulation and grant management, technology solutions, software development, report and data management, strategy compliance, financial management, and energy-related matters. Puerto Rico is advancing its economic and disaster recovery by investing in infrastructure, its people, and the environment. Federal funds from FEMA and other government entities are crucial in achieving these targets.

VIII. GENERATION SYSTEM STATUS

A. Pre-Genera Generation System Status

The condition and performance of PREPA's aging plants has continued to deteriorate over the years. Availability of the system's generating units dropped by approximately 18% from calendar year 2015 to 2022. In part aggravated by the hurricanes and other events, forced outages of generating units have also seen an

[50] Department of Emergency and Military Affairs, Mitigation: https://dema.az.gov/emergency-management/operations-and-coordination/recovery (last visited on August 1, 2022).
[51] Section 428, Guide for Permanent Work (FEMA-4339-DR-PR) (February 2020).

increase of approximately 88% over the same period and underperformed peer units, exemplifying the unreliability of PREPA's legacy generating fleet.[52] The net heat rate of generating units has also seen an increase of roughly 800 Btu/kWh from FY2016 to FY2023.[53] These trends point to growing inefficiencies and unreliability as these units continue to age.

Figure 3: System Status as Found on June 30, 2023

GENERATOR	COD	NAMEPLATE CAPACITY (MW)	CURRENT CAPACITY	NOTES
Aguirre 1	May 1975	450	0	Under maintenance
San Juan 7	May 1965	100	0	Under maintenance
Palo Seco 3	Feb 1970	216	0	Under repair
Aguirre 2	Oct 1975	450	0	Under repair
Costa Sur 5	Sep 1972	410	180	In service with limitations
Costa Sur 6	Sep 1973	410	310	In service with limitations
Palo Seco 4	Jul 1970	216	185	In service with limitations
Ag CC 1&2	July 1977	592	198	In service with limitations
Mayaguez	Apr 2009	220	171	In service with limitations
Cambalache	Apr 1997	247	154	Failures and limitations
Peakers Fleet	(18) 1971 & (3) 2019	396	137	Failures and limitations
San Juan 5	Oct 2008	220	203	Normal operation
San Juan 6	Oct 2008	220	205	Normal operation
San Juan 9	June 1968	100	90	Normal operation
	TOTALS	4247 MW	1833 MW	Available Capacity

GENERATION SUMMARY	MW	%
PREPA LGA Total Installed Capacity	4,247	100%
PREPA LGA Available Capacity	**1, 833**	**43%**
PREPA LGA unavailable	2, 414	57%

Unit in maintenance or repair | Unit in operation with limited capacity | Unit in normal operation

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B. Post-Genera Generation System Metrics and Performance

Over the past year, Genera made notable progress in the capacity and actual capacity of total generation by executing strategic projects and implementing short-term repairs and maintenance work on various plants and generators including AG 1 & 2, SJ 5, 6, 7, & 9, PS 3 & 4, PS 5 & 6, Mayagüez, CMB, AG CC 1 & 2 and the peakers fleet. With these repair and maintenance initiatives, Genera plans to attain short-term goals of increasing planned maintenance work by 15%, increasing availability of generation

[52] As reported and calculated by PREPA. Equivalent Force Outage Rate (%) – Weighted, increased from 19.6% in 2015 to 36.9% in 2022.
[53] Figures derive from PREPA Monthly Report to the Governing Board 2016 and Performance Metrics Summary Report April 2023.

of 60% by July 2024, reduce load shedding events by 90% and by December 2025 reduce forced outage events by 50%.

Figure 4: Key Performance Indicators – 2023 vs Actual (2024)

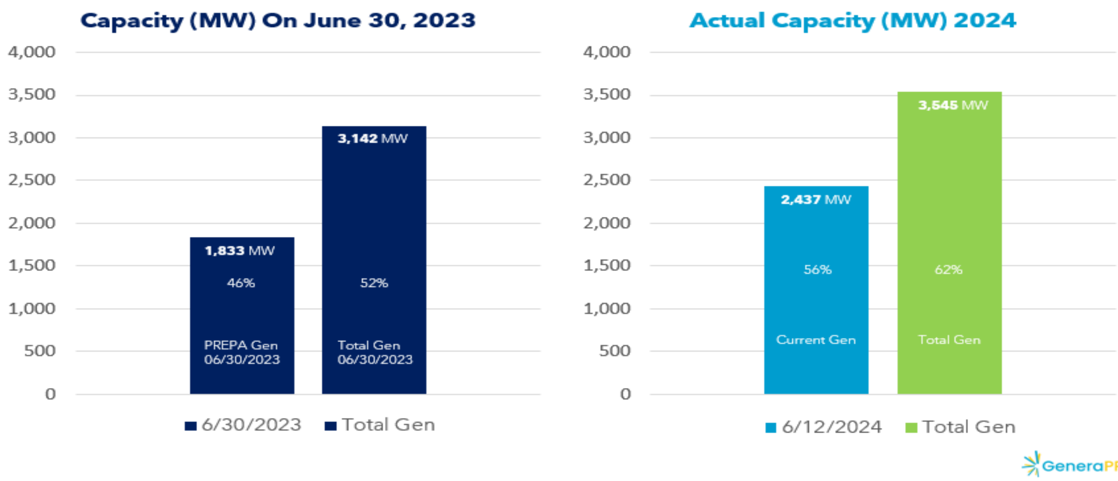
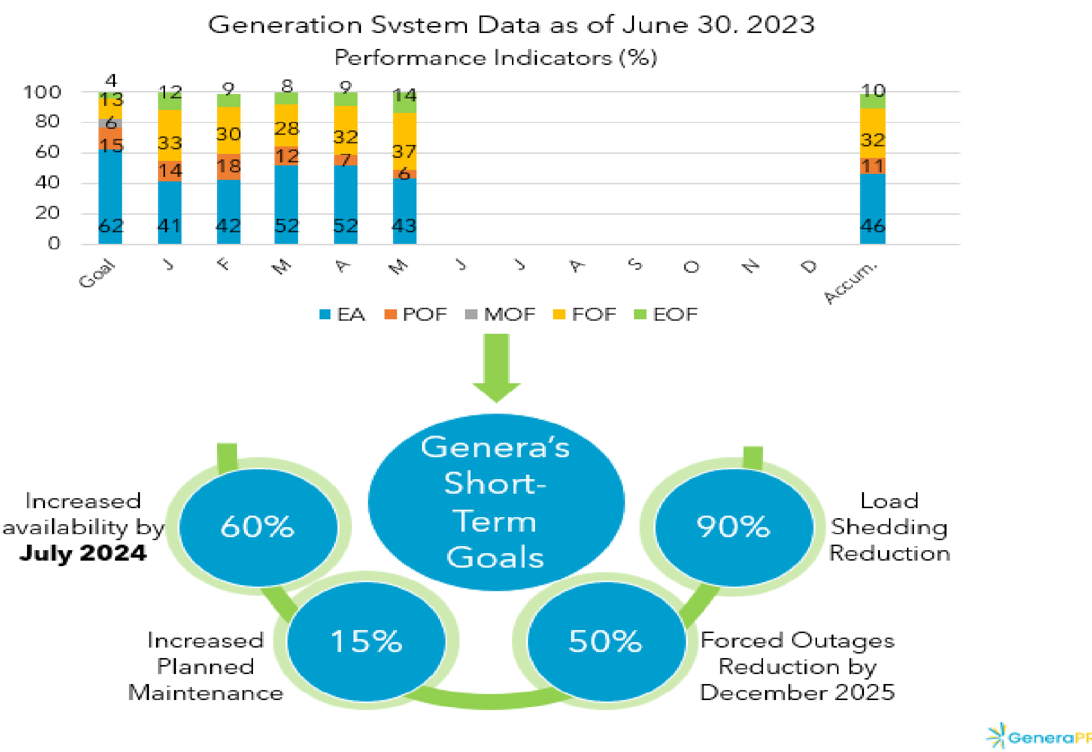


Figure 5: Key Performance Indicators Goals



C. Resource Adequacy

Resource adequacy implies having sufficient capacity and reserves for the T&D System Operator to maintain a balanced supply and demand.[54] LUMA filed its latest Resource Adequacy Study[55] with the Energy Bureau on December 11, 2023, and assessed the sufficiency of electricity generation owned and operated by PREPA and other generators to meet existing electric customer load requirements in Puerto Rico. LUMA, which does not generate electricity, carried out this analysis in compliance with its responsibilities under the T&D OMA, to inform the PREB, policymakers, and stakeholders about the adequacy and inadequacy of generation resources in the Puerto Rico electric system and to inform strategic resource planning decisions.

The key findings of this latest resource adequacy analysis include the following:

- Puerto Rico is unable to rely on electricity imports to support grid stability, and the island generators are generally unreliable. This results in Puerto Rico facing challenges to meet industry standard resource adequacy risk targets.
- The probability that Puerto Rico's generators will be unable to meet system load during a year was calculated to be 100%.
- LOLE was calculated to be 37.5 days in FY2024. This LOLE is significantly higher than other LOLE targets adopted in the energy industry, including those adopted by similar islands.
- For reference this LOLE is 375 times higher than a commonly accepted 1 day in 10 years LOLE industry standard (0.10 days per year).
- The analysis demonstrated that outages to individual generators, whether planned or unplanned, have a significant impact on the electrical system's ability to reliably meet load.

[54] PREPA FY2023 Fiscal Plan at page 38.

[55] Resource Adequacy Study prepared by LUMA, December 11, 2023: https://energia.pr.gov/wp-content/uploads/sites/7/2023/12/20231211-Motion-to-Submit-Corrected-Exhibit-1-to-Motion-to-Submit-LUMAs-2024-Resouce-Adequacy-Study-Filed-on-November-14-2023.pdf.

- The study calculated that 905 MW of new "perfect capacity" (available 100% of the time for each hour of the year) would result in a LOLE of 0.10 days/year.

Throughout 2023, significant emergency generation efforts were made by the federal government, the Department of Energy, FEMA, and the USACE to assess, determine, and ultimately install highly reliable capacity in northern Puerto Rico to help reduce the LOLE that Puerto Rico customers experienced in FY2024.

Despite these efforts, the lack of sufficient generation capacity to meet ongoing demand needs requires all stakeholders to implement short- and long-term projects including maintenance and repair initiatives that seek to stabilize Puerto Rico's electrical system.

IX. ELECTRIC SYSTEM STABILIZATION PLAN

Genera's Electric System Stabilization Plan features a comprehensive short- and long-term strategy that seeks to address reliable generation issues, fluctuations in power supply and minimize the impact of unexpected outages. In the short-term, the plan focuses on key repairs to existing facilities. In parallel, the plan transforms existing power plants into multi-purpose grid support centers equipped with generation and energy storage systems at key locations across the island. It includes provisions for future equipment expansion to enhance efficiency, reduce production costs, and accommodate the island's growing energy needs. The plan also employs operational capabilities essential for flexibility, responsiveness, and advanced control systems to manage and integrate the anticipated surge in renewable generation and energy storage projects. By utilizing these innovations, Genera will quickly address fluctuations in power supply or demand, minimize the impact of unexpected outages, and bolster the grid's resilience to natural and unforeseen disruptions. Also, the plan includes projects to replace components that are the most common cause of forced outages. These projects aim to not only add generation capacity, but to reduce forced outages with reliable generation, which is the core of the stabilization of the generation system. These projects advance a sustainable energy future by seamlessly integrating energy storage and peaker solutions and promoting a more adaptable, robust, and efficient energy generation system.

When in the next two years Genera completes major repairs, replaces part of the peaker generation capacity and critical components, adds energy storage resources, the generation system will be improved in the following areas:

