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

IN RE: REVIEW OF THE PUERTO RICO ELECTRIC POWER AUTHORITY INTEGRATED RESOURCE PLAN	**CASE NO.:** CEPR-AP-2018-0001 **SUBJECT**: Report of the Authority's Retirement Plan

MOTION TO SUBMIT BI-ANNUAL STATUS REPORT OF THE AUTHORITY'S RETIREMENT PLAN AND EXPECTED CAPACITY RESOURCE BALANCE

TO THE HONORABLE PUERTO RICO ENERGY BUREAU:

COMES NOW, the Puerto Rico Electric Power Authority, through its counsel of record and respectfully sets forth and prays:

1. On August 24, 2020, the Puerto Rico Energy Bureau of the Public Service Regulatory Board (the "Energy Bureau") entered *Final Resolution and Order on the Puerto Rico Electric Power Authority's Integrated Resource Plan* (the "Final IRP Order") directing the Puerto Rico Power Authority (PREPA or the "Authority") to, among other things, "file with the Energy Bureau bi-annual status reports, commencing on April 1, 2021, that provide a near-term forecast (two years forward of the reporting date) of PREPA's expected capacity resource balance on a seasonal basis and its ability to meet peak load and operating reserve requirements with existing and anticipated resources on its system at each of the forecasted intervals[]" (the "Bi-Annual Status Report"). Final IRP Order, pag. 270, ¶ 872.

2. In the Final IRP Order, the Energy Bureau had determined that, should "PREPA find[] that it is unable to meet any of the deadlines [included in the Final IRP Order], [it] shall timely provide notice to the Energy Bureau no less than 10 business days prior to the deadline." *Id.*, pag. 263, ¶

845. Further, the Energy Bureau ordered that "[a]ny such notice should be accompanied by a justification for the delay and a reasonable proposal for a new deadline." *Id.*

3. As such, and in compliance with the above-cited directives, on March 18, 2021, the Authority filed *Motion to Request Extension of Time to Submit Status Reports (sic) on Retirement of Existing Thermal Resources* requesting the Energy Bureau to grant a 45-days extension of time, that is until May 16, 2021, to file the first Bi-Annual Status Report (the "Motion for Extension"). The Authority explained to the Energy Bureau that the delay in the approval of an amendment and extension to Sargent and Lundy LLC's professional services agreement and also, several ongoing discussions with the Puerto Rico Department of Natural and Environmental Resources and the United States Environmental Protection Agency in regards to the control strategies for the State Implementation Plan, prevented the Authority from delivering to the Energy Bureau the Bi-Annual Status Report by the mandated deadline. To date the Energy Bureau has not responded to the request made by the Authority in the Motion for Extension.

4. In compliance with the deadline suggested by the Authority, included as Exhibit A to this motion is the first Bi-Annual Status Report titled *Retirement Plan, PREPA's Expected Capacity Resource Balance*. Exhibit A.

WHEREFORE, the Authority herein requests the Energy Bureau to find PREPA in compliance with its obligation to submit the first Bi-Annual Status Report.

RESPECTFULLY SUBMITTED.

In San Juan, Puerto Rico, this 17th day of May 2021.

s/ Katiuska Bolaños Lugo
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CERTIFICATE OF SERVICE

It is hereby certified that, on this same date I have filed the above motion using the Energy Bureau's Electronic Filing System, at the following address: http://radicacion.energia.pr.gov and that a courtesy copy of the filing was sent via e-mail to: sierra@arctas.com; tonytorres2366@gmail.com; cfl@mcvpr.com; gnr@mcvpr.com; info@liga.coop; amaneser2020@gmail.com; hrivera@oipc.pr.gov; jrivera@cnslpr.com; carlos.reyes@ecoelectrica.com; ccf@tcmrslaw.com; manuelgabrielfernandez@gmail.com; acarbo@edf.org; pedrosaade5@gmail.com; rmurthy@earthjustice.org; rstgo2@gmail.com; larroyo@earthjustice.org; jluebkemann@earthjustice.org; acasellas@amgprlaw.com; loliver@amgprlaw.com; epo@amgprlaw.com; robert.berezin@weil.com; marcia.goldstein@weil.com; jonathan.polkes@weil.com; gregory.silbert@weil.com; agraitfe@agraitlawpr.com; maortiz@lvprlaw.com; rnegron@dnlawpr.com; castrodieppalaw@gmail.com; voxpopulix@gmail.com; paul.demoudt@shell.com; javier.ruajovet@sunrun.com; escott@ferraiuoli.com; SProctor@huntonak.com; GiaCribbs@huntonak.com; mgrpcorp@gmail.com; aconer.pr@gmail.com; axel.colon@aes.com; rtorbert@rmi.org; apagan@mpmlawpr.com; sboxerman@sidley.com; bmundel@sidley.com.

In San Juan, Puerto Rico, this 17th day of May 2021.

s/ Katiuska Bolaños Lugo
Katiuska Bolaños Lugo

Exhibit A

Report SL-016223 | Revision 0 | May 17, 2021

Retirement Plan

PREPA's Expected Capacity Resource Balance

Prepared by

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Legal Notice

This deliverable was prepared by Sargent & Lundy, L.L.C. (S&L) expressly for the sole use of the Puerto Rico Electric Power Authority (Client) in accordance with the contract agreement between S&L and Client. This deliverable was prepared using the degree of skill and care ordinarily exercised by engineers practicing under similar circumstances. Client acknowledges: (1) S&L prepared this deliverable subject to the particular scope limitations, budgetary and time constraints, and business objectives of Client; (2) information and data provided by others, including Client, may not have been independently verified by S&L; and (3) the information and data contained in this deliverable are time-sensitive and changes in the data, applicable codes, standards, and acceptable engineering practices may invalidate the findings of this deliverable. Any use or reliance upon this deliverable by third parties shall be at their sole risk.