Figure 6: Key Performance Indicators Goals

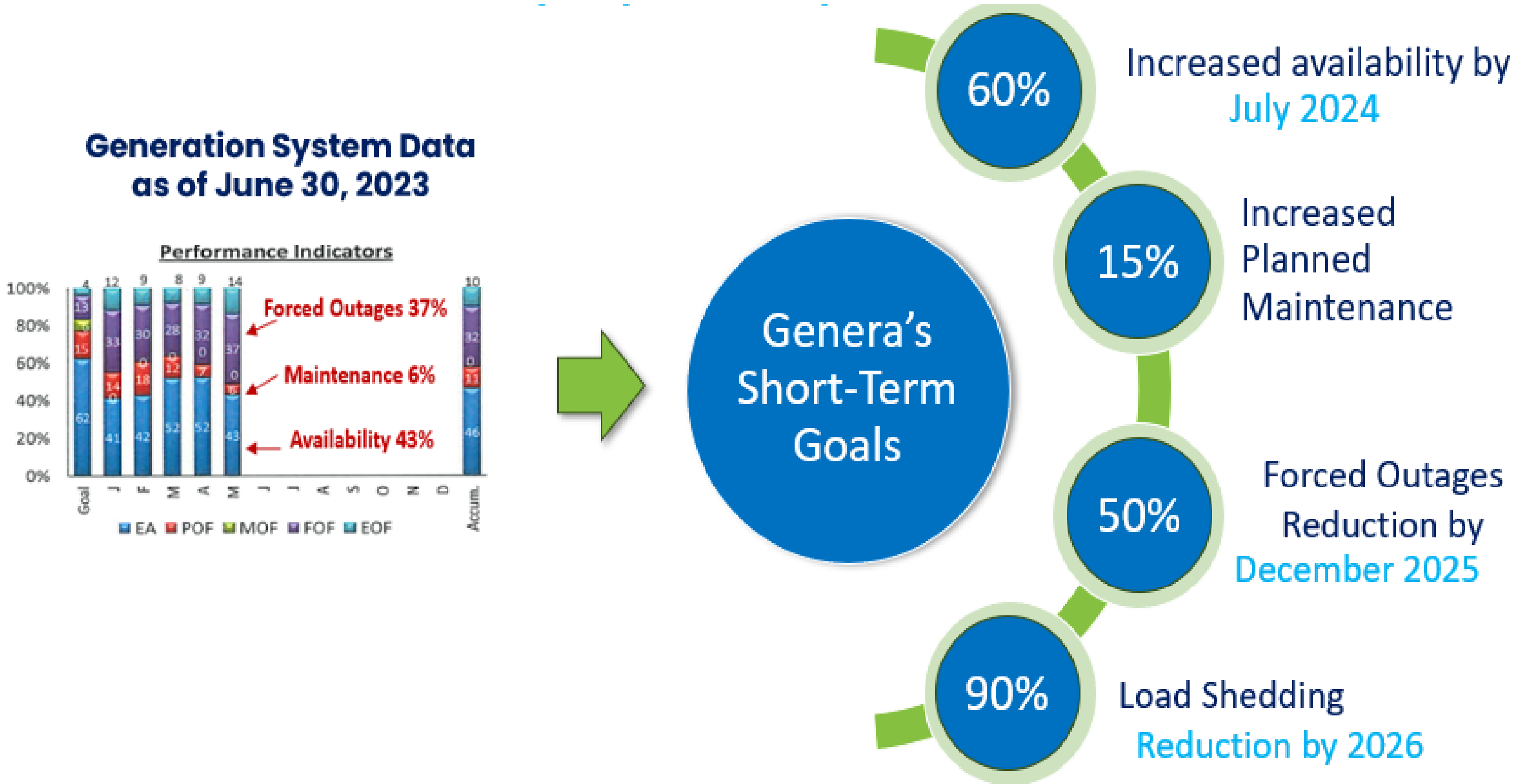


Figure 7: Workplan to Increase Reliability 2023-2025 Increase Capacity Goals

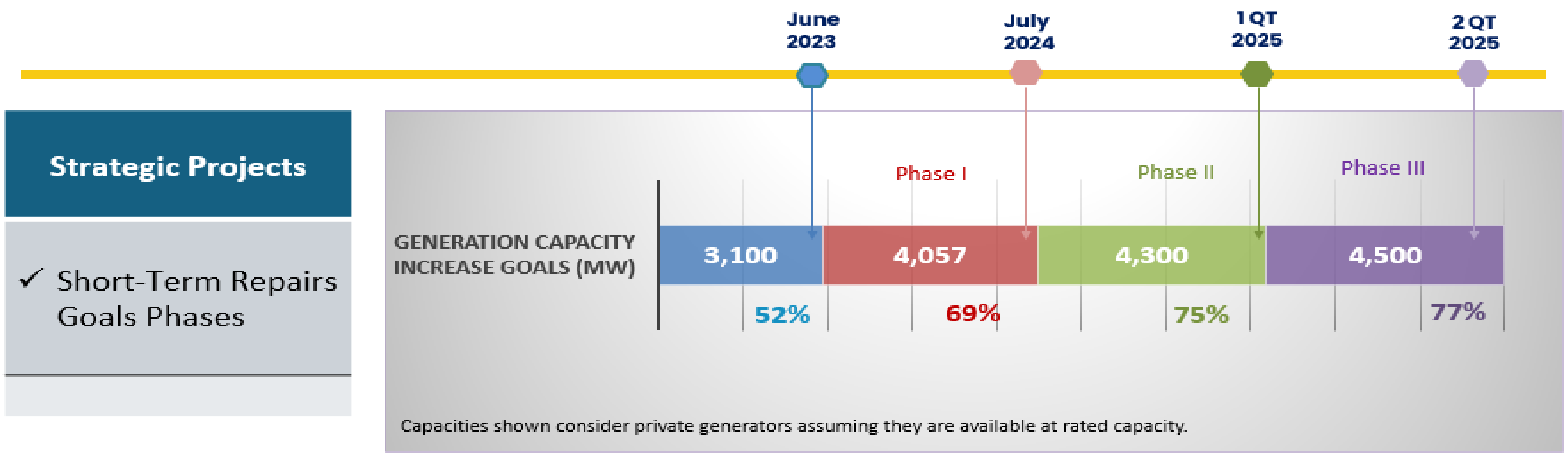


Figure 8: Workplan to Increase Reliability

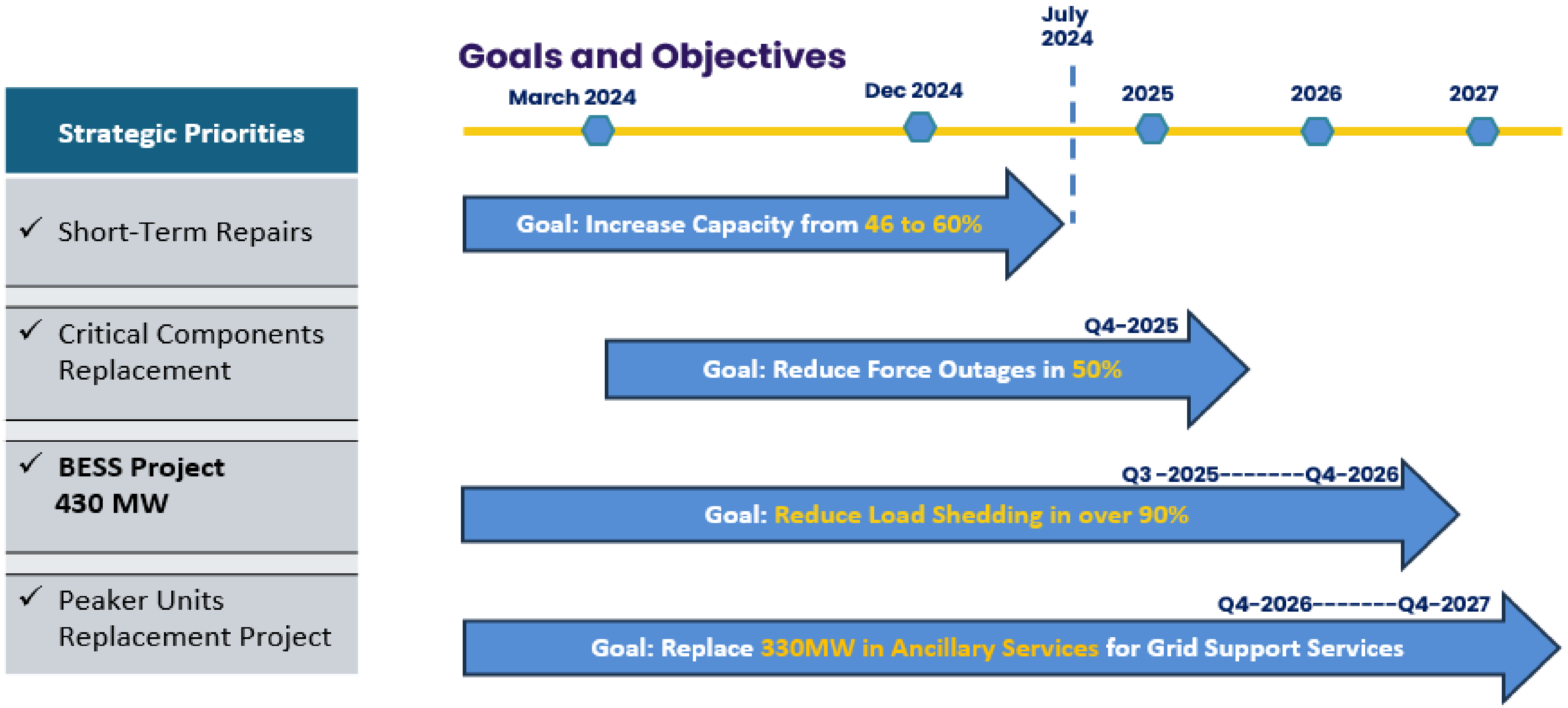
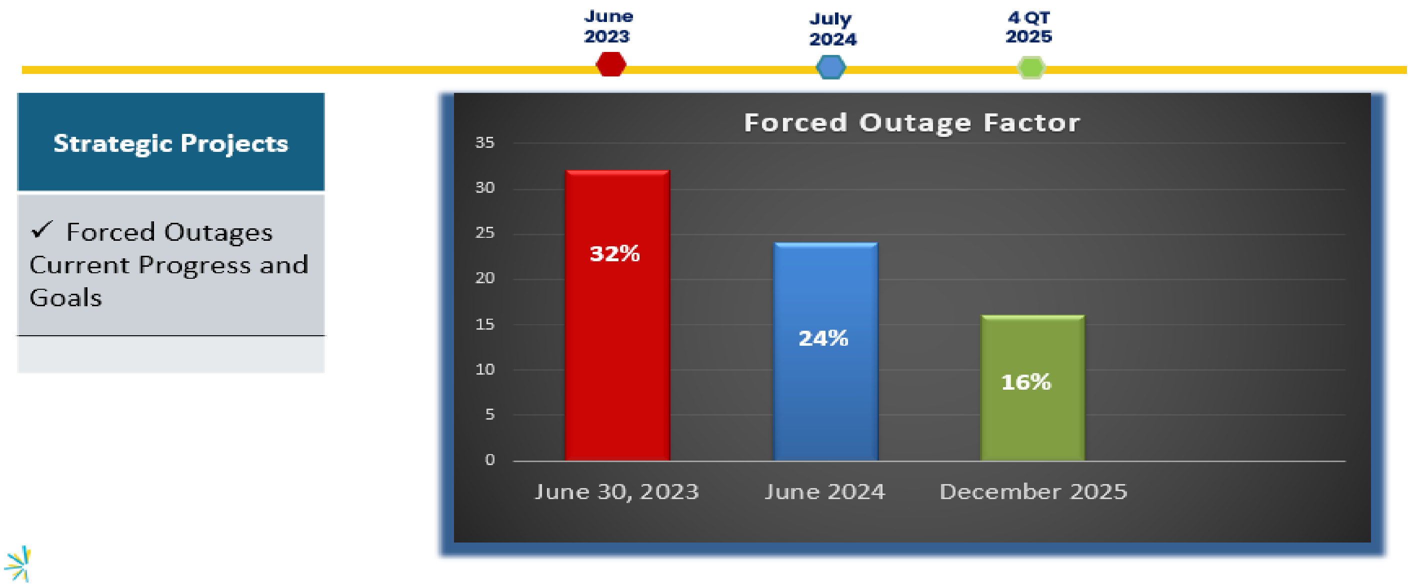


Figure 9: Workplan to Increase Reliability 2023-2025 Forced Outage Factor Goals



A. People

By focusing efforts on unit repairs to increase power generation capacity, availability, and efficiency, Genera has had considerable success increasing base load unit capacity from 46% to over 62% since July 2023. To continue this trend, reach the generation capacity goals stated before, and maintain the capacity to meet system demand, Genera established a Performance Task Force (PTF). The main goal of the PTF is to improve the overall performance of the Genera PR baseload power plants (AG, SJ, CS, PS) by increasing power generation, reliability, availability, efficiency and reduce costs, implement automatic frequency regulation strategies to consistently generate at nameplate capacity and reduce or eliminate forced outages. Additionally, the PTF provides rapid response to forced outages, limiting unit repair time.

The PTF meets twice daily Monday through Friday and some weekends to track work at all units in all plants. The work focuses on the baseload and reserve units (that is PS, SJ, CS, AG, Mayagüez, and CMB, as well as peaker and temporary generation units).[56] The PTF's goal is to increase unit availability and stabilize the system until industry-standard reliability goals are met. The PTF work varies by unit and by plant, ranging from planning unit outages to address maintenance and environmental compliance requirements, to quickly resolving forced outages. The PTF's focus areas include predictive and program maintenance, conditional assessments for the boilers, turbines, condensers, cooling water system, cooling tower, and other balance of plant material. Minutes and status reports by unit, by plant and by work needs are issued after each meeting.

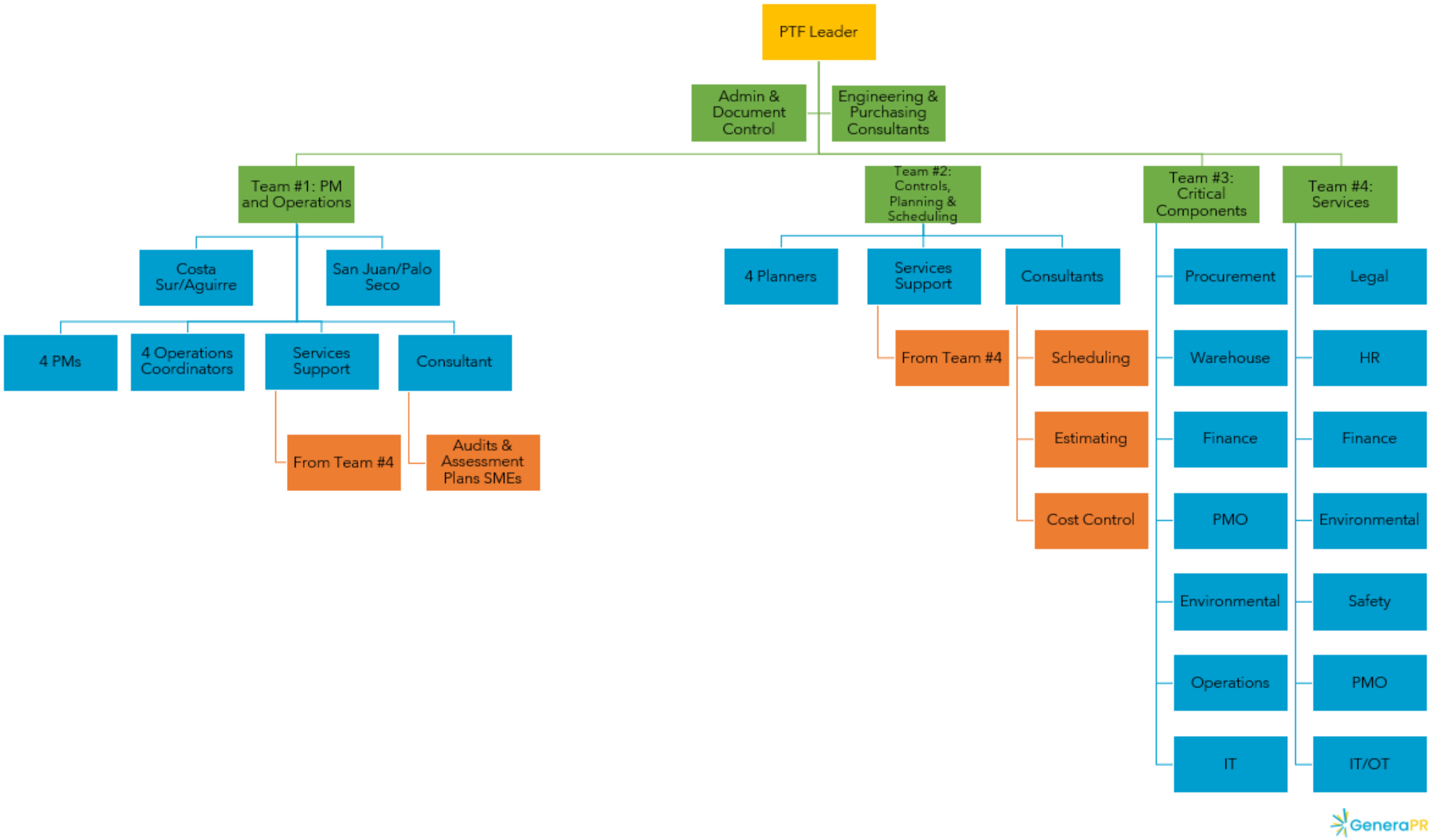
The PTF Team includes:

- Task Force Leader
- Engineering and technical / purchasing consultants
- Heads of projects
    - CS & AG

[56] Base load units: SJ 5, 6, 7, 9; PS 3, 4; AG 1,2; CS 5, 6. Swing units: Mayagüez 1-4; CMB 1-3.

  - SJ & PS
  - PMs covering CS, AG, PS, SJ, CMB and Mayagüez
  - Subject matter expert consultant supporting audits and assessment plans.
- Head of operations
  - Operations plant managers and coordinators covering CS, AG, PS, SJ, CMB and Mayagüez
- Personnel focused on planning, scheduling, and cost control
  - Planners covering CS, AG, PS, SJ, CMB and Mayagüez
  - Consultant covering scheduling, estimating and cost control.
- Heads of and support for various services
  - Legal, finance, procurement, warehouse, IT/OT, environment, safety, and HR

Figure 10: PTF Organizational Chart



B. Short-Term Repairs

Pursuant to the OMA, Genera plant operations address maintenance and repairs regularly. However, with limited spare generation capacity available from the legacy generation units, repairs and maintenance planning—more specifically planned outage work—has been a constant challenge. This section describes the current status of the Legacy Generation Assets.