Version Log

Version	Issue Date	Sections Modified
Revision 0	May 17, 2021	Initial Issue

Issue Summary and Approval Page

This is to certify that this document has been prepared, reviewed, and approved in accordance with Sargent & Lundy's Standard Operating Procedure SOP-0405, which is based on ANSI/ISO/ASSQC Q9001 Quality Management Systems.

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17 May 2021

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Figures and Tables

Acronyms and Abbreviations

Acronym/Abbreviation	Definition/Clarification
AES	Applied Energy Services
BESS	battery energy storage system
COA	conditions of approval
COD	commercial operation date
DNER	Puerto Rico Department of Natural and Environmental Resources
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FOMB	Financial Oversight and Management Board
HMGP	Hazard Mitigation Grant Program
IRP	Puerto Rico Integrated Resource Plan 2018–2019
MTR	minimum technical requirement
NERC	North American Electric Reliability Corporation
NPDES	National Pollutant Discharge Elimination System
PPOA	power purchase and operations agreement
PREB	Puerto Rico Energy Bureau
PREPA	Puerto Rico Electric Power Authority
PRM	planning reserve margin
PSS/E	power system simulator for engineering
PV	photovoltaic
RFP	request for proposal
RPS	renewable portfolio standard
S&L	Sargent & Lundy
VPP	virtual power plant

1.0 Introduction

1.1. Background

In February 2018, PREPA's governing board released its vision statement as a guide for the future of the electric utility. One of the basic principles is that PREPA will strive to develop a more sustainable system and move away from its reliance on inefficient, fossil fuel-based generation and transition to a diverse mix of generation resources. Based on the principles of the new vision and the requirements imposed by applicable laws and regulations, PREPA prepared the Puerto Rico Integrated Resource Plan 2018–2019 (IRP) and issued it in draft form in June 2019. The IRP set a roadmap for the future development of the utility's electrical infrastructure with specific plans to improve the resiliency and reliability of its entire electrical generation and delivery systems, reduce the cost of energy to customers, and limit PREPA's future dependence on fossil fuels. The Puerto Rico Energy Bureau (PREB) reviewed the IRP plan and issued its final resolution and order on the IRP on August 24, 2020, therein providing detailed findings, conclusions, and orders to PREPA.

PREB's final resolution and order dictates the action plan that PREPA must follow as it lays the foundation for the future of Puerto Rico's electrical system. Among the key elements of the order are the following:

- An increased deployment of solar photovoltaic (PV) and battery resources as compared to the plan outlined within PREPA's IRP
- The issuance of a series of requests for proposal (RFPs) for all forms of renewable energy resources that will allow PREPA to meet the renewable portfolio standard (RPS) requirements set forth in Act 82-2010 and Act 17-2019
- The systematic retirement of PREPA's oil-fired plants (Aguirre Steam Units 1 and 2, Palo Seco Steam Units 1, 3, and 4 [Palo Seco Unit 2 has already been retired], and San Juan Steam Units 7–10) with a combined nameplate capacity of 1817 MW by 2025

PREPA is working on several studies to determine how these goals can be implemented successfully and expeditiously. Regarding the retirement schedule for the thermal generation, it is important to note that the retirement of units can only occur after enough replacement generation is available to allow the system to serve all its demand safely, reliably, and at an acceptable cost.

1.2. Biannual Status Reports

This report is the first in a series that will be prepared in six-month intervals to fulfill the requirements set forth by the PREB in their final resolution as quoted below:

> "The Energy Bureau orders PREPA to file with the Energy Bureau bi-annual status reports, commencing on April 1, 2021, that provide a near-term forecast (two years forward of the reporting date) of PREPA's expected

> capacity resource balance on a seasonal basis and its ability to meet peak load and operating reserve requirements with existing and anticipated resources on its system at each of the forecasted intervals. PREPA shall include in these reports an explanation of how this expected capacity resource balance informs PREPA's plans to retire the oil-fired steam units or the Aguirre combined cycle units, or to convert certain steam units to synchronous condensing operation. Caveat Number 170 in PREPA's Proposed IRP indicates that retirement shall only be implemented after new resources are fully operational. PREPA must indicate in these reports the threshold capacity balance at which retirement for these units can commence, or continue, and provide an explanation of its rationale for decisions to retire, or retain, these units prior to or past the retirement dates listed in the resource development scenarios in the Proposed IRP."

The first part of these biannual status reports will consist of an update of recent developments since the issuance of the previous report. It will describe the progress made related to contracting, engineering, and construction of the different types of projects that will have an influence on the capacity resource balance and therefore on PREPA's ability to successfully retire aging thermal generation. This includes any projects related to new renewable energy generation and energy storage as well as any new thermal generation projects that may be required. It will also include a discussion of any ongoing grid essential services projects, such as synchronous condenser projects, that need to be in place before old thermal generation can be retired. Finally, it will conclude with an update of activities related to the retirement of existing thermal generation.

The second part of the report will build on the information presented in the first part to present a discussion of the activities planned for the following two-year period. Again, this section will cover projects related to new renewable energy generation projects, energy storage, thermal generation projects, and grid essential services projects. Based on the anticipated progress across all these different types of projects, a forecast will be made of the thermal generation resources that can be retired during this period.

Finally, a spreadsheet was used to calculate the available capacity on a monthly basis for this 24-month forecast. The nameplate capacity of each unit was adjusted to reflect unit derates, planned maintenance, environmental outages, and forced outages (based on historical equivalent forced outage rates). In addition, any unit retirements and the addition of new generation occurring during this 24-month period are included in the spreadsheet evaluation. The peak demand forecast for the spreadsheet evaluation was provided by PREPA's load forecasting department. This combination of available generation and system load has been used to verify the adequacy of the available generation to reliably supply the demand on a monthly basis.

2.0 Current Status

2.1. Renewable Generation Projects

Act 82-2010, as amended by Act 17, directed PREPA to procure renewable energy resources in accordance with the following milestones relative to the aggregate percentage of generation supplying its system: 20% by 2022, 40% by 2025, 60% by 2040, and 100% by 2050.