Genera has developed a comprehensive plan to repair certain LGA units and replace the more critical components with new ones. The main purpose of this initiative is to improve reliability by reducing the forced outage factor rate by 50 %. The repairs to be conducted in FY25 will add 661 MW to the system while the repairs to be done in FY26 will add 185 MW to the system. In total, the repair program will add 846 MW over the next two years. These repairs will stabilize the generation service, allowing the integrated system to meet the T&D System Operator required reserves. Also, this, coupled with other initiatives, will also aid in having enough generation in the system to allow generators to perform regular maintenance outages and implement repair programs. The following tables summarize the short-term repair phases.

Table 4: Phase I, II & III Short-Term Repairs

2024 Phase I Repairs in Progress			
Units Under Repair or Maintenance	**Capacity (MW)**	**Reason Planned or Unplanned**	**Expected Completion Date**
SJ 7	90	FO Repair	3Q 2024
PS 3	180	Maintenance	3Q 2024
AG 1	60	Limitation	3Q 2024
Total	**330 MW**		

2024 – 2025 Phase II & III Short-Term Repairs			
Units Under Repair or Maintenance	**Capacity (MW)**	**Reason Planned or Unplanned**	**Expected Completion Date**
SJ STG 5	55	FO Repair	TBD – under assessment
SJ STG 6	55	FO Repair	TBD – under assessment
AG CC 2-1, 2-2	96	Transformer replacement	3Q 2024
Mayagüez 3B	25	PT repair	3Q 2024

2024 – 2025 Phase II & III Short-Term Repairs			
AG 2	75	Air heater replacement Turbine LP seals	1Q 2025
AG 1	75	Air heater replacement Hydrogen leakage repair	2Q 2025
PS 4	185	Generator Repair	4Q 2025
Total	**516 MW**		

C. Capital Projects

Once Genera took over the operation of the LGA, it presented an initiative to establish a logical, technical direction for the use of available FEMA funds—or more specifically, the optimized use of FEMA 404[57], 428[58], and other available funds to execute new power generation and energy storage projects in a way that best serves the present and future needs of the island, including grid support services to manage the anticipated large influx of inverter-based renewable generation projects—coupled with extensive rooftop solar adoption in Puerto Rico—and the resulting grid stability challenges.

Within Genera's initiative, consideration was given to the following *key aspects* for the selection and execution of new generation and energy storage capital projects:

- Hazard mitigation, to reduce the impact and long-term effects of a natural disaster.
- Critical services, or areas of the island that are most susceptible to losses during a natural disaster
- Restoration of the island's degraded, power generation black start systems.
- Availability of necessary fuel supplies.
- Existing infrastructure, land, and utilities currently owned by PREPA.
- Condition and/or status of existing generation assets, including impairments, planned generation retirements, and reliability.
- Integration of future renewable generation and energy storage projects.

References to key aspects, hereafter, are meant to include all items given above.

When fully implemented, the planned peaker, black start and BESS capital projects described herein will decrease the cost of power generation in the near term

[57] FEMA Section 404: Hazard Mitigation Grant Program assists in implementing long-term hazard mitigation planning and projects.
[58] FEMA Section 428: Public Assistance Program.

and even more so in the long term. These projects use FEMA funds to reconfigure existing generation facilities with a combination of GTGs, RICE generators and BESS. No greenfield development work is planned at present, and new interconnection work is not anticipated, or if so, very limited.

Part of this Electric System Stabilization Plan places new generation equipment and black start facilities at or nearby the island's two LNG points-of-import with the reconfiguration of both the SJ and CS power plants. This provides new generation facilities suitable for current and future operating needs that minimize operation and maintenance costs by using cleaner and less expensive natural gas, rather than diesel; it also includes opportunities for future power and efficiency enhancements that would also allow Genera to produce more power with less fuel at these two sites. By placing multiple GTGs at these LNG points-of-import, the operator will be able to use the machinery in a more cost-effective manner since the fuel is both delivered and regasified at the generation location rather than being trucked in bulk to areas far away from the seaports. At the SJ and CS locations, space was allocated for HRSGs and steam turbines to dramatically improve the efficiency of each simple-cycle GTG site by converting each project to a combined-cycle configuration in the future, if regulatory approval is granted.

The Electric System Stabilization Plan also reconfigures many existing peaker plant locations. These locations will still require trucked fuel, however smaller and more efficient RICE generators are planned to minimize the amount of LNG and diesel needed to be transported to the peaker sites on Puerto Rico's roadways. These sites will utilize 18 MW RICE generators that are inherently more efficient than the existing simple-cycle gas turbines, thus using less fuel for power production (translating to fewer truck deliveries for the reconfigured peaker generation sites). The RICE generation units are equipped and designed for multiple, rapid starting duties that can provide better load following capability across the island to suit the ongoing integration of renewable generation and energy storage projects.

Finally, the Electric System Stabilization Plan utilizes BESS equipment for areas of select facilities to provide instantaneous support, among other grid services to provide stability, as required, by the power system.

1. Replacement of Peaking Capacity and Integration of Storage

Planned FY25 and FY26 Investment: $1,500 Million

Federally funded

This section focuses on the replacement of peaking capacity and the integration of storage and how it will stabilize the electric system in Puerto Rico. The plan encompasses the deployment of a combination of RICE, GTGs, and BESS units to enhance generation capabilities, flexibility, and rapid response, essential for integrating renewable energy and storage projects and adding reliable emergency generation to surpass tropical storms or major disaster events challenges.

a) Selection of Sites

New land acquisition is often a lengthy and uncertain process in Puerto Rico that may affect the outcome and schedule of new projects. Therefore, to avoid these potential delays in the execution of the Electric System Stabilization Plan, Genera reconfigured existing generation sites. The primary sites planned for new peaker, black start generation and BESS projects are the PREPA sites of AG, CS, SJ, DG, JB, PS, VB, YB, and CMB.

Some demolition work is required at these existing power plants so that they may be reconfigured for the planned projects. Decommissioning plans are currently in process to define the specific work required at each facility. The transmission lines for these existing sites are well-established and would require minimal work to accommodate the planned generation and BESS projects when compared to the development of greenfield project sites. The reconfigured sites remain roughly equivalent to their current generation capacity to facilitate the integration of new equipment without significant changes to the interconnecting transmission systems; the expectation is that network upgrades may be avoided. This will be confirmed with interconnection studies completed by the T&D System Operator.

Based on the benefits described in this section, Genera has determined that these capital projects including a combination of RICE, GTGs and BESS units, along with consideration given to future expansion, are the main components necessary for the stabilization of the system from a generator's perspective. This new equipment will provide essential generation capabilities, including flexibility, rapid response, and turndown, for the successful future integration of renewable energy and storage projects. It is also recognized that coordination with the T&D System Operator is also needed to complete a system-wide stabilization plan, including dynamic system studies which would be part of the T&D System Operator's work.

b) Fleet Replacements and Capability Upgrades

It is worth noting a few important elements of current transmission planning work with respect to generation diversity. It is no longer enough for a utility to have sufficient generation and transmission capacity to meet the peak demands of their systems; they must also have enough flexibility in their system to accommodate the inherent variability and uncertainty in their generation portfolio, particularly as renewable systems such as solar PV and wind turbines are added to the power system. This flexible generation capacity is required to dynamically adjust output levels to compensate for changes in demand or the amount of generation available from wind resources (when the wind stops blowing) or from solar generation (when there is cloud cover, or the sun sets). In addition, the system must be able to provide this reliable service while maintaining acceptable frequency and voltage levels during normal conditions and even after disturbances to system stability or the unexpected loss of components. Also, as tropical storms cross or pass near the island, the ability to utilize renewable generation throughout the events may be limited, and in these circumstances energy storage systems such as BESS would be depleted within a short period of time. Further, it is anticipated that some renewable generation systems are likely to be damaged following a major disaster event. During these conditions, reliable emergency generation systems are vital for the safety and security of the island's residents.

Grid frequency support is provided by the coordinated actions of synchronous inertia and frequency response. The first mitigative action in the event of a system frequency drop is provided by the inertia that comes from the kinetic energy in the collective rotating masses of generators within the grid system. This inertial response acts within fractions of a second to arrest the drop in system frequency. Primary and secondary frequency responses depend on control systems that are slower to act and work to raise the frequency back to its nominal level. Inverter-based generation cannot provide this inertial response because there is no rotating mass, so studies must be performed to ensure that other means are available to help correct deviations in system frequency during disturbances. As higher levels of inverter-based generation are integrated into the power system, one option of maintaining inertia is to provide the ability to operate new synchronous generation machines as synchronous condensers.

With Genera's planned Grid Stability Plan, the new generation units could use diesel and NG and ready for use with future, low-carbon fuel alternatives. The equipment will be capable of firing either fuel on a primary basis and without any modifications to the supplied packages. The units will be equipped with modern environmental control and emissions monitoring equipment along with control logics to ensure compliance with all local, sand federal requirements.

Each new generation unit would have provisions for fast starts, with the ability to reach full load from standby in 30 minutes with GTG equipment and less than 10 minutes with RICE generators. Furthermore, across the fleet, BESS equipment will provide the ability to react to grid support services in less than 1 second. The installation of these new generation and BESS units is planned within existing facilities after demolition of old equipment, facilities, or structures to provide sufficient space for the development of new generation projects.

The generation units would comply with EPA and EQB requirements that include but are not limited to the Clean Air Act, Clean Water Act, New Source Performance Standards, Spill Prevention Control & Countermeasure requirements, Facility Response Plans, waste disposal regulations, construction and operating permits, and the regulations promulgated thereunder.

OEM equipment for the entire project must comply with all required emissions and environmental guarantees, controls, and documentation necessary to obtain required authorizations and approvals for each facility.

At present, the largest electric power generating plants are on the island's south side, while the largest power demand is in the San Juan metropolitan area. There are multiple high-level voltage transmission lines that interconnect these south-coast generation plants with the metropolitan area in the north. The electrical system's continuous operation depends on the reliability of these transmission lines. During Hurricane Maria the main north-south transmission lines suffered extensive damage causing catastrophic delays to island-wide power restoration and greatly hindering Puerto Rico's recovery. Delays were due to damaged transmission lines and an island-wide inability to provide black start power services. Not only were there a limited number of operational black start generation systems, but because of the damaged transmission lines, the black start units that were operational could not be connected to facilities that needed grid start-up power.

The installation of distributed power generation units at the existing generation locations would provide much needed resiliency during emergencies to local populations that could become disconnected from the main power transmission lines and could be the foundation for any new planned microgrid infrastructure. The ability to rapidly recover the generating capacity during emergencies would greatly aid in the protection of life, health, and property.

The re-establishment of lifeline systems that provide affordable and reliable energy, telecommunications, potable water and transportation throughout the entire island of Puerto Rico is a priority. These are critical components to the island's economy and necessary to ensure the proper functioning of government. It's vital to Puerto Rico to have a reliable energy grid that would keep water treatment plants, hospitals, and other critical infrastructure such as emergency response organizations operational and less vulnerable to power outages or damage from natural disasters.

The new peaker, black start, and BESS projects planned herein are a result of an optimization exercise seeking to serve the previously mentioned *key aspects* of new generation, while at the same time, minimizing the cost of power generation in both the short and long term. It provides an optimal operation and maintenance configuration and locates new generation equipment at the island's two LNG points-of-import to minimize the cost of fuel. The new projects could include an overrunning clutch so that the synchronous generators could spin when unfired, to provide inertia and stability as synchronous condensers when not generating power. The new peaker, black start and BESS configurations will create multi-purpose generation and grid support systems within existing, reconfigured generation facilities—unlike any capability currently in place within Puerto Rico, and very well-suited for both current and future needs, including the ability to perform future expansions.

Additional black start and generation units are planned across the island to provide emergency power in a disaster and to restart the larger generating units after a total loss of power. Over time, many existing black start units have failed and left large areas of the island, including major power plants without the ability to restart in the event transmission system connectivity has been lost. After a disaster, black start capability is essential to reestablish lifeline systems like, telecommunications, potable water and transportation around the metropolitan area and the other populated areas or strategic locations, and minimize risk associated with security, health, and government services. This plan also provides for full repairs to the currently degraded black start system.

c) *Reconfigured Existing Power Generation Sites*

The existing PREPA facilities noted as the primary sites for consideration, have equipment that is overdue for retirement and may easily be replaced with modern equipment to achieve dramatic improvements in reliability, efficiency, and reductions to operational costs. The existing thermal generation equipment cannot provide rapid responses to changes in grid demand. However, a well-balanced combination of new RICE generation technology, modern GTGs, and/or responsive BESS may all be utilized throughout the fleet for grid stabilizing services, hazard mitigation purposes—and a whole host of other benefits that may be achieved with each thoughtfully reconfigured power generation site.

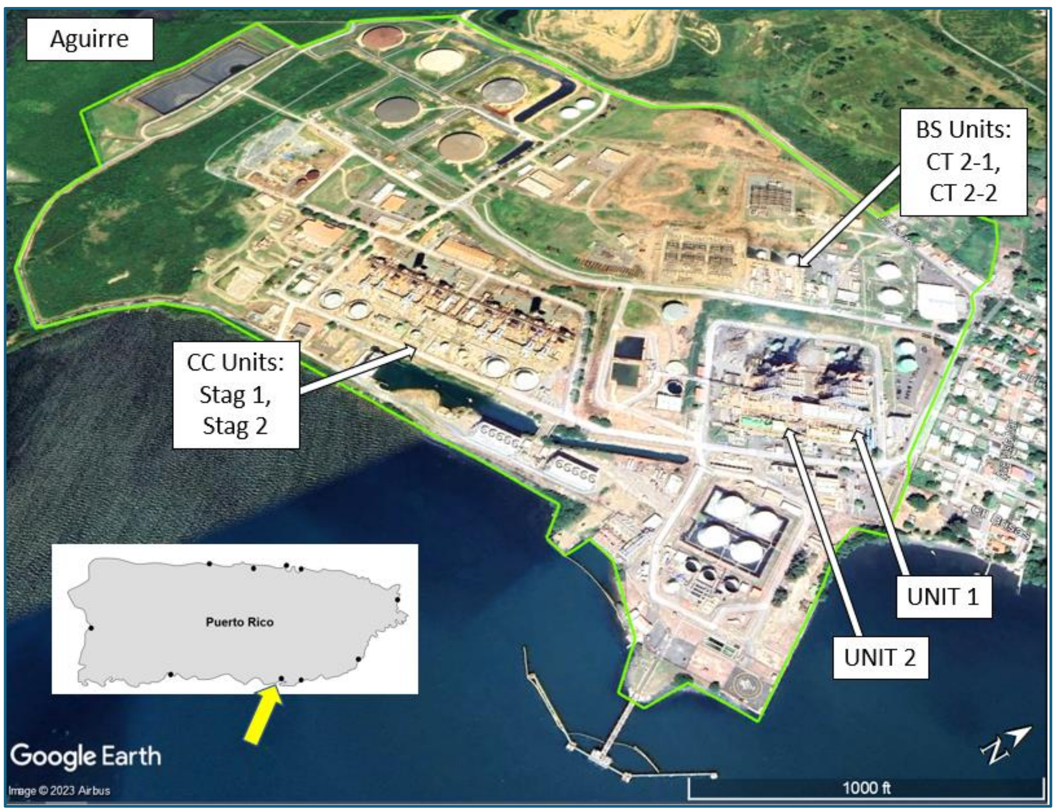
Each power generation site has existing infrastructure—such as fuel supply and/or storage systems, electrical transmission interconnection points, potable water supply, and wastewater processing facilities—although the features of each site vary. In the future, as renewable energy generation and storage projects are added to the island, additional brownfield or greenfield sites may be evaluated for grid services based upon the need for grid stabilizing systems. A discussion of each existing primary power generation site planned to be reconfigured to better serve the electrical utility is included within the sections that follow.