PREB issued its final resolution and order on the IRP in Case No. CEPR-AP-2018-0001 on August 24, 2020 (the "Final Resolution"). In the Final Resolution, PREB approved a modified preferred resource plan and a modified action plan for PREPA to follow over the next five years for the procurement of new energy resources and the retirement of many of its fossil fuel generating units. In addition, on December 8, 2020, PREB issued the December 8 Energy Bureau Order, directing PREPA to use every effort to comply with the IRP, the modified preferred resource plan, and the modified action plan approved in the Final Resolution and to achieve the 40% renewable energy generation target for 2025 as required by Act 82-2010 as amended by Act 17. PREB also ordered PREPA to implement a procurement plan and develop a RFP in accordance with the December 8 Energy Bureau Order.

2.1.1. Requests for Proposals for Renewable Generation Projects

To achieve the established targets, PREPA began implementing a procurement plan for renewable resources and battery energy storage. The plan consists of issuing six separate RFPs, in six-month intervals, for tranches of renewable generation and energy storage projects that will lead to reaching the RPS targets corresponding to 2025.

On February 22, 2021, PREPA issued the first RFP to developers to solicit proposals for the design, construction, installation, ownership, operation, and maintenance of renewable energy generation and battery energy storage projects installed at sites across Puerto Rico as well as for the sale and purchase of energy or capacity made available by such projects. To incentivize the rapid growth of renewable generation, the RFP stipulates the projects must achieve commercial operation in no more than 24 months from the date on which a selected proponent executes a contract, with preference given to those proposals that can achieve commercial operation within a shorter timeframe.

With this first RFP process, PREPA intends to procure at least 1000 MW of renewable energy resource capacity and at least 500 MW (2000 MWh) of energy storage resource capacity with an effective duration of four hours, including at least 150 MW of distributed energy storage virtual power plants (VPPs). PREPA will accept proposals for all, or a portion, of this capacity, but renewable energy resources offered in response to this RFP on a standalone basis (i.e., other than those aggregated into a VPP) must have a

generating capacity of at least 20 MW. The proposed projects must comply with a set of minimum technical requirements prepared by PREPA for the specific technology of each type of project.

The deadline for submission of proposals in this first RFP process of the new procurement plan is May 28, 2021.

2.1.2. Proposal Evaluation/Awards for Renewable Generation Projects

From 2009 to 2012, the PREPA entered into power purchase and operations agreements (PPOAs) with 60 developers of renewable energy projects. As detailed in "PREPA – Operating PPOA Justification Memo" and "PREPA – Non-Operating PPOA Justification Memo," both dated May 26, 2020, PREPA management determined in 2019 that 9 of the agreements with projects currently in operation (i.e., operating PPOAs) and 19 of the agreements which reached various stages of development (i.e., non-operating PPOAs) should be renegotiated to better align PREPA's finances with PREPA's fiscal plan.

The renegotiation process for the 19 non-operating PPOAs continued through the end of 2020 and has culminated with the selection of 2 of those PV projects for which PREPA intends to sign PPOAs, pending approval from PREB. The two projects together will add 150 MW of capacity to the system, with an estimated commercial operation date (COD) approximately 30 months from assumption of the PPOAs.

2.1.3. Permitting, Engineering and Construction of Renewable Generation Projects

No renewable energy generation projects are currently in permitting, engineering, or construction phases.

2.2. Battery Energy Storage System (BESS) Projects

BESS is an integral part of PREPA's plan for the future in order to meet the RPS levels mandated by Act 17, since it enhances power system flexibility and enables high levels of renewable generation integration by storing energy generated by variable renewable energy sources for later use.

2.2.1. Requests for Proposals for BESS Projects

The procurement plan described above for renewable generation resources also covers an aggressive plan to substantially increase the amount of BESS projects in the PREPA system. The procurement of these projects will be performed through the same combined RFP processes. The plan consists of issuing six separate RFPs, in six-month intervals, for tranches of renewable generation and energy storage projects that will lead to reaching the RPS targets corresponding to 2025.

On February 22, 2021, PREPA issued the first RFP to developers to solicit proposals for the design, construction, installation, ownership, operation and maintenance of renewable energy generation and battery energy storage projects installed at sites across Puerto Rico as well as for the sale and purchase of energy or capacity made available by such projects. To incentivize the rapid growth of renewable generation, the RFP stipulates the projects must achieve commercial operation in no more than 24 months from the date on which a selected proponent executes a contract, with preference given to those proposals that can achieve commercial operation within a shorter timeframe.

With this first RFP process, PREPA intends to procure at least 1000 MW of renewable energy resource capacity and at least 500 MW (2000 MWh) of energy storage resource capacity with an effective duration of four hours, including at least 150 MW of distributed energy storage VPPs. PREPA will accept proposals for all, or a portion, of this capacity, but renewable energy resources offered in response to this RFP on a standalone basis (i.e., other than those aggregated into a VPP) must have generating capacity of at least 20 MW. The proposed projects must comply with a set of minimum technical requirements prepared by PREPA for the specific technology of each type of project.

PREPA will give a preference to energy storage resources with four-hour discharge durations but will also consider two-hour and six-hour discharge durations. All proposed energy storage resources must provide delivered energy during evening peak periods but may also provide ancillary service capability such as frequency response, regulating capacity, or operating reserves.

The deadline for submission of proposals in this first RFP process of the new procurement plan is May 28, 2021.

2.2.2. Proposal Evaluation/Awards for BESS Projects

No proposals for BESS have been evaluated or awarded in the past six months.

2.2.3. Permitting, Engineering and Construction of BESS Projects

No BESS projects are currently in permitting, engineering, or construction phases.

2.3. Synchronous Condenser Projects

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. PREB agreed with the findings of the IRP related to 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 includes 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.