(1) Aguirre Power Plant

The AG is located on the south coast of Puerto Rico in the Salinas municipality, is owned by PREPA and operated by Genera. The site has two (2) 450 MW thermal steam power generation units (Units 1 and 2), two (2) 296 MW CC power generation blocks (STAG 1 and 2) that can also operate in simple-cycle mode, and two (2) 21 MW black start gas turbines (GT 2-1 and 2-2). The actual site generation capacity is lower than the nameplate capacity, with portions of the CC currently inoperable and black start units unable to provide service. Because the black start generation units are out of service, AG must rely on one diesel generator to startup one gas turbine, which in turn can provide startup power for the larger boiler units at the facility. The thermal steam power generation units frequently experience reliability issues.

The site is along the shore in a residential and nature preserve. An aerial view of the site is provided in Figure 11, noting the boundaries defined by the green outline around the facility.

Figure 11 — Aguirre Power Plant Aerial View



Source: Google Earth

The planned reconfiguration adds 156 MW (4-hr) BESS. Other maintenance projects are planned for the existing generation facilities described within the

Maintenance section of this Electric System Stabilization Plan. There are several points to support the path forward for BESS, including:

  - Existing generation capabilities are high. While the reliability of the existing systems has been a challenge, the total nameplate capacity is the largest of any single site in the fleet. However, the units are old, and not well-suited for rapid grid response. The implementation of BESS allows AG to provide faster response to grid demand needs, while permitting the older generation equipment time to follow the demand at a slower pace and in line with the current equipment limitations.
  - Existing grid connections are available after the demolition of the impaired black start units; additional line capacity, as determined by electrical analysis, should also be available.

- AG has many transmission system interconnection points available, permitting some flexibility in the interconnection output of the BESS; this will be finalized during the detailed design phase. The power plant is near a central point on the south side of the island and provides power export through multiple interconnections.
  - BESS projects have a shorter deployment schedule duration to reach COD than generation projects. Using the existing infrastructure and interconnections along with prepackaged BESS that are well-suited for rapid deployment, AG may quickly begin providing service to customers as part of the Electric System Stabilization Plan.
  - BESS facilitates the storage of renewable sourced power for dispatch when needed. Furthermore, BESS can provide the following grid services:
    - Fast “spinning” reserve
    - Frequency regulation
    - Load balancing
    - Energy storage
    - Voltage support

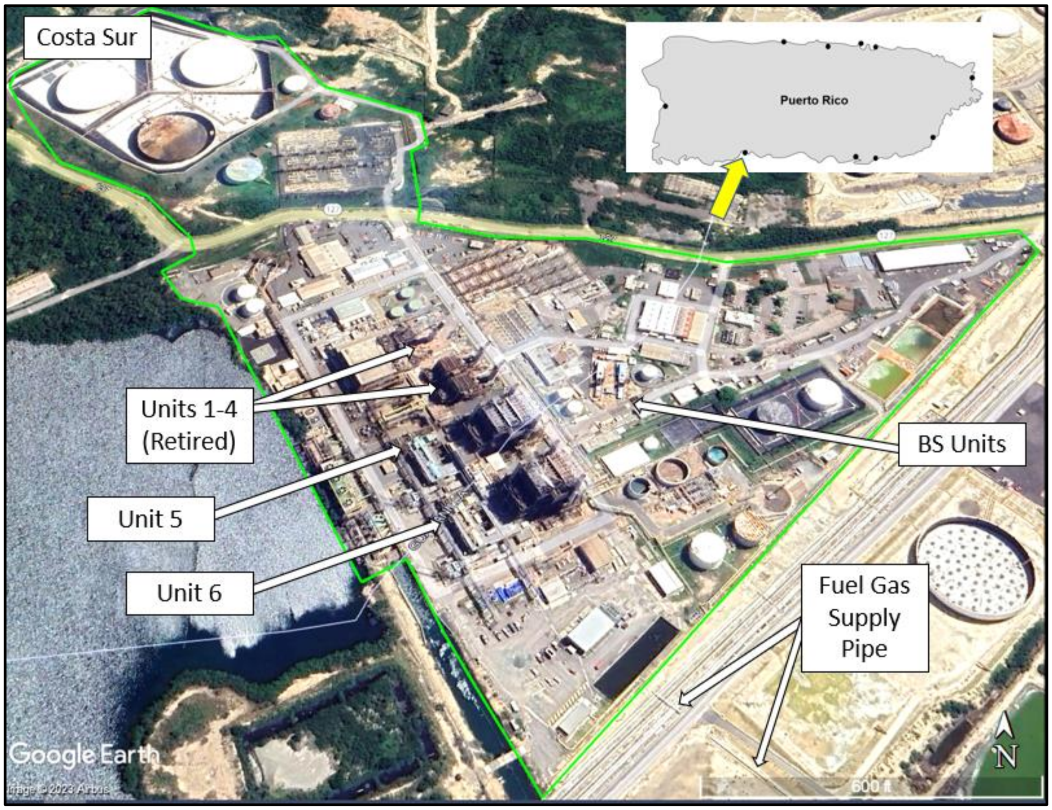
Note that these points would also apply to all other facilities utilizing BESS as part of their site reconfiguration plan. For brevity, the above BESS points will not be restated for each additional reconfiguration project but should be understood all BESS units (including CS, YB, PS, VB, and CB) regardless of the project site, serve the same purpose as noted for AG.

(2) Costa Sur Power Plant

CS includes two (2) operating steam units with a total nameplate capacity of approximately 820 MW. These steam units (Units 5 and 6) were converted from heavy fuel oil operation to fire on natural gas in 2011. The natural gas is supplied by the neighboring LNG facility. CS contains other units, including boiler units (Units 1 and 2 which were recently demolished and Units 3 and 4 that are slated for demolition soon) that are no longer in service, and two (2) black start generation units (GT 1-1 and 1-2) that are not operable and candidates for demolition. Because the black start generation units are out of service, CS and neighboring EcoEléctrica's power plant must rely on grid power for plant startup. This has been problematic after tropical storms, particularly when nearby transmission lines are damaged.

CS is located on the south side of Puerto Rico, west of Ponce. Industrial users adjoin the site. An aerial view of the site is provided in Figure 12 noting the boundaries defined approximately by the green outline around the facility.

Figure 12 — Costa Sur Power Plant Aerial View



Source: Google Earth

CS does not have significant undeveloped space for new project construction and would require some demolition work, including near Units 5 and 6, which are operational. Currently, demolition of Units 1 and 2 is complete, and demolition is being planned for retired Units 3 and 4. Space for new construction on a plant-size scale, within the current boundaries, is available but would require a phased approach.

This key power generation site has access to nearby large scale shoreside LNG storage and fuel gas is delivered to the CS site by pipeline. Therefore, there is no need for LNG delivery trucks for frequent refills of small storage vessels for the generation units. Other maintenance projects are planned for the existing generation facilities described within the Maintenance section of this Electric System Stabilization Plan. There are several points to support the planned path forward for CS including:

The planned reconfiguration:

- Two GTGs, 100 MW (total nominal)[59]
  - BESS 40 MW (4 hours)
  - And one RICE Generator serves as a black start unit, 18 MW (nominal).

After demolition of Units 1, 2, 3, 4 and the existing Frame 5 black start units, coupled with the availability of fuel gas, CS is an excellent candidate for additional power generation equipment.

BESS provides the T&D System Operator with additional options for sizable and dispatchable power when needed in short order. BESS allows storage of renewable sourced power for dispatch when needed. Refer to the AG planned reconfiguration summary for a complete list of benefits for BESS systems regarding grid stabilization.

Currently, two CS black start GTG units are required to black start either CS Unit 5 or 6 but neither of the two are presently operable and thus are unable to respond to a grid-wide blackout emergency. In the event of a total system outage, Units 5 and 6 are not able to restart without a back feed of grid power or a feed from another interconnected site, such as the nearby EcoEléctrica facility or Mayagüez. If the transmission lines are damaged in an event, then back feed of grid power in a timely manner may not be available until the transmission lines are restored to service. The addition of a single black start unit, replacing the two inoperable units on site, along with new GTG units will strengthen the resiliency of CS and the reliability of the nearby south side grid power suppliers. Black start capability will be fully restored for the CS site and neighboring facilities.

The planned increase in natural gas use at CS reduces the use of diesel and heavy fuel oil elsewhere, by employing new GTGs, a RICE unit and BESS as defined by the Electric System Stabilization Plan.

Cleaner burning, more efficient, and more responsive units of smaller scale not only provide cleaner generation than existing heavy fuel oil units (such as at AG, SJ, and PS), but they also provide rapid response to provide grid support for higher levels

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[59] Can be expanded with a combined cycle configuration in the future to bring the total capacity to approximately 160 MW in a 2x1 configuration. Space for a future 3x1 arrangement is also being evaluated and may be reserved so that the combined-cycle plants for CS and SJ (discussed later) may be identical in design. PREB approval is needed to proceed with this expansion.

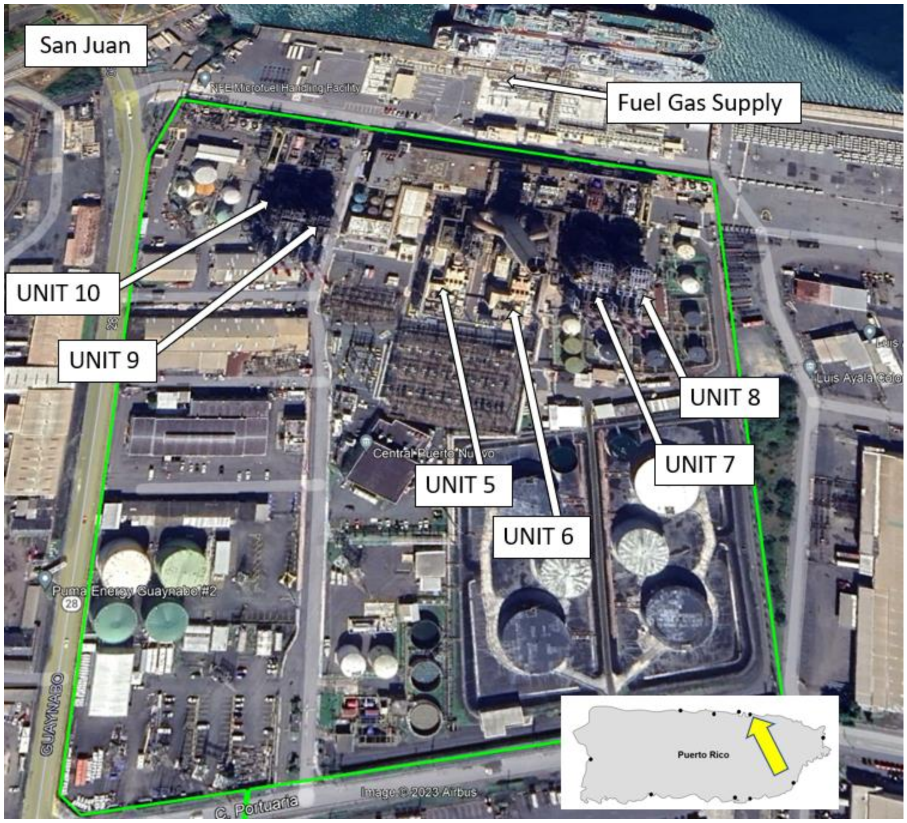
of renewable generation and energy storage projects. The current 400+ MW thermal units along the south coast of the island at CS and AG are "sluggish" in their response times and not well-suited for power turndown. In the future, larger amounts of renewable generation will require redispatching of existing fossil-fuel fired units. CS and AG are unlikely to be suitable for such turndown or rapid grid response. Executing the Electric System Stabilization Plan will provide CS with the capability to serve future needs as renewable generation penetration increases.

As future renewable generation and energy storage projects are executed, more flexibility is required from the fossil-fired generation units. New GTGs at CS would provide this flexibility and ability for Genera to execute turndown, flexibility, and agility in its operations while decreasing production costs. This modern generation equipment, including GTGs coupled with RICE and BESS equipment, would displace older units from the 1960s and 1970s with equipment that is much more efficient and economical to operate, and provides support for a stable power system.

_(3)_ San Juan Power Plant

SJ consists of four (4) thermal plants (Units 7, 8, 9, and 10) at a nameplate rating of 100 MW each, and two (2) CC plants (Unit 5 and 6) approximately 232 MW each. The site is in municipality of San Juan, located on the north coast of Puerto Rico and adjacent to the San Juan marine terminal to the east. To the north is a fuel terminal that can receive diesel and LNG. An aerial view of the site is provided in Figure 13 noting the boundaries defined approximately by the green outline around the facility.

Figure 13 — San Juan Power Plant Aerial View



Source: Google Earth

At present, SJ does not have available space for construction without some demolition work. Space for new construction of significant generation or grid support projects within the current boundaries, is available but must use a phased approach. Other maintenance projects are planned for the existing generation facilities described within the Maintenance section of this Electric System Stabilization Plan.

This site is the second in the fleet to obtain bulk natural gas, which is regasified at the port and currently delivered to the combined-cycle units and TM units.

The planned reconfiguration:

- Three GTGs, 150 MW (total nominal)[60]

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[60] Can be expanded with a combined cycle configuration in the future to bring the total capacity to approximately 220 MW in a 3x1 configuration. The combined-cycle plants for CS and SJ (discussed later) may be identical in design. PREB approval is needed to proceed with this expansion.

- One RICE Generator serves as a black start unit, 18 MW (nominal).

SJ's proximity to the large demand center of the adjacent city makes this site key to serving the grid and the immediate area.

The site also has four older thermal units (Units 7-10) in various stages of operations, but the equipment is beyond its design life. The older units provide connection and grid capacity opportunities for new and more reliable methods of power generation, which will be used for the new projects. While the older units will eventually be decommissioned, the Electric System Stabilization Plan described below does not require demolition of generation units, but rather other infrastructure within the SJ facility.

Since SJ has access to bulk LNG fuel, the expansion of natural gas use by employing new GTGs, as defined by the planned configuration, along with a new Black Start RICE Generation Unit, is planned. By employing new GTGs and a RICE unit as defined in the Electric System Stabilization Plan, the immediate effect of this expansion is the reduction in the use of diesel and heavy fuel oil elsewhere.

Cleaner burning, more efficient, and more responsive units of smaller scale not only provide cleaner generation than existing heavy fuel oil units (such as at AG, SJ, and PS), but they also provide rapid response to provide grid support for higher levels of renewable generation and energy storage projects. The current 200+ MW thermal boiler units along the north coast of the island at SJ and PS are "sluggish" in their response times and not well-suited for power turndown. In the future, larger amounts of renewable generation will require redispatch of existing fossil-fuel fired units and SJ and nearby PS are unlikely to be suitable for such turndown or rapid grid response. Executing the Electric System Stabilization Plan will provide SJ with the capability to serve future needs as renewable generation penetration increases.