These studies are currently underway. Site visits have been made to the locations of the existing units that are potential candidates for conversion to synchronous condensers in order to examine the condition of these units and determine the feasibility of the conversions if it is determined that support is required at those locations.

In parallel, analytical studies are also being performed to determine those areas of the system that can require synchronous condenser support. Since the IRP was produced, PREPA updated the transmission system models to reflect its current condition, which has enabled PREPA 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. PREPA also started the process of updating the models of their existing generators, which will allow PREPA to study the dynamic behavior of the system and determine the 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 put in operation before each becomes necessary. A failure to put these synchronous condensers in place in a timely manner may result in delays to the integration of additional renewable generation projects until such time the system is ready to accommodate those projects.

2.3.1. Requests for Proposals for Synchronous Condenser Projects

No RFPs for synchronous condenser projects have been prepared or issued in the past six months.

2.3.2. Proposal Evaluation/Awards for Synchronous Condenser Projects

No proposals for synchronous condenser projects are currently being evaluated.

2.3.3. Permitting, Engineering and Construction of Synchronous Condenser Projects

No projects related to synchronous condensers are currently in permitting, engineering, or construction phases.

2.4. Thermal Generation Projects

2.4.1. Combined Cycle Power Plant

In response to a funds consideration submitted by PREPA for the addition of a combined-cycle power plant under the Hazard Mitigation Grant Program (HMGP), on October 16, 2020, FEMA granted the funds for Phase I (Engineering) of HMGP Project Number 4339-0008, known as the "Palo Seco Generation Plant." This project includes the installation of a new 400-MW advanced technology combined-cycle power plant fueled with natural gas as the primary fuel and diesel as secondary backup fuel. This new combined-cycle power plant would help PREPA recover its electrical generation service to its customers following any weather or seismic emergency. This authorization obligated $13,507,500 for Phase I of the project, with an initial amount of $5,130,000 and a future increment of $8,377,500. As established in the authorization letter, after the satisfactory completion of Phase I, FEMA would consider the approval of additional funds for Phase II (Construction), which consists of the detailed design, permitting, equipment acquisition, construction, and installation of the combined-cycle plant for a total project estimated cost of $558,869,550. The conditions of approval (COA), as part of the referenced authorization letter, details the tasks, milestones, and deliverables that shall be accomplished in Phase I before proceeding to Phase II, which is contingent upon FEMA's approval. These COAs for Phase I includes all the project initiation and planning tasks (the cost estimates and schedule), preliminary design drawings and technical specifications, a revised benefit cost analysis, and environmental data collection. Phase II will include the completion of the detailed design, procurement of equipment and materials, permitting process, and construction/installation through testing and commissioning.

On January 4, 2021, PREPA approved Task Order #4 to start work of Phase I with Sargent & Lundy (S&L), the engineering firm contracted to perform all the tasks included under this phase. Planning and coordination meetings soon followed between S&L and PREPA staff to develop a plan and schedule to meet the COA due date, which includes preliminary engineering, developing commercial and technical documents to obtain project pricing and construction schedules, environmental permitting requirements, and initial plant sitting options.

On January 25, 2021, PREPA received a resolution and order from PREB with comments regarding PREPA's 10-year infrastructure plan, which includes this 400-MW combined-cycle project. In this

document, PREB made an initial evaluation of these projects included in the plan and their alignment with the IRP, which PREB approved on August 24, 2020. It was PREB's determination that some parts of the 10-year plan were not consistent with the approved IRP and requested that the plan be revised and resubmitted for their revision and approval. This resolution resulted in a delay of Phase I by halting key tasks already underway.

On February 16, 2021, PREPA responded to PREB's resolution and order, submitting a revised plan and approach for the 10-year plan for approval and aligning some of the short-term projects to PREB's mandates as a strategy to continue with the initiation of the FEMA-funded projects. For this project, PREPA included a detailed need to install a synchronous thermal power plant to restore power following any weather or seismic emergency. PREPA proposed a 400-MW dual-fuel natural gas and diesel combined-cycle power plant with advanced proven technology to meet a fast start response while meeting current environmental air emissions regulations.

On March 26, 2021, PREB issued a resolution and order in response to PREPA's motion to comply with PREB's approved IRP resolution of August 24, 2020 to carry out a thermal generation feasibility study in alignment with the PREB's IRP resolution; focusing on preliminary economic, siting, permitting, and planning analysis regarding a new fossil-fuel powered unit near the San Juan area (Palo Seco). The feasibility study will also take into account: (i) responses to PREPA's recently issued renewable energy and energy storage RFPs; (ii) indicative pricing for combined-cycle, reciprocating engine, and combustion engine generators; (iii) siting and feasibility analysis for fueling infrastructure; (iv) opportunity cost to siting energy storage systems or renewable resources near the San Juan area (Palo Seco); and (v) recommendations regarding specific resources that may be needed near the San Juan area (Palo Seco) to most cost-effectively compliment the resources being developed and deployed elsewhere in Puerto Rico. PREB then "determines that to be fully aligned with the Approved IRP and the Modified Action Plan, any project defined by PREPA in the mid-term related to generation in the San Juan area shall include BESS and renewable energy sources." The result of these mandates by PREB is holding the performance of key tasks of the combined cycle project as initially planned by PREPA, and consequently, the deadlines established by FEMA in the COA mentioned above may not be accomplished as required. PREPA will proceed with the completion of the thermal generation feasibility study as mandated by PREB and continue its studies and assessment regarding the thermal generation needs in the system for a transition to a full renewable energy system by year 2050, as required by law.

2.4.2. Black Starts

In response to a funds consideration submitted by PREPA for grants for the replacement of its existing simple-cycle gas turbines under the HMGP, on October 15, 2020, FEMA granted the funds for Phase I of

HGMP Project Number 4339-0010. This project includes the replacement of 11 Frame 5, diesel-only gas turbines with new simple-cycle, dual-gas turbines that would help PREPA with the recovery of the electrical system in case of an emergency.