As future renewable generation and energy storage projects are executed, more flexibility is required from the fossil-fired generation units. New GTGs at SJ would provide this flexibility and ability for Genera to provide turndown, flexibility, and agility in its operations while decreasing production costs. As with the CS power plant initiatives, this modern generation equipment, including GTGs coupled with RICE generation equipment, would displace older units from the 1960s and 1970s with equipment that is much more efficient and economical to operate, and provides stabilizing support for the power system.

(4) Daguao Power Plant

DG consists of two (2) GTGs, totaling a nominal nameplate rating of 42 MW. The site is in Quebrada Seca, Ceiba, on the east coast of Puerto Rico. The site is a small peaker station, using diesel for firing the units. An aerial view of the site is provided in Figure 14 noting the boundaries defined approximately by the green outline around the facility.

Figure 14 — Daguao Power Plant Aerial View

Source: Google Earth

DG is a small project site when compared with other peaker plants. The plant auxiliary equipment and an interconnection switchyard utilize much of the available space on site. The site does not have available space for new equipment without demolition of the existing GTGs currently in place.

The planned reconfiguration:

- Two 18 MW (Nominal) RICE Generators

This site does not have access to bulk natural gas fuel. Therefore, LNG delivery trucks may deliver fuel to small generation units in a similar manner to the diesel deliveries. For emergency use, like disaster recoveries or similar emergency circumstances, the site would rely on bulk storage of natural gas then diesel.

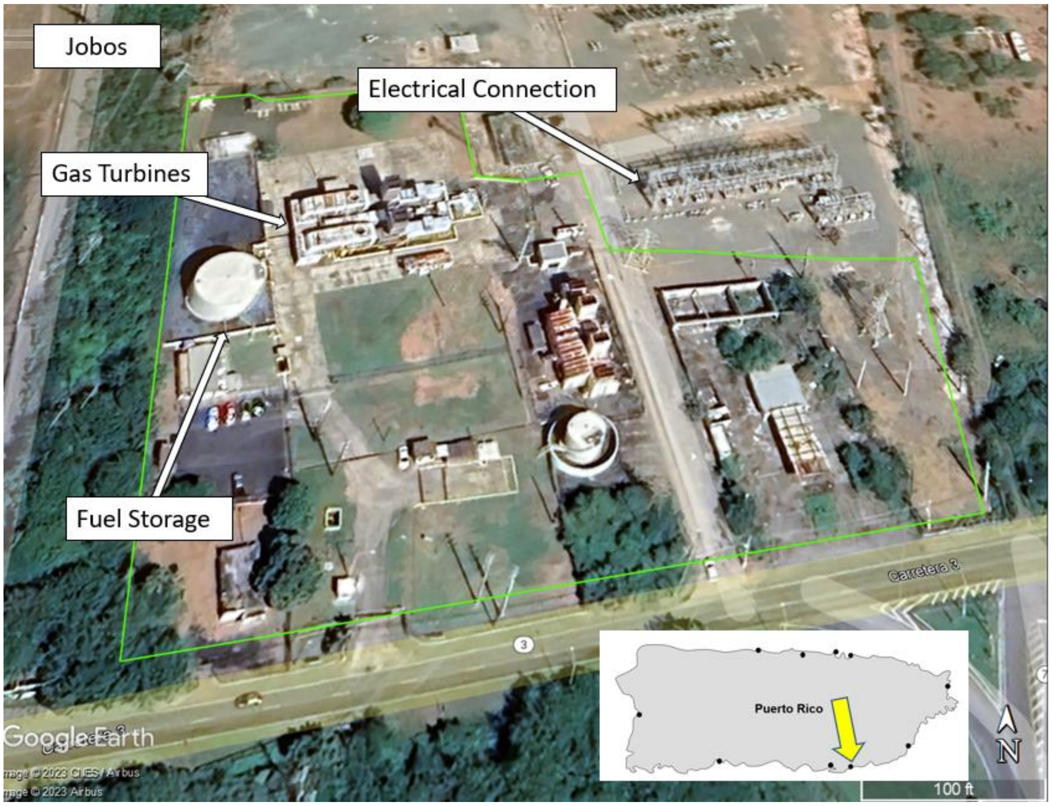
RICE generator units are planned for this location to provide grid support with more efficient technology than the GTGs in place. Unlike GTG units, RICE generator units are well-suited to frequent starts and may deliver power faster than turbine equipment. This configuration makes optimal use of space for fuel storage based on generation and primary and secondary fuel requirements.

The existing Frame 5 generation units are beyond their useful operating life and may be decommissioned. Two (2) RICE Generator units are well-suited to this small site. Therefore, Genera plans to demolish the two (2) existing Frame 5 gas turbines of 21 MW each and install two (2) 18 MW RICE Generator units fired primarily with natural gas with diesel as a backup fuel in the event of an emergency.

(5) Jobos Power Plant

JB consists of 2 GTGs, totaling a nominal nameplate rating of 42 MW. The site is located in Guayama, on the southern coast of Puerto Rico. The site is a small peaker station, using diesel for firing the units. An aerial view of the site is provided in Figure 15 noting the boundaries defined approximately by the green outline around the facility.

Figure 15 — Jobos Power Plant Aerial View



Source: Google Earth

This site does not have access to bulk natural gas fuel. Therefore, LNG delivery trucks may deliver fuel to small generation units in a manner similar to the diesel deliveries. For emergency use, like disaster recoveries or similar emergency circumstances, the site would rely on bulk storage of natural gas and then diesel.

At present, the site does not have available space for new equipment without demolition of the existing GTGs currently in place.

The planned reconfiguration:

- Two 18 MW (Nominal) RICE Generators
- Black start system

This site does not have access to bulk natural gas fuel. Therefore, LNG delivery trucks may deliver fuel to small generation units in a similar manner to diesel deliveries.

RICE generator units are planned for this location to provide grid support with more efficient technology than the GTGs in place. Unlike GTG units, RICE generator units are well-suited to frequent starts and may deliver power faster than turbine equipment. This configuration makes optimal use of space for fuel storage based on generation and primary and secondary fuel requirements.

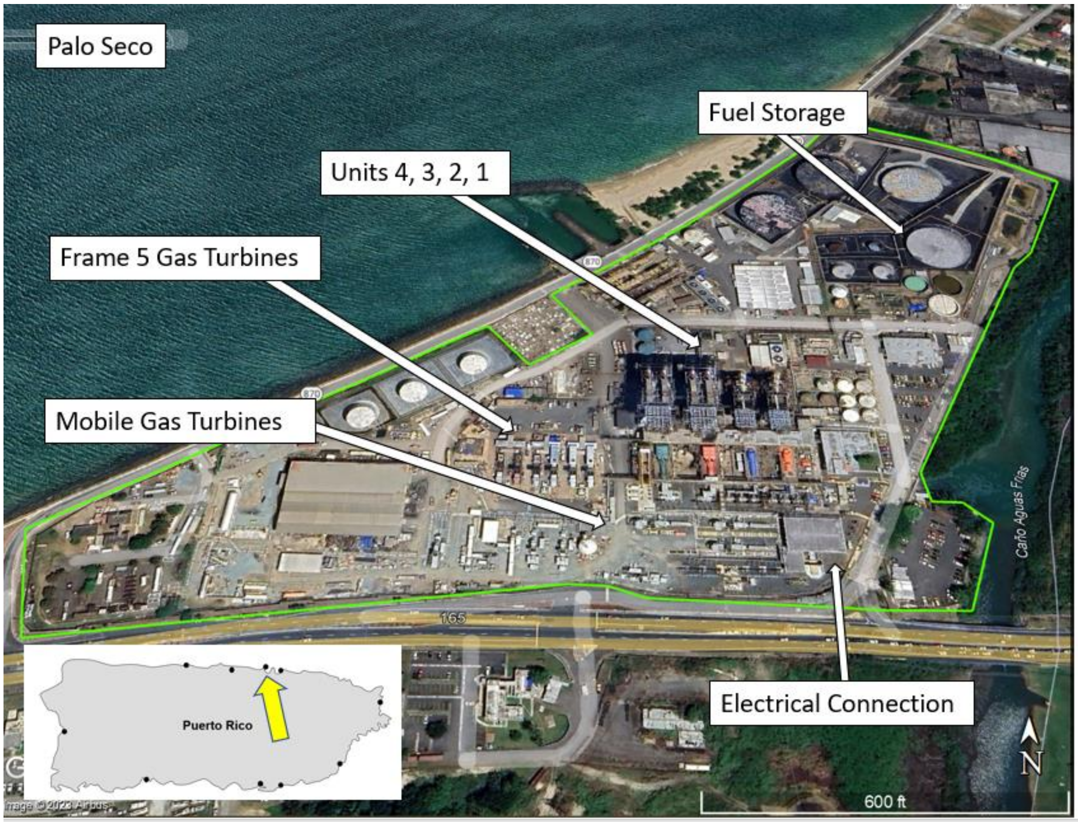
The existing Frame 5 generation units are beyond their useful operating life and may be decommissioned. Two (2) RICE Generator units are well-suited to this small site. Therefore, Genera plans to demolish the two (2) existing Frame 5 gas turbines of 21 MW each and install two (2) 18 MW RICE Generator units fired primarily with natural gas with diesel as a backup fuel in the event of an emergency.

(6) Palo Seco Power Plant

PS consists of four (4) thermal steam power generation units and multiple dual-fuel fired, mobile GTs–which are GE TM 2500 (TM Units 1 through 4). The site also has six (6) older Frame 5 oil fired GTGs, most of which are not in operation, and an additional three (3) new mobile mega generation sets (MG 1 through 3, also referred to as mega-gens) that are owned by the utility and have recently been integrated into the plant. Many of the older units at PS are inoperable or not reliable.

PS is located on the northern coast of Puerto Rico in the Cataño municipality, near San Juan. An aerial view of the site is provided in Figure 16 noting the boundaries defined approximately by the green outline around the facility.

Figure 16 — Palo Seco Plant Aerial View



Source: Google Earth

PS does not have available space for construction without significant demolition. Other maintenance projects are planned for the existing generation facilities described within the Maintenance section of this Electric System Stabilization Plan.

The planned reconfiguration:

- 84 MW (4 hour) BESS

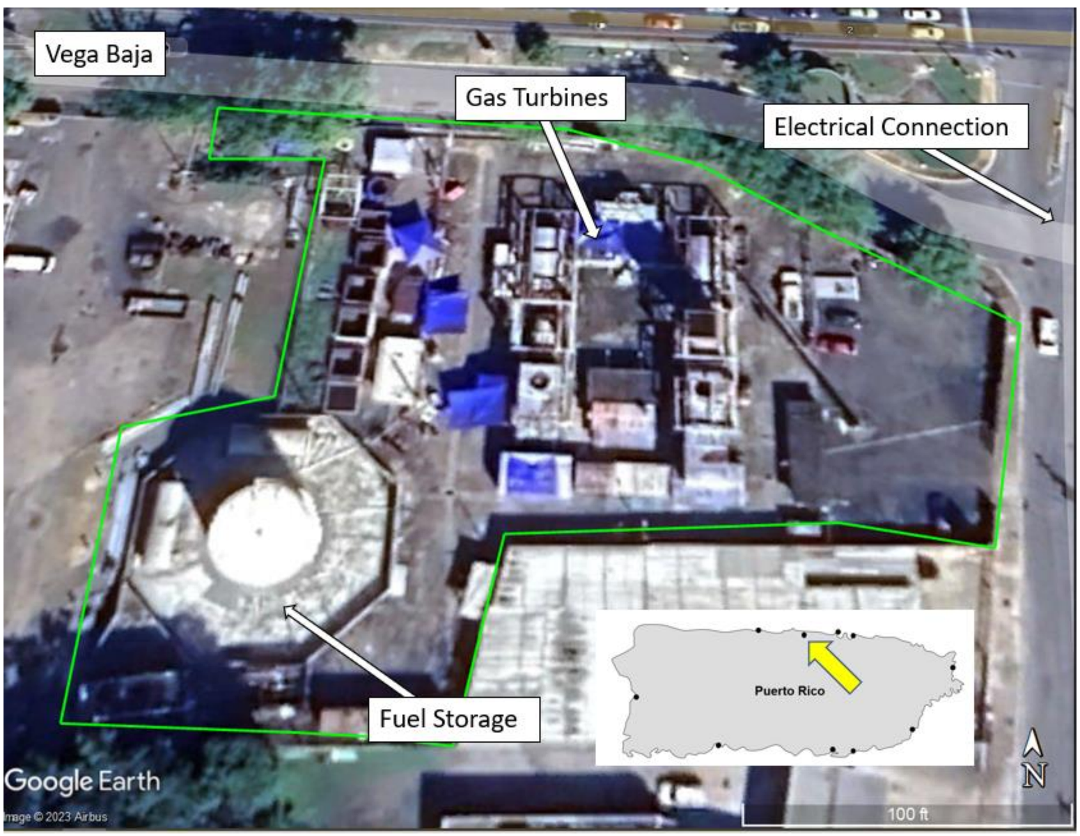
This reconfiguration leverages the existing electrical connections not currently utilized. The BESS location also utilizes an area with the least impact to the current site, while also potentially providing a faster implementation schedule for needed grid stability infrastructure.

The six (6) existing Frame 5 GTGs are beyond their useful operating life and may be decommissioned. PS does not have an efficient means to transport bulk quantities of LNG to site, nor does PS have a seaport; additional large-scale natural gas users should utilize an interconnecting pipeline from SJ. The existing facility is supplied with heavy fuel oil and diesel via pipeline from the adjacent SJ. The planned configuration (the implementation of BESS) provides suitable solutions for reconfiguration now. Refer to the AG planned reconfiguration summary for a complete list of benefits for BESS systems with respect to the grid stabilization.

(7) Vega Baja Power Plant

VB consists of two (2) GTs, totaling a nominal nameplate rating of 42 MW. The site is in the Vega Baja area, approximately in the middle of the northern coast of Puerto Rico. The site is a small peaker station that uses diesel for firing the units. An aerial view of the site is provided in Figure 17 noting the boundaries defined approximately by the green outline around the facility.

Figure 17 — Vega Baja Power Plant Aerial View



Source: Google Earth

The site does not have available space for construction without significant demolition. The space is constrained by both neighboring commercial space and public roads. Space for expansion on a plant-size scale is only available with demolition of the existing units.