This authorization obligated $12,700,000 for Phase I of the project, with an initial amount of $7,196,429 and a future increment of $5,503,571. As established in the authorization letter, after the satisfactory completion of Phase I, FEMA will consider the approval of additional funds for the acquisition and installation of the emergency units for a total of $280,822,500. The COA of the authorization letter details the tasks and milestones of the project and defines those that shall be accomplished in Phases I and II. The authorized Phase I includes all the project initiation and planning tasks (cost estimates and schedule), preliminary design drawings and technical specifications, benefit cost analysis, and environmental data collection. Phase II will include the completion of the design, procurement of materials, permitting process, and construction/installation.

On December 2020, PREPA started the works of Phase I with S&L, the engineering firm contracted to perform all the tasks included under this phase. Planning and coordination meetings with PREPA staff, schedule drafts developing, environmental permitting planning, and initial gas turbines options discussion were immediately initiated; however, on January 25, 2021, PREPA received a resolution and order from PREB, with comments about PREPA's 10-year infrastructure plan, which includes this project. In this document, PREB made an initial evaluation of the projects included in the plan and their alignment with the IRP, which PREB approved on August 24, 2020.

It was PREB's determination that the 10-year plan was not consistent with the approved IRP, and PREB requested that the plan be revised and resubmitted for their revision and approval. This halted many of the tasks currently underway. For the replacement of the simple-cycle units, PREB only approved the replacement of 81 MW, limiting the approved scope of replacing 11 units to that of 3 or 4.The intent of new simple-cycle generation is to provide emergency and black start generation to mitigate hazards during an emergency event.

On February 16, 2021, PREPA responded to PREB's resolution and order and submitted a revised plan and approach for the 10-year plan for approval, aligning some of the short-term project to PREB's mandates as a strategy to continue with the initiation of the FEMA-funded projects. For this project, PREPA included a detailed explanation of the need of the replacement of the existing Frame 5 units and their unreliability for a future response to an emergency. PREPA proposed the replacement of the 330 MW in their current locations and collaboration with PREB to determine their optimal location should the optimization proceedings conclude that relocation is needed as part of a microgrid plan for a better response in future emergencies.

On March 26, 2021, PREB issued a resolution and order in response to PREPA's motion and indicated that the information necessary to determine the amount of generation needed is unavailable and determined that PREPA may only replace 81 MW of the existing Frame 5 generation capacity with new simple-cycle units and mandated that PREPA explore the acquisition of renewables generation and BESSs instead of the balance of the 330 MW. Accordingly, PREB also considered the replacement of PREPA's black-start units in Aguirre and Costa Sur, funded under FEMA 428, as part of the overall approved 81 MW generation capacity to be replaced.

This mandate by PREB is holding the performance of the project as initially planned by PREPA, and the deadlines established by FEMA in the COA may not be accomplished as required. PREPA will proceed with the replacement of 81 MW of existing generation, as mandated by PREB, but continues its studies and assessment regarding the thermal generation needs in the system for a transition to a full renewable energy system by year 2050, as required by law.

2.4.3. Requests for Proposals for Thermal Generation Projects

No RFP processes are currently underway for thermal generation projects.

2.4.4. Proposal Evaluation/Awards for Thermal Generation Projects

No proposals for thermal generation projects are currently being evaluated.

2.4.5. Permitting, Engineering and Construction of Thermal Generation Projects

Currently at Palo Seco, there are three new units, 27 MW each, known as MegaGens. There are ongoing permitting efforts and discussions with the DNER (Puerto Rico Department of Natural and Environmental Resources) and EPA to obtain an operating permit for these units. As part of the commissioning of these units new demineralized water storage tanks are being installed to provide demineralized water injection for emissions control.

There are no other projects related to thermal generation are currently in permitting, engineering, or construction phases.

2.4.6. Retirement of Existing Thermal Generation

No existing thermal generation projects are currently in process of being retired.

3.0 24-Month Forecast

3.1. Renewable Generation Projects

There are two PV projects with capacities of 90 MW and 60 MW whose PPOAs that have been in renegotiation and will be signed in May 2021 pending PREB approval. Permitting, engineering, and construction of both projects will commence during the coming 24 months after the PPOAs are signed; however, completion of the projects is expected to take 30 months, so neither project will come online during the 24-month period covered by this report.

The procurement plan will continue during the next 24-month period, with RFPs issued for a new tranche or renewable generation projects and battery storage every six months.

The deadline for submission of proposals for the ongoing RFP process corresponding to the first tranche is May 28, 2021. Once the proposals are received, the bid evaluation process will begin, which will consist of three phases:

Phase I of the evaluation will consist of a quality control review and will start on May 28, 2021. During this phase, PREPA will determine which proposals satisfy the minimum requirements outlined in the RFP and determine the proposals that should advance to the next phase of evaluation. PREPA will notify each proponent whether their proposal passed the quality control review and whether such proponent will advance to Phase II. Following such notification, PREPA will publish a list of median price proposals for each technology group that will advance to Phase II on the PREPA website. The selection of proposals for Phase II evaluation is scheduled for June 24, 2021.

The Phase II evaluation will consist of two main parts. The first part will be a qualitative evaluation, in which PREPA will conduct feasibility studies and independently model interconnection and system upgrade costs, where possible, analyzing clusters of potential projects based on an initial selection of RFP responses that PREPA ranks high on its list of projects eligible for contracting. In addition, PREPA will evaluate the extent to which multiple projects have proposed or can be made to share the same interconnecting facility, if reasonable and applicable for any given set of proposals. PREPA will give priority to those proposals that provide resource installations at or technically close to the indicated priority locations. PREPA will evaluate the impact of each proposed resource on the transmission and distribution system and will endeavor to notify proponents with proposals that will require additional network upgrades. The qualitative evaluation will also include, among other factors: (i) a review of each proposal for conformance to the applicable minimum technical requirements; (ii) development, schedule and permitting risk; (iii) environmental impacts; and (iv) integration to the transmission system.