The planned reconfiguration:

- 52 MW (4 hour) BESS

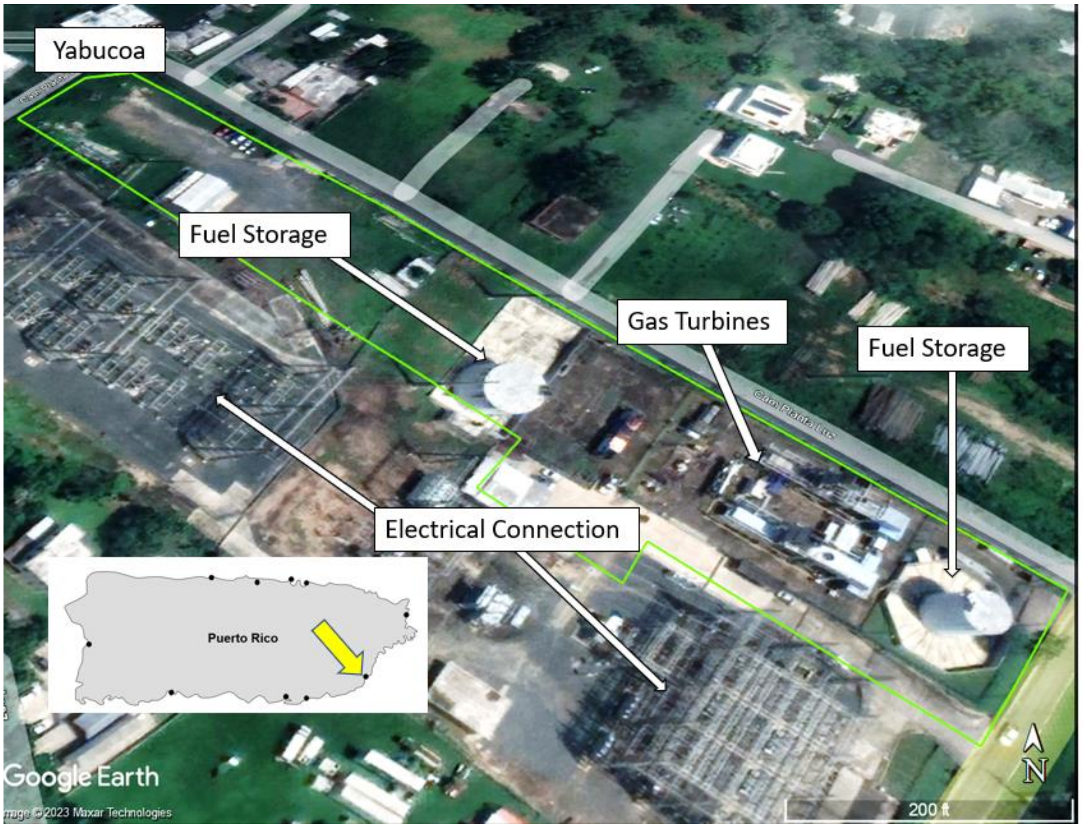
VB has a location in proximity to northern population centers further from SJ. This provides some benefit to power distribution. Use of BESS in the small available footprint will provide large amounts of power injection to help stabilize the grid.

The existing Frame 5 GTG units are beyond their useful operating life and may be decommissioned 52 MW BESS is recommended for the Vega Baja site. Refer to the AG planned reconfiguration summary for a complete list of benefits for BESS systems with respect to the grid stabilization.

(8) Yabucoa Power Plant

YB consists of two (2) GTs, totaling a nominal nameplate rating of 42 MW. The site is in the Yabucoa area in the middle of the eastern coast of Puerto Rico. The site is a small peaker station that uses diesel for firing the units. An aerial view of the site is provided in Figure 18 noting the boundaries defined approximately by the green outline around the facility.

Figure 18 — Yabucoa Power Plant Aerial View



Source: Google Earth

The plant auxiliary equipment and an interconnection switchyard utilize most of the available space on site; however, some space is available for future expansion, despite the narrow geometry of the site.

This site does not have access to bulk natural gas. Therefore, LNG delivery trucks for frequent refills of small storage vessels for the generation units would be required.

The planned configuration:

- Two 18 MW (Nominal) RICE Generators
- Black start system
- 40 MW (4 hours) BESS

RICE generator units are planned for this location to provide grid support with more efficient technology than the GTGs in place. Unlike GTG units, RICE generator units are well-suited for frequent starts and may deliver power faster than turbine equipment. This configuration makes optimal use of space for fuel storage based on generation and primary and secondary fuel requirements.

The existing Frame 5 generation units are beyond their useful operating life and may be decommissioned. Two (2) RICE Generator units are well-suited to this small site. Therefore, Genera plans to demolish the two (2) existing Frame 5 gas turbines of 21 MW each and install two (2) 18 MW RICE Generator units fired primarily with natural gas with diesel as a backup fuel in the event of an emergency. Additionally, space is still available for 40 MW BESS to provide supplemental power and grid support for stability. Refer to the AG planned reconfiguration summary for a complete list of benefits for BESS systems regarding grid stabilization.

The delivery of truck supplied LNG does create challenges for large scale power generation. YB has historically been in the direct path of frequent storms and hurricanes, and as such, a hardened generation site with suitable diesel storage can provide safeguards for the immediate area.

(9) Cambalache Power Plant

CB currently employs three (3) GTGs fired by diesel. The plant auxiliary equipment and an interconnection switchyard utilize most of the available space on site; however, some space is available for future expansion, despite the fixed and protected geometry of the site. GTG Unit 1 was permanently damaged, leaving a 100 MW interconnection point available for use. Given the site's arrangement, it was determined that the deployment of BESS units would be a good fit within the site to use the available interconnection point. In the future, Unit 1 GTG may be repaired and reconnected to the interconnection point. Until such a time, BESS may be installed with plans for a new, future MPT in the event GTG Unit 1 must be reconnected for generation service.

The planned configuration:

- 58 MW (4 hours) BESS

d) *Other Improved Services*

In addition to new and reliable generation, the peaker and battery projects described above will provide other improved services to the Puerto Rico electric system. These services are summarized in points 1 through 4 that are described in the paragraphs that follow.

(1) Restored Black Start Capability

To start a large utility-scale electrical generating power plant, electricity is required to turn on large BOP equipment to support the operation of the generator prior to firing the machine or boiler. For large generators like thermal or gas-fired boilers, 25 to 50 MW of auxiliary power may be needed to facilitate a unit startup. These larger, more complex power plants include large induction loads such as circulating cooling water pump motors and boiler feedwater pump motors that must be operational. These units require secure and reliable power that can be utilized to deliver the large auxiliary power load needed to support plant start-up, which may require multiple attempts if the unit has been damaged during its most recent trip. In most cases, battery power is not well-suited for startups of such utility scale power plants, particularly during emergency operation. While some large batteries may be configured to do this, it is not good practice—batteries may not be suitably charged, or the plant may require multiple start attempts, which may deplete the batteries before a successful startup occurs, all of which is not recommended for emergency situations.

During a power system outage, such as after a hurricane event, damaged transmission systems may prevent power from being delivered to large power plants. When there is no power available, to completely start a power plant, a smaller generator, called a black start generator, typically a small RICE generator system started with a suitable battery system, is needed. The electrical supply is delivered to the plant until the unit can be stabilized and synchronized to the local grid. Black start units that start a GTG may not need to run as long when compared to a large thermal unit. The difference may be from less than an hour for a GTG, compared to three or four hours for a large thermal generation unit.

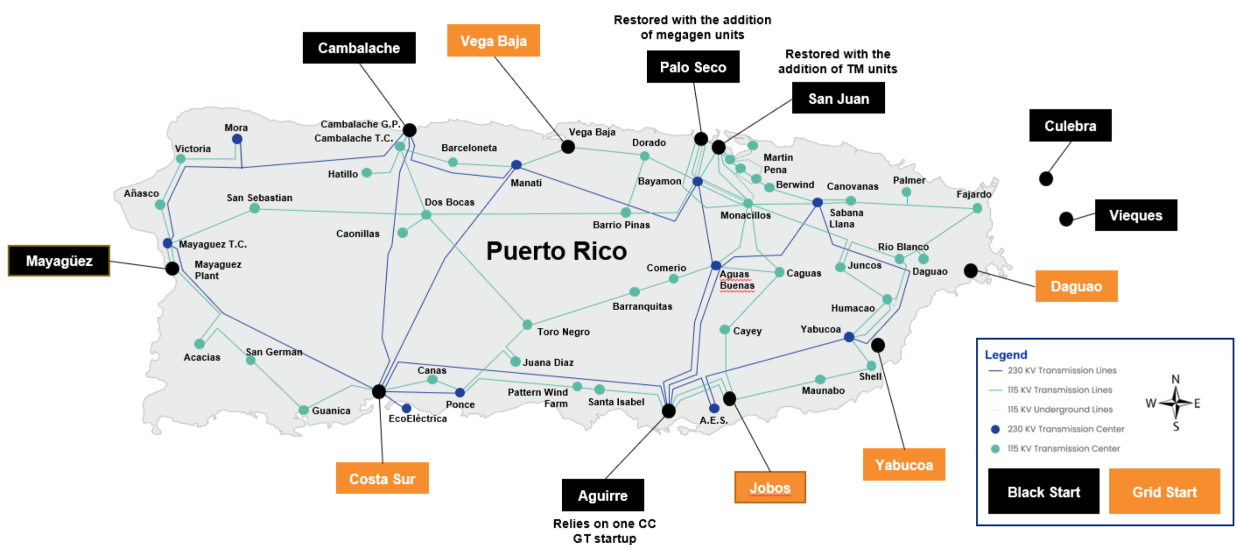
The black start generators are typically connected to the site's local power system via a step-up transformer. The generator will energize the local plant bus, allowing the back feed of the unit generator step-up transformer as per normal operating procedure. This will allow the energization of the unit auxiliary loads and initiation of the black start process.

The power plants in Puerto Rico that do have black start capability are outlined below in Figure 19. Plants identified inside a black box can start without an external grid connection (black start capability). Plants shown in an orange box require an operating transmission line feed to provide power for a plant restart.

Note that this has not always been the case, as most power plants were originally designed with black start capability. The black start systems have degraded over time and at present, only the facilities identified within a black box have this capability.

Hurricanes Irma and Maria in 2017 and Hurricane Fiona in 2022 damaged transmission lines and prevented many plant restarts. Only the facilities in black boxes could black start, and as such, interconnecting transmission lines had to be repaired before the grid power could be used to start the power generation facilities in orange. Thus, the plants shown in the orange boxes needed a working transmission line connection from a plant shown in the black box to restart.

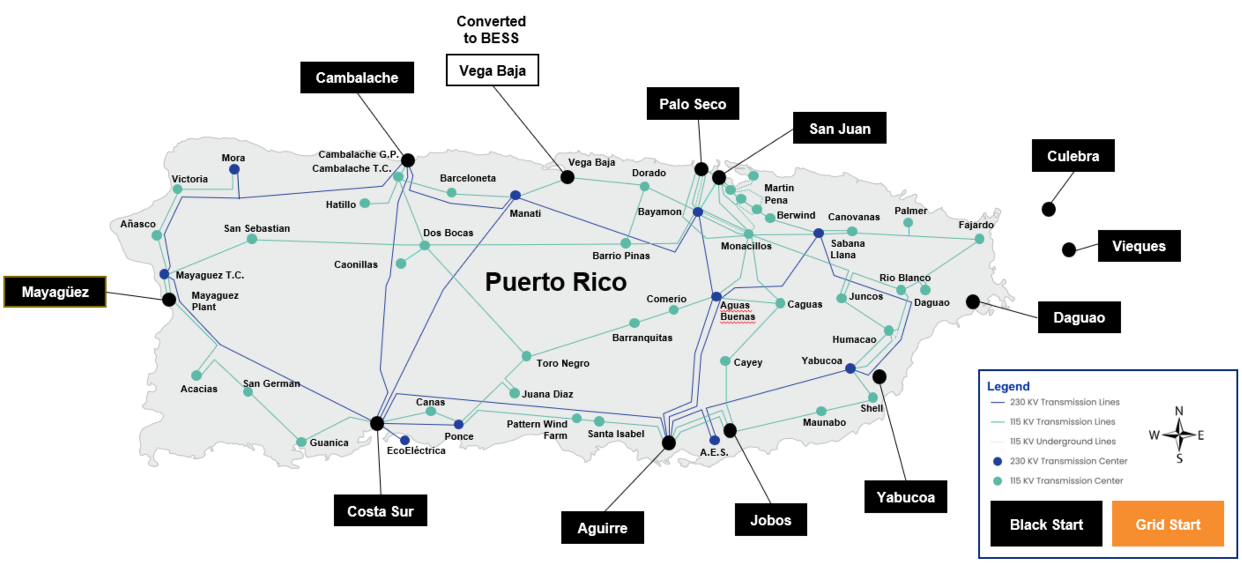
Figure 19 — Degraded Black Start System



Additional black start capability is needed so that individual plants, as defined in the orange boxes, may start without reliance on transmission lines, which may be damaged during disaster events. To understand the importance of black start capabilities, a power plant that is self-sufficient and has the capability to black start, may take only a few hours to restore its generation capability and inject power into the grid. As per Figure 19 a plant that must rely on an operating transmission line may require days, weeks, or longer before the electrical repairs are completed to restore a transmission circuit between any one of the black boxes, to an orange box needed to perform a plant startup from an outage condition. In the latter case, it is easy to understand the potentially tragic impact on critical and essential services when one compares restoration of service between a few hours versus days, weeks or more.

With the addition of the planned RICE Generator units at the existing peaking sites, in addition to RICE Generator units at select main generation sites, full restoration of the presently degraded services will be completed. This capability had previously degraded over the decades and was never properly restored. The critical situation becomes more apparent after each passing hurricane season. Plants identified in Figure 20 below with a black box will have the ability to startup without a grid connection and will be fully black start capable.

Figure 20 — Restored Black Start System



(2) Synchronous Generation

The latest IRP described the need for different types of support that the transmission system will require as synchronous generation is retired and replaced with inverter-based generation from renewable sources. In compliance with the IRP, PREB agreed with the need to add synchronous condensers to the system, which will provide voltage regulation and stability, short-circuit strength, and rotational inertia. These essential services are necessary in a system with large amounts of renewable generation to ensure that voltage and frequency throughout the system can remain stable under normal and contingency conditions, and to avoid voltage control issues in the inverter-based power sources.

The IRP included some preliminary analysis that supports the recommendation to add synchronous condensers to the system; based on this analysis, it recommends that many of the existing steam units be converted to synchronous condensers. The IRP cautions, however, that those recommendations are not final and should be verified with more detailed studies, which are currently underway.

To determine conversion feasibility, site visits were made to the locations of the existing units identified as potential candidates for conversion to synchronous condensing machines. It was determined these units were not good candidates for conversion due to their age and the necessary investment required for conversion and reconditioning to enable long-term reliable operation. When synchronous condensing support is needed, the equipment to provide that service must be as reliable with sufficient redundancy to provide stabilizing services to the power system. As such, if the synchronous condensing machines are not reliable, then the power system remains unstable.

The possibility of installing peaker and black start synchronous units that have the capability to operate in synchronous condenser modes is being evaluated. Although dedicated synchronous condensers have been in operation for over a century; the available smaller, multi-purpose generation units that can be switched to synchronous condensing mode to support the integration of inverter-based generation resources are a relatively new offering. To provide grid essential services at multiple locations in the future, without the need of dedicated synchronous condensers, if feasible, the new peakers and black start units will be furnished with this capability or configured in a "ready" mode for conversion.

Analytical studies must be performed to determine those areas of the system that would require synchronous condenser support. Since the IRP was published, the transmission system models have been updated to reflect its current condition, which has made it possible to study more accurately the short-circuit strength throughout their system and identify the weak areas that will require support as more renewable generation is added to the system. Dynamic testing of the existing power generation units is essential to update the grid system models, which will make it possible to study the dynamic behavior of the system and determine the grid support that may be required to ensure that both voltage and frequency can be maintained stable throughout the system and recover quickly after a disturbance.

The analyses described above will define the location and characteristics of the synchronous condensers that will become necessary in the system. These synchronous condensers need to be defined, designed, constructed, and placed in operation preemptively; since failure to put these synchronous condensers in place in a timely manner may result in delays to the integration of additional renewable generation projects or system instability until such time as the system is ready to accommodate those projects. Genera may define suitable areas of existing generation sites so that in the future, new synchronous condensing machines may be operated and maintained by existing staff.