The second part of the Phase II evaluation will consist of a pricing evaluation to determine the cost effectiveness of the shortlisted proposals. This detailed pricing evaluation will include and reflect information received in response to any clarifying questions, interviews, site visits, and other due diligence work. It will consider: (i) the all-in costs that each proposal will likely impose on ratepayers, including contract charges and pass-through costs; (ii) costs for required transmission and distribution reinforcements; (iii) system impacts, including impact on transmission transfer capability, PREPA capacity requirements, and deliverability; and (iv) levelized cost of energy. Following completion of the pricing evaluation, the selection of proposals for Phase III evaluation will take place on August 19, 2021.

During Phase III, PREPA will, for each selected proposal: (i) enter into negotiations during a 30-day period with the proponent of such proposal for the finalization, execution, and delivery of a contract governing the terms and conditions under which such proponent will develop, finance, construct, own, and operate energy resources and sell capacity and energy made available by the proposed project; and (ii) conduct system impact and facility studies to evaluate whether the proposed project may be interconnected with the transmission and distribution system at an acceptable cost and with acceptable impacts on the system. As part of completing the system impact and facility studies, PREPA may conduct additional diligence, including management interviews, environmental legal and regulatory due diligence, detailed engineering assessments, and facility dispatch modelling.

Upon the completion of the feasibility, system impact, and facility studies by PREPA for all proposed projects in a resource and technology group, PREPA will determine whether each project will serve the best interests of rate payers as evidenced by the findings and inform each proponent thereof. PREPA will invite successful proponents to present its best and final price proposal offer under its contract and will then make its final decision whether to proceed with a proposed project by announcing its acceptance of the best and final offer.

The execution versions of contracts will be presented to PREB and FOMB for approval in October 2021. It is anticipated that contracts can be executed in December 2021, assuming all interconnection studies have been completed by that time. Permitting, engineering, and construction of these projects will follow, but none are expected to be online within the 24-month period covered in this report.

The RFP for the second tranche of renewable generation and battery energy storage projects will be issued in August 2021 and is expected to follow the same steps as the procurement process currently underway for the first tranche.

3.2. Battery Energy Storage System Projects

The RFP process for BESS projects in the procurement plan has been combined into that for the renewable generation projects. The deadline for submission of proposals for the ongoing RFP process corresponding to the first tranche is May 28, 2021. Once the proposals are received, the bid evaluation process will begin. It will consist of the same three phases and will follow the same schedule as described in Section 3.1.

The executed versions of contracts will be presented to PREB and FOMB for approval in October 2021. It is anticipated that contracts can be executed in December 2021, assuming all interconnection studies have been completed by that time. Permitting, engineering, and construction of these projects will follow, but none are expected to be online within the 24-month period covered in this report.

The RFP for the second tranche of renewable generation and battery energy storage projects will be issued in August 2021 and is expected to follow the same steps as the procurement process currently underway for the first tranche.

3.3. Synchronous Condenser Projects

In the coming 24 months, PREPA will continue its efforts to update the dynamic models of their generation fleet so that the necessary studies can be performed to determine the locations and characteristics of the synchronous condensers needed to support the integration of large amounts of inverter-based generation into their system.

It is expected the models will be updated by October 2021 and that the necessary studies to define the synchronous condenser requirements can be completed by March 2022. The projects identified in those studies will then need to be submitted for stakeholder approval and this process is expected to be completed by September 2022. Due to the urgency to get these projects in place and avoid slowing down the penetration of renewable generation, the conceptual design and RFP will be prepared in parallel with the stakeholder review process so that they can also be issued in September 2022. Awards for the respective contracts are scheduled for early 2023.

Engineering, procurement, construction, and commissioning of these projects is anticipated to take between 24 and 28 months, so no synchronous condensers are expected to come online within the 24-month horizon of this report.

3.4. Thermal Generation Projects

In the next 24 months, the replacement of PREPA's black-start units in Aguirre and Costa Sur, funded under FEMA 428, will occur. In addition, it is expected in the next 24 months that the existing emergency

units at Yabucoa will be retired to allow for the installation of new gas turbines. This project will be funded under FEMA 404, and will start as per PREB approval dated March 26, 2021. It will be followed by similar replacements at Vega Baja, Palo Seco, Jobos and Daguao contingent upon PREB's approval.

The new Aguirre black-start units have an anticipated output of 2 MW and will not be connected to the grid. They will only provide black-start capability to the Aguirre combustion turbines that will then be used to start the remaining units at the combined-cycle plant. There is available space at the Aguirre site for these two new units, and the retirement of existing units is not required.

The two new Costa Sur black-start units have an anticipated output of 20 MW each for a total of 40 MW. These units will replace the existing black-start units and require the retirement and demolition of the existing Costa Sur units 1 and 2. The RFP process for the new units is expected to start at the end of October 2021 after internal PREB, FOMB and PREPA review and approval.

The new Yabucoa units have an anticipated output of 20 MW each for a total of 40 MW. These units will replace the existing peaking units and require the retirement and demolition of the existing Yabucoa units. The RFP process for the new units is expected to start November 2021 after internal PREB, FOMB and PREPA review and approval. The planned RFP schedule for the new thermal generation projects is as follows:

Table 3-1 — New Thermal Generation RFP Schedule

Step	Aguirre (2MW)	Costa Sur (2 x 20MW)	Yabucoa (2 x 20MW)
Start technical and commercial OEM and EPC RFP package	May-2021	May-2021	May-2021
Submit OEM and EPC RFP packages for PREB, FOMB and PREPA review and approval	Jun-2021	Jun-2021	Jun-2021
Issue OEM and EPC RFP to OEM suppliers and contractors after internal approval	Nov-2021	Nov-2021	Nov-2021
Review OEM and EPC proposals and prepare letter of recommendation for vendors and contractors	Mar-2022	Mar-2022	Mar-2022

The environmental permitting process for Aguirre, Costa Sur, and Yabucoa is scheduled to begin in August 2021. The planned permitting schedule is as follows:

Table 3-2 — New Thermal Generation Permitting Schedule

Step	Aguirre	Costa Sur	Yabucoa
Develop Environmental Permitting Plan	Aug-2021	Aug-2021	Aug-21
Submit Air Permit application	Oct-2021	Dec-2021	Nov-21
Submit NPDES Permit Application	Oct-2021	Dec-2021	Nov-21
Dispersion Modeling	Not Applicable	Dec- 2021	Dec-2021

The construction and commissioning process for Costa Sur, and Yabucoa is scheduled to begin August 2022 and for Aguirre on March 2022. The planned construction and commissioning schedule is as follows:

Table 3-3 — New Thermal Generation Construction and Commissioning Schedule

Step	Aguirre	Costa Sur	Yabucoa
Demolition of Existing Units	Not Applicable	Jul-2022	Jul-2022
Construction contract award and mobilization	Mar-2022	Aug-2022	Aug-2022
Mechanical Completion	Jun-2022	Feb-2023	Feb-2023
Start Up and Commissioning	Jul-2022	Apr-2024	Apr-2024

3.5. Retirement of Thermal Generation

For the near-term forecast, units that are currently not operational or will be replaced will be retired, and PREPA will proceed with amending the Title V permits, officially declaring them "Not in Service." Near-term retirements are shown in Table 3-4.

Table 3-4 — Thermal Generation Retirements & Replacements (June 2021–June 2023)

Station – Unit	Fuel	Nameplate MW	Notes
Costa Sur – ST #3	HFO	85	Retired – Not Operational
Costa Sur – ST #4	HFO	85	Retired – Not Operational
Palo Seco – ST #2	HFO	85	Retired – Not Operational
Costa Sur – CT #1	diesel	21	Replaced with New Black Starts
Costa Sur – CT #2	diesel	21	Replaced with New Black Starts
Palo Seco – CT 2-2	diesel	21	Replaced with MegaGen (currently in permitting approval)
Palo Seco – CT 3-2	diesel	21	Replaced with MegaGen (currently in permitting approval)
Yabucoa CT #1	diesel	21	Replaced with New Emergency Generation

Station – Unit	Fuel	Nameplate MW	Notes
Yabucoa CT #2	diesel	21	Replaced with New Emergency Generation
Total Retired Capacity by 2023		**381**	–

The near-term retirements summarized in Table 3-4 are not expected to have an impact on the available generation capacity, since these units are no longer operational or are being replaced; however, there is a deficit in available generation in the near-term due to the availability of the existing generation, as noted in Section 3.6

Title V operating permits, which are issued by the Puerto Rico Environmental Quality Board, identify generating units that are installed at each power facility in Puerto Rico. Title V permits include air emissions limits and operational limits for generating units at each facility. Title V operating permits can be modified either at the time of retirement, or during the permit renewal period which occurs once every 5 years. For units that are non-operational or that will be replaced, the facility's Title V permit will be modified to remove those units, thus rendering the units permanently retired.

In order to demonstrate that some of PREPA's generation replacement projects will not result in a net emissions increase, such projects will rely on emissions reductions from planned retirements, thus minimizing the permitting burden. For such projects, the air construction permit will likely include language stating that the new replacement units shall not commence commercial operation until the existing units have permanently ceased firing fuel. Subsequent modifications to the facility's Title V operating permit will be made to remove the retired units, as described above.

3.6. Load Forecast

As a result of the near-term retirements noted in Table 3-4 and the existing fleet availability, Figure 3-1 depicts the available capacity in the near term from June 2021 to June 2023. In Figure 3-1, the available capacity considers the expected unit output adjusted by planned maintenance, environmental outages, and forced outages (based on historical equivalent forced outage rates). The peak demand forecast has been provided by PREPA's load forecasting department.

Planning reserve margin (PRM), shown in Figure 3-1, is designed to measure the amount of generation capacity available to meet expected demand across a planning horizon.[1] Currently PREPA is operating with a PRM that is much greater than what is typical of North American operators, which may give the

[1] As defined by NERC

impression that PREPA has a certain amount of dispensable generation resources that could be retired without adversely affecting the operation of the system.

The reality is that PREPA often struggles to meet its demand. This can be explained by the fact that although PREPA may have a surplus of nameplate generation, that generation is substantially more unreliable than that of North American utilities. Much of PREPA's fleet dates back to the 1960s and 1970s with poor EFOR statistics, so all this additional reserve becomes necessary to ensure that enough operable spare generation is available to cover demand when unexpected forced outages occur.