(3) New Capabilities with RICE Generation

RICE Generator technology, while over a century old, has made large improvements in recent decades in terms of efficiency, cost, and emissions. Due to the anticipated future generation needs on the island as larger amounts of renewable generation projects are integrated into the system, RICE technology provides many distinct advantages over traditional gas turbine or thermal boiler generators. The advantages are summarized below, providing many new capabilities that are currently not available within the present fleet:

- RICE technology can be procured in sizes up to 18 MW; this makes the technology useful for distributed generation.
- RICE technology provides a much faster response from standby and cold start up than gas turbines. The recent bids illustrate ramp rates to full load from 1 to 10 minutes vs. 10 to 30 minutes for gas turbine technology. Distributing RICE technology across the island will equip Genera with a rapid response attribute

currently not in place, which will be useful now and in the future for renewable load following.

- In addition to fast ramp rates, RICE machines are designed for frequent starts. As renewable penetration levels increase, this will be another attribute that is currently not in place but will serve much better than gas turbine technology for rapid grid response.
- Each of the peaker facilities will include black start facilities. At present, the peaker sites are degraded and not fully capable of starting without grid power. The new RICE machines will be equipped to start even after a grid-wide outage following a weather event.
- RICE machines will employ modern controls and design features to ensure high availability and reliability.
- RICE units are specifically designed for frequent starts, fast starts, and intermittent duties. There will be a large advantage in switching technologies at the remote peaker sites, not only due to the inherent design features of RICE units, but also due to the use of natural gas fuel. Gas turbine maintenance cycles are largely dependent upon number of starts, hot shutdowns, fuel quality and ramp rates, and other OEM specific parameters. These parameters are used to develop "factored fired hours" which are used to establish maintenance intervals for gas turbines. RICE equipment maintenance intervals are primarily dependent upon operating hours, thus providing an advantage between maintenance intervals for the intended service.
- Part load efficiency is not affected as dramatically as gas turbine technology while operating at high turndown levels.
- Fewer BOP requirements when compared to GTGs and steam plants. As a result, many of the systems are integrated within prepackaged skidded assemblies.
- The thermal efficiency of RICE technology is approximately 45% vs the current Frame 5 gas turbine generators, which are approximately 22%. This means less fuel is required to be trucked to the sites per generated MW. This is a substantial

improvement over the existing gas turbine units and will lead to fuel savings with this technology.

- Truck and over the road modularity requirement for site delivery.

The RICE generators for Puerto Rico would benefit from the selection of a standardized model and associated BOP. This would be helpful from an operations and maintenance standpoint. Additionally, common spare parts could be procured from multiple support centers and be dispatched as needed. All RICE equipment at all peaking sites, including black start units for SJ and CS, are planned to be identical to ensure spare parts may be utilized across the fleet. A similar strategy has been successfully employed with the existing Frame 5 units since their initial COD.

(4) Energy Storage

BESS equipment has been configured for each site based on the available space and the need for backup black start capability. BESS provides a suitable backup for black start equipment when engaged in a plant sequential startup beginning with the lowest power consumer for startup. For example, at CS, the BESS system may supply 750 kW for the RICE engine for a secondary black start method, or it may supply 1.5 MW for a single GTG for a secondary black start method. Once the units are started, the larger steam plants, Units 5 and 6 may then be started with GTG power. Similar methods for backup black start services are available for the other generation plants. -

BESS may also be utilized to maximize the use of existing POI at the existing generation facilities scheduled for reconfiguration. The opportunity to co-locate BESS with both existing and new thermal generation equipment can be utilized to maximize the electrical injection capacity available without overloading the existing grid connection. This approach would add a significant amount of flexibility and resiliency to the operation of the reconfigured generation facilities that are currently not available with the existing equipment. All BESS systems are presumed to have 4-hr storage capacity.

In each case of reconfiguring the existing thermal generation facility, additional injection capacity may remain after the new thermal systems have been installed, and a BESS may be utilized to supplement and enhance the services provided by the reconfigured thermal generation plant. The addition of a BESS would improve the generating capabilities by responding faster than conventional generators to frequency and voltage changes in the grid. These variations may be a result of inclement weather conditions, the intermittency of renewable energy generation, or other grid events or disruptions.

BESS would also provide grid support ancillary services such as fast" spinning reserve," load balance, and frequency regulation—again, creating a new level of grid support and injection services that are presently not in place and essential for facilitating the future integration of renewable generation projects. Fast spinning reserve response has the capability to inject up to 100% of the battery capacity in seconds. This instantaneous injection of reserve energy is a function of the rate of change and system frequency deviations in the event of a sudden loss of generation or unexpected ramp-up in demand. This operation mode could potentially prevent most of the current load-shedding events due to forced outages caused by generation failures. Frequency regulation could be the primary response to protect current base-load thermoelectric generators from frequency and voltage ride-through events. This fast active power source function can continuously inject or absorb energy from the grid as a function of system frequency deviations to help manage and maintain frequency at 60 Hz.

The newly installed batteries would be available to be dispatched at the T&D system operator's request. The BESS would inject active power at the POI for a maximum duration of the BESS' storage duration to cover temporary generation deficits or start-up fast-generating units. This system would also help ensure service continuity to the area loads in a grid event. These estimates were calculated initially on the maximum amount of BESS that can be physically installed at each of the sites then refined afterwards for the available area left over subsequent to the demolition and installation of the existing generation and new thermal units respectively. It should be noted that the physical space available will not necessarily be the limiting factor when determining how much BESS can be installed at each site. Electrical power system studies must be performed to ensure that the BESS will not cause overloads or other system issues.

The final configuration of the new thermal and BESS equipment will be confirmed with an electrical interconnection and facility study in addition to dynamic studies to confirm any impacts and necessary support that the reconfigured site may provide to the electrical grid.

The following tables contain a summarized timeline for the execution of these projects.

e) Interconnection Processing

The interconnection application process with the T&D System Operator has already commenced to evaluate the Planned Configuration. Table 4 outlined the main action items from the generation interconnection process and the responsible entity.

Table 4— Generation Interconnection Tasks

Item	Genera	T&D System Operator
Determine proposed configuration and maximum MW input	✓	
Fill the generation interconnection application data forms	✓	
Provide an equivalent steady state and dynamics PSS\E model	✓	
Provide an equivalent transient PSCAD model	✓	
Documentation completion review, and model benchmarking		✓
Perform system impact and facility studies, including: • Steady state • Dynamics • Short circuit • MTR • Infrastructure and network evaluation		✓
Identify network upgrades to accommodate the requested MW input or identify maximum allowable MW injection before any network upgrades		✓

Table 6 shows a summary of the replacement of peaking capacity and storage initiative that is being undertaken by Genera.

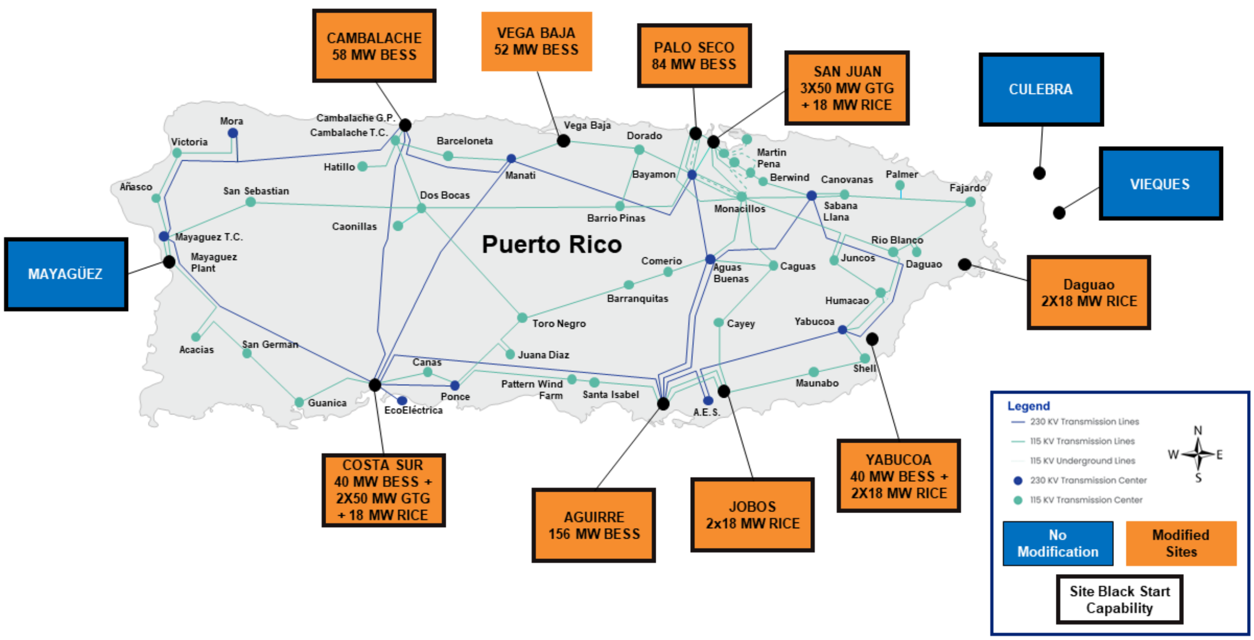
Table 5— Final Planned Power Plant Configuration

Existing Site	Existing Plant Change	Nominal MW for New Thermal Generation Equipment	Nominal MW for New Battery Energy Storage Systems	Interconnection Details
AG	Demolish 2x21 MW Black Start Units.	N/A	156	Phase 1 of BESS (40 MW) to be connected temporarily through ESST 1/2 and then transferred to new POI. Remaining capacity of BESS (116 MW) to use new POI at existing 115 kV Switchyard either at 92/24 or 96/92 breaker positions with new MPT.
CS	Installation of BESS in previous location of 50 MW Unit 1 and 50 MW Unit 2. Demolish warehouse #5, mechanical workshop 2, maintenance team building, BS #1 and BS #2, and other small buildings.	2x50 MW GTGs 1x18 MW Black Start RICE Generator	40	To connect new thermal units (GTG & RICE Generator), a new GIS will be installed and tied to existing Units 3 & 4 POI. BESS Will be connected through ESST 5/6
SJ	Demolish mechanical workshop, main and small warehouses, safety and PMO offices, maintenance and mechanical team members, small shops (e.g. abandoned vehicle maintenance shops), reconfiguration of transmission lines.	3x50 MW GTGs 1x18 MW Black Start RICE Generator	N/A	Re-utilize Unit 8(84/86 BAH) to feed a new GIS SWGR with seven breakers (two mains and 5 feeders), breakers for each of the three new gas turbines with MPT each one, another port for future STG with MPT and a breaker for 1x18 MW RICE Generator unit.
DG	Demolish 2x21 MW GTGs – Need additional land from substation.	2x18 MW RICE Generator	N/A	RICE Generator to use POI at existing 115 kV switchyard with existing MPT that will be replaced in the future.

JB	Demolish 2x21 MW GTGs and adjacent abandoned property structures owned by PREPA.	2x18 MW RICE Generator	N/A	RICE Generator to use a new POI at the existing 38 kV switchyard using the existing MPT that will be replaced in the future. A new POI configuration is suggested to improve reliability.
PS	Demolish 6x21 MW GTGs for BESS installation.	N/A	84	BESS to use existing GT 115 kV MPTs (Blocks 1 & 2) that will be replaced in the future.
VB	Demolish 2x21 MW GTGs.	N/A	52	BESS to reuse POI at existing 38 kV MPT that will be replaced in the future.
YB	Demolish 2x21 MW GTGs – Need additional land currently used by LUMA.	2x18 MW RICE Generator	40	BESS to reuse POI at existing 115 kV MPT that will be replaced in the future. RICE Generator to use new POI with a new MPT at the existing 115 kV switchyard
CMB	Use Unit 1 - 82.5 MW out of service connection as temporary BESS connection.	N/A	58	BESS to reuse POI at existing 230 kV MPT for U1 GTG that is impaired. A new POI at the 230 kV switchyard with a new MPT will be planned in the future.

The new projects associated with the Electric System Stabilization Plan outlined above, are graphically illustrated in Figure 21. As per the legend, the sites tagged in orange—all of which are considered brownfield sites—would require multiple steps to reconfigure the facilities including decommissioning, salvage and dismantling, remediation, site preparation, construction, commissioning, and testing. The sites in blue would remain as presently configured.

Figure 21— Map of Capital Projects for Electric System Stabilization Plan



As defined previously, the key aspects are all suitably addressed with the planned configuration shown in Figure 21, which also satisfies the requirement for FEMA funding. These improvements will provide better support for reliable service while maintaining acceptable frequency and voltage levels during normal conditions and even after disturbances to system stability or the unexpected loss of components.

Genera's recommendation also addresses the island's severely degraded black start capabilities. With these power plant reconfigurations, black start capability is restored for all thermal generation facilities across the island and includes a fully redundant black start backup for sites with BESS installations. In the event of storm or other disaster event, these facilities would be able to quickly support electric power restoration of communities helping to keep critical systems available by supplying electricity to hospitals, elderly care homes, police stations, fire stations, transportation, commercial, industrial, and critical infrastructure utilities like water and telecommunications. Placing dual-fuel generation equipment at these locations, particularly the east side of the island that often bears hurricane and storm landfalls, will help improve the resiliency of the electrical grid in the immediate area during or following these events. The new generators would provide reliable services for emergency power and reduce the dependence on an intact transmission system immediately after a storm to deliver power to these locations.

The configurations planned not only provide substantial improvements for current power generation needs but are also effectively configured to manage the anticipated needs of the future power grid, address hazard mitigation needs, provides for grid support services for stabilization, include provisions for future expansions to lower the cost of power generation, and fully restore the degraded black start systems across the island.

2. Replacement of Critical Components

Planned FY25 and FY26 Investment: $130 Million

Federally funded

Replacing critical components of thermal units in the energy industry is crucial for maintaining the reliability and safety of power generation systems. Compared to repairing these components, replacing them offers long-term benefits that substantially outweigh the initial costs. By proactively replacing critical components such as air and water heater baskets, pumps, motors, hydrogen coolers, seals, screens, valves, breakers, switch gears, controls, fire protection systems, and cooling towers, Genera will reduce forced outages and the resulting unexpected power interruptions.

The long-term cost-benefit of replacing rather than repairing these critical components lies in the increased reliability and reduced maintenance costs. While repair may seem like a cost-effective solution in the short term, it often leads to frequent failures and the need for continuous repairs, ultimately resulting in higher costs and decreased system reliability. On the other hand, replacing critical components ensures the stability of the generation fleet, reduces the occurrence of forced outages, and minimizes the risk of unexpected power interruptions, thereby enhancing the overall efficiency and resilience of the power generation systems.

As of the date of this report, Genera has published RFPs for over 60% of the identified critical components and will have another 10% published in the coming weeks. Estimated delivery times for these parts are expected to be between 12 to 24 months after contract signing; some contracts will need government approval(s). Genera will update the estimated timelines as it receives contractual commitments from vendors. For the remaining 30% of the parts, technical specifications and scope of supply are under development; these items generally require re-engineering or more extensive technical design work than the initial 70%, which has contributed to their delay.