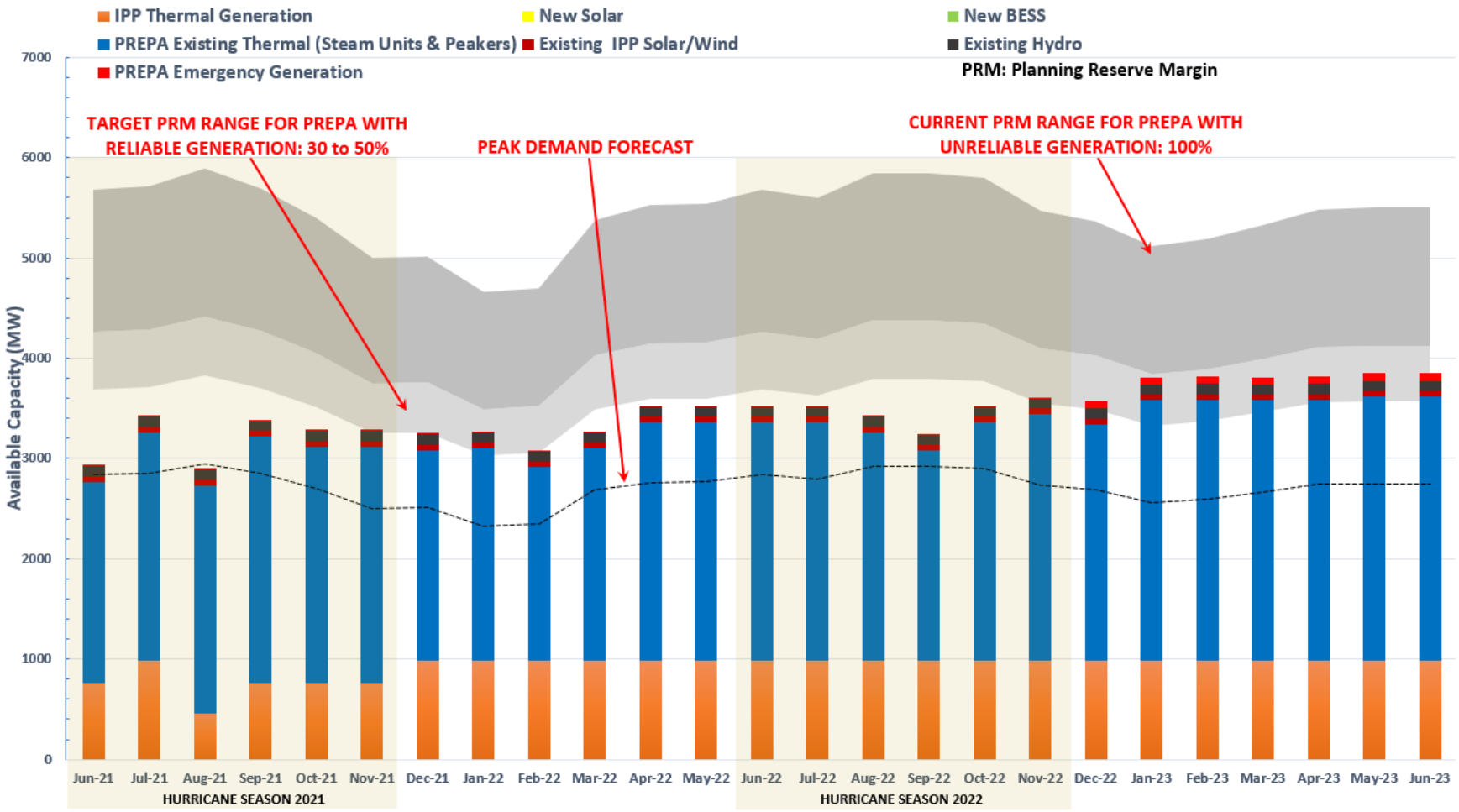
PREPA's current power system, is aged, distressed, and is unable to perform with metrics in line with North American averages. For instance, EFOR rates of PREPA's generation fleet span from levels that are barely acceptable by North American average standards of 7.19% for thermal plants above 20 MW, to nearly 100%. EFOR rates above 10% would be considered unacceptable by most North American standards while EFOR rates below 10% would be considered acceptable. With a planning reserve margin estimated between 61% and 142%, PREPA has been able to meet demand across many unexpected and frequent failures. For example, in April 2019, the transformer for Aguirre Unit 2 failed and as a result 450 MW became unavailable. PREPA was able to face this challenge with its reserve margin until the transformer was replaced many months later. In January 2020, an earthquake damaged the Costa Sur station, removing 820 MW of power generation from service. Failures occur on a frequent basis across the fleet and emergency crews are dispatched to address these events to the best of their ability. These failures are typical of an aged fleet. Removing or retiring such units without suitable replacements, despite their age and high EFOR rates will inevitably reduce the utility's ability to respond in an acceptable manner. Even units that are not fully functional contain valuable spare parts for a utility that is faced with these challenges. The risk of not meeting demand will increase as units are removed from service unless suitable dispatchable systems are put in place during the 20 to 30-year transformation to renewable energy systems. Furthermore, unlike mainland US utilities, PREPA has no backup interconnection to supply emergency power when faced with disasters or unit failures. Additional reserve margin may provide essential generation services during these circumstances.

The emergency generation noted in Figure 3-1 consists of units that do not operate during normal operating conditions. It includes Aguirre black starts, Costa Sur black starts, Culebra, and Vieques.

In the near term, there are two months, June and August 2021, that are anticipated to have an available capacity almost equivalent to the peak load. This is due to a scheduled generator cooler outage at Costa Sur Unit 5 in June 2021 and a planned maintenance outage at EcoEléctrica in August 2021. Situations when the available capacity can marginally meet the peak demand mode are high risk for the grid operation.

Any unplanned outage can cause the available capacity to fall below the load demand and result in load shedding or a brown out.

Figure 3-1 — Capacity vs. Demand (June 2021–June 2023)



4.0 Conclusions

The comparison of monthly available capacity against the forecasted load for the next 24 months show the necessity to retain the existing operable thermal generation in service until replacement generation is added to the system, as evidenced specifically by the effects on the system of scheduled outages such as those of June and August of 2021. Under those conditions the system will be highly vulnerable to any unforeseen outages. Should such outages occur at the time of peak demand, it is highly likely that load will need to be shed.

The process of retiring old thermal generation will therefore start during the coming 24 months focusing solely on generating units that are either not operable, or are operable but undependable and need to be replaced with new units because the units need to be available in emergency conditions. It is anticipated that more thermal generation can be retired as the generation and battery storage from the ongoing renewables RFP processes comes online.

5.0 References

1. PREB Final Resolution and Order of the PREPA Integrated Resource Plan (Case NO.: CEPR-AP-2018-0001)
2. Siemens Industry, Inc., Siemens Power Technologies International, Puerto Rico Integrated Resource Plan 2018-2019, Draft for the Review of the Puerto Rico Energy Bureau, Revision 2, June 7, 2019.