In summary, the replacement of critical components is a proactive initiative aimed at securing the long-term reliability and stability of power generation systems in the energy industry. It not only reduces forced outages but also contributes to the uninterrupted supply of power to meet the needs of customers, making it a sound investment in ensuring the security and resilience of energy services.

D. Adding Temporary Supplemental Generation

Investment FY24 and FY25: TBD

LUMA's Resource Adequacy Study reveals significant challenges in meeting industry-standard resource adequacy risk targets due to the inability to rely on electricity imports and the unreliability of its generators. The analysis calculated a loss of LOLE of 37.5 days per year, significantly higher than industry benchmarks, with a high standard deviation in the results, indicating a wide distribution in LOLE. This wide distribution is attributed to the high forced outage rates of existing power plants and the significant risk of not having enough remaining generators available to cover the load when power plants go offline for outages.

The report analyzes risk measures and several sensitivity cases, including alternatives to new emergency generation, retirement of AES, demand response programs and flexible combined cycle.

PREPA recently purchased 14 generators that will be in place until December 21, 2025. These generators add ~ 340 MW of dispatchable generation to the grid. Per the Resource Adequacy Study, adding this new emergency generation will reduce the 37.5 LOLE to 18.5. Nonetheless, the report also calculates that adding 905 MW would reduce it further to 0.1. An additional ~ 565 MW, which added to the 340 MW already installed on a temporary basis, is needed to almost eliminate LOLE. This generation should be flexible and dispatchable.

This additional supplemental power will give stability to the system until new generation assets are integrated on a permanent basis and also allow the system to meet the required reserve margin while long-term repairs and decommissions are being performed. Genera has already assessed the system and identified multiple interconnection points that are available to several connect mid-size (25 MW) units.

Adding these units to the system on a temporary basis is similar to replicating the FEMA-driven temporary missing by which USACE installed and connected 425 MW to the system in record time. In the interest of time, the best option is to identify units that are already available on the market and will most likely be used. This reduces the lead-time of new units, which is mainly what this temporary initiative seeks to avoid. The units would be added to the system on a temporary basis to meet the regulatory requirements, including PREB's. Furthermore, to ensure cost-reasonableness, it is preferable that the integration of the units not entail upgrades in the interconnection processes. Additional details on this initiative must be closely coordinated with the T&D System Operator and several regulatory bodies, including environmental.

It is recommended that PREB allows an RFP process to be initiated as soon as possible to identify real costs from the market to assess the cost-reasonableness of this initiative. Similar to the TM Units installed, fuel costs would be funded through the regular fuel adjustment process.

X. CHALLENGES AND CONTINGENCIES

A. Lead-times

Genera will face several challenges in the process of implementation of its projects. One of the major challenges will be the long lead times for the delivery of major electrical and power equipment being confronted by utilities worldwide. Generating units, GSU, switchgears, and high voltage breakers are just some of the equipment that will be used for the construction and rehabilitation of the generating fleet.

In most cases, the lead time for these major equipment dictates the time for completion of the project. A high demand worldwide due to the construction of new projects and replacement of existing generating units is having a high impact in all markets. Contracts for the acquisition of new peaking units are expected to have lead times between 18 and 30 months after their execution with an additional six months for installation, testing and commissioning of the entire related system. Similarly, GSUs and switchgear manufacturers deliver their equipment between 18 and 30 months after a contract is signed.

Also, these long lead times are impacting efforts to improve and strengthen the existing generating fleet reliability. Critical components, GSUs and expected part replacement programs (e.g., CMB) are some of the key areas affected by lead times, due to their high demand, cost and lead time, all of which represent a challenge to Genera in the plan to replace this equipment and have replacements available to improve the reliability of the system.

The increase in the penetration of renewable generation also increases the utility market's demand for fast response generation, and Puerto Rico is not an exception. Genera is seeking small and medium-sized generating units and battery energy storage systems that can compensate for intermittent solar and wind generation. Original equipment manufacturers and specialized contractors are currently in high demand and will represent a challenge for Genera to get proposals and negotiate contracts.

B. Generation Insufficiency

Although Puerto Rico has a substantial amount of generation installed, most of that generation is historically unreliable and too frequently incapable of operating reliably.

Generation PRM defines if there is enough installed generation capacity. The PRM is defined as the amount by which the total system generation capacity exceeds peak electrical demand. For a given system, higher PRM typically equates to a lower risk that load will not be served during a given period. The available PRM provides planning criteria, such as a requirement to have enough generation to cover the loss (planned or unplanned) of the largest generator in the system. Currently, the generation system is operating with a PRM that is much greater than what is typical of North American operators, which may give the impression that the generation system has a certain amount of dispensable generation resources that could be shut down without adversely affecting the operation of the system. The reality is that there are often struggles to meet demand. This can be explained by the fact that although there may be a surplus of nameplate generation, that generation is substantially more unreliable than that of North American utilities. Much of the generation fleet dates back to the 1960s and 1970s with poor effective forced outage rate statistics, so all this additional reserve becomes necessary to ensure that enough operable spare generation is available to cover demand when outages occur.

In June 2024, the electric system experienced 6 load shed events due to generation shortfall and 11 generation events that caused underfrequency load shed to prevent frequency decay. Demand is expected to remain high through June 2024 and frequently reach peaks of 2900 MW to 3000 MW. In June 2024, the hourly reserve levels averaged 623 MW, with 467 hours during the month having less than 750 MW in reserves.

Given the frequent outage events, extensive staffing and resources are required to bring systems back online after each forced outage event. Without adequate PRM, scheduled preventative maintenance cannot be performed and must be delayed. For example, planned maintenance on AG Unit 1 results in a decrease in 450 MW of capacity. During a planned maintenance outage of one of the large generation units, no other units can have a forced outage. If these events occur together, there will not be adequate power generation to meet the load demand. Delay of maintenance, of course, increases the likelihood of future issues. Genera seeks an additional temporary generation bridge to this challenge, as noted above.

XI. ELECTRIC SYSTEM STABILIZATION PLAN SUMMARY

A summary of the Electric Stabilization Plan is presented in Table 6. This Table includes short-term and long-term initiatives, targeted areas to be improved and other pertinent details of the planned projects.

Table 6— Summary of the Electric Stabilization Plan

Initiative	Commercial Operation Date	Areas to be Improved	Benefits to the Electric System	Investment	Source
Short-term Repairs	Q4 2026	Forced outage resolution Plant/unit maintenance Limitation	Add capacity Reliability	TBD	Non-Federally Funded
Replacement CS Peakers	Q1 2027	Load-shedding	Fast-response Meet reserve margins	$800MM	Federally Funded
Replacement CS Black Start System	Q1 2027				
Replacement SJ Peakers	Q4 2027				
Replacement SJ Black Start System	Q4 2027				
Replacement DG Peakers	Q3 2027				
Replacement JB Peakers	Q1 2027				
Replacement YB Peakers	Q2 2027				
Installation of CS BESS	Q4 2025				

Initiative	Commercial Operation Date	Areas to be Improved	Benefits to the Electric System	Investment	Source
Installation of CMB BESS	Q4 2025	Grid stability	Instant response	$700MM	Federally Funded
Installation of VB BESS	Q4 2025				
Installation of AG BESS	Q3 2026				
Installation of YB BESS	Q2 2026				
Installation of PS BESS	Q3 2026				
Temporary Supplemental Power	Q2 2025	Load-shedding	Reliability Meet reserve margins	TBD	TBD

XII. APPENDIX

Appendix A

Status Of Thermal Generation Fleet

Facility	Station – Unit	COD	Nameplate Capacity (MW)	Status	Refurbishment Plan	Retirement Plan[61]
AG	AG – ST #1	1971	450	Operational with temporary limits, Not Impaired	In FY 2023 work continued on boiler components, turbine control valves, feedwater motors and pumps, condensate water circulation motors and pumps, induced draft, forced draft and gas recirculating fans were maintained.	N/A at this time
	AG – ST #2	1971	450	Operational with temporary limits, Not Impaired	Maintenance scheduled for FY 24 and 25.	N/A at this time
	AG – Black Start Turbine #1	1972	21	Permanently Impaired – FY22	Scheduled for demolition – Date TBD	
	AG – Black Start Turbine #2	1972	21	Permanently Impaired – FY22	Scheduled for demolition – Date TBD	
	AG – CC1 – CT 1	1977	50	Not Impaired		N/A at this time
	AG – CC1 – CT 2	1977	50	Not Impaired		N/A at this time
	AG – CC1 – CT 3	1977	50	Impaired FY22 – Will be refurbished	Major inspection and repairs pending.	N/A at this time

[61] Considers the next two (2) years.

Facility	Station – Unit	COD	Nameplate Capacity (MW)	Status	Refurbishment Plan	Retirement Plan[61]
	AG – CC1 – CT 4	1977	50	Impaired FY22 – Will be refurbished	Approximate date of completion of this works is May 23,2024. Contract for HGPI in P3 and FOMB evaluation. 100 days of work after mobilization.	N/A at this time
	AG – CC1 - ST	1977	96	Impaired FY22 – Will be refurbished	Unit available in continuous monitoring to improve capacity by adding GT 1-4 and GT 1-3 to combine when available.	N/A at this time
	AG – CC2 – CT 1	1977	50	Impaired FY22 – Will be refurbished	MPT Failure. New transformer purchase in process.	N/A at this time
	AG – CC2 – CT 2	1977	50	Impaired FY22 – Will be refurbished	MPT Failure. New transformer purchase in process.	N/A at this time
	AG – CC2 – CT 3	1977	50	Not Impaired	Requires CI inspection	N/A at this time
	AG – CC2 – CT 4	1977	50	Not Impaired	Requires HGP inspection	N/A at this time
	AG – CC2 - ST	1977	96	Impaired FY22 – Will be refurbished	Turbine and aux equipment repairs pending.	N/A at this time
CMB	CMB – CT #1	1997	82.5	Impaired – FY22	Gas turbine failure – impair unit	Refurbishment is still being evaluated.
	CMB – CT #2	1997	82.5	Not Impaired	Ongoing replacement of critical components	N/A at this time
	CMB – CT #3	1997	82.5	Not Impaired	Ongoing replacement of critical components	N/A at this time
CS	CS – ST #1	N/A	50	Impaired – FY22	Scheduled for demolition – Demolition is ongoing	
	CS – ST #2	N/A	50	Impaired – FY22	Scheduled for demolition – Demolition is ongoing	
	CS – ST #3	1962	85	Impaired – FY22	Scheduled for demolition – Date TBD	

Facility	Station – Unit	COD	Nameplate Capacity (MW)	Status	Refurbishment Plan	Retirement Plan[61]
	CS – ST #4	1963	85	Impaired – FY22	Scheduled for demolition – Date TBD	
	CS – ST #5	1972	410	Not Impaired	Air heater basket replacement needed	N/A at this time
	CS – ST #6	1973	410	Not Impaired	BFP 6-2 repair needed	N/A at this time
	CS – CT #1	1972	21	Impaired – FY22	Scheduled for demolition – FY2025	
	CS– CT #2	1972	21	Impaired – FY22	Scheduled for demolition – FY2025	
Culebra	Culebra #1	2018	2	Not Impaired	N/A	N/A at this time
	Culebra #2	2018	2	Not Impaired	N/A	N/A at this time
	Culebra #3	2018	2	Not Impaired	Repair work through June 30, 2024	N/A at this time
DG	DG – CT #1	1972	21	Not Impaired	N/A	Expected FY2027
	DG – CT #2	1972	21	Not Impaired	N/A	Expected FY2027
JB	JB – CT #1	1971	21	Impaired – FY22	Scheduled for demolition – FY 2026	
	JB – CT #2	1971	21	Not Impaired	N/A	Expected FY2026
Mayagüez	Mayagüez – CT #1A	2008	27.5	Not Impaired	N/A	N/A at this time
	Mayagüez – CT #1B	2008	27.5	Not Impaired	N/A	N/A at this time
	Mayagüez – CT #2A	2008	27.5	Not Impaired	N/A	N/A at this time
	Mayagüez – CT #2B	2008	27.5	Not Impaired	N/A	N/A at this time
	Mayagüez – CT #3A	2008	27.5	Not Impaired	N/A	N/A at this time
	Mayagüez – CT #3B	2008	27.5	Not Impaired	N/A	N/A at this time
	Mayagüez – CT #4A	2008	27.5	Not Impaired	N/A	N/A at this time
	Mayagüez – CT #4B	2008	27.5	Not Impaired	N/A	N/A at this time
PS	PS – ST #1	1960	85	Impaired – FY22	Scheduled for demolition – Date TBD	
	PS – ST #2	1961	85	Impaired – FY22	Scheduled for demolition – Date TBD	

Facility	Station – Unit	COD	Nameplate Capacity (MW)	Status	Refurbishment Plan	Retirement Plan[61]
	PS – ST #3	1967	216	Not Impaired	Ongoing replacement of critical components to return to full nameplate output.	N/A at this time
	PS – ST #4	1967	216	Idle - Will be refurbished	Ongoing replacement of critical components	N/A at this time
	PS – CT #1-1	1972	21	Not Impaired	Expected FY2026 – After CT 2-2, 3-1, and 3-2.	
	PS – CT #1-2	1972	21	Not Impaired	Expected FY2026 – After CT 2-2, 3-1, and 3-2.	
	PS – CT #2-1	1972	21	Not Impaired	Expected FY2026 – After CT 2-2, 3-1, and 3-2.	
	PS – CT #2-2	1972	21	Impaired – FY22	Scheduled for demolition – Expected FY 2025	
	PS – CT #3-1	1972	21	Impaired – FY22	Scheduled for demolition – Expected FY 2025	
	PS – CT #3-2	1972	21	Impaired – FY22	Scheduled for demolition – Expected FY 2025	
	PS – Mega Gen 1	2022	27	Not Impaired		N/A at this time
	PS – Mega Gen 2	2022	27	Not Impaired		N/A at this time
	PS – Mega Gen 3	2022	27	Not Impaired		N/A at this time
	PS – TM 1-2	2024	2 x 25	Not Impaired	New units	Newly acquired
	PS – TM 3-4	2024	2 x 20	Not Impaired	New units	Newly acquired
SJ	SJ – CC #5	2008	220	Not Impaired		N/A at this time
	SJ – CC #6	2008	220	Not Impaired		N/A at this time
	SJ – ST #7	1965	100	Not Impaired		N/A at this time
	SJ – ST #8	1966	100	Impaired – FY22	Scheduled for demolition – Date TBD	
	SJ – ST #9	1968	100	Not Impaired		N/A at this time
	SJ – ST #10	1969	100	Impaired – FY22	Scheduled for demolition – Date TBD	
	SJ – TM 1 - 10	2024	10 x 25	Not Impaired	N/A – New Units	
VB	VB – CT #1	1971	21	Impaired – FY22	Scheduled for demolition – Expected FY 2025	
	VB – CT #2	1971	21	Impaired – FY22	Scheduled for demolition – Expected FY 2025	

Facility	Station – Unit	COD	Nameplate Capacity (MW)	Status	Refurbishment Plan	Retirement Plan[61]
Vieques	Vieques – 1	2004	3	Not Impaired	N/A	N/A at this time
	Vieques – 2	2004	3	Not Impaired	N/A	N/A at this time
YB	YB – CT #1	1971	21	Impaired – FY22	Scheduled for demolition –Expected FY 2027	
	YB – CT #2	1971	21	Not Impaired	N/A	Expected FY2027