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

IN RE: IMPLEMENTATION OF THE PUERTO RICO ELECTRIC POWER AUTHORITY INTEGRATED RESOURCE PLAN AND MODIFIED ACTION PLAN	CASE NO.: NEPR-MI-2020-0012 SUBJECT: Procurement Plan

MOTION TO SUBMIT PRESENTATION FOR TECHNICAL CONFERENCE

TO THE HONORABLE PUERTO RICO ENERGY BUREAU:

COMES NOW the Puerto Rico Electric Power Authority (the "Authority") through the undersigned counsel and respectfully submits and requests as follows:

1. On August 24, 2020, the Energy Bureau of the Public Service Regulatory Board (the "Energy Bureau") entered the Final Resolution and Order on the Puerto Rico Electric Power Authority's Integrated Resource Plan (the "IRP Order").[1]

2. In compliance with the IRP Order, on September 23, 2020, the Puerto Rico Electric Power Authority (the "Authority") submitted a status report on the development of its Draft Procurement Plan (the "Status Report") and requested the scheduling of a technical conference.

3. Thereafter, in response to the Authority's request, on October 9, 2020, the Energy Bureau held a technical conference where the Authority's officers and consultants had the opportunity to exchange information and receive feedback from the Energy Bureau Commissioners and its consultants regarding the Status Report (the "October 9 Technical Conference").

[1] IRP Order, pags. 266-269, ¶¶ 860-867

4. After taking into consideration the IRP Order and feedback received during the October 9 Technical Conference, on October 23, 2020, the Authority submitted the Draft Procurement Plan.[2]

5. During the development of the Draft Procurement Plan, the Authority had several concerns that were addressed in part in the development of the document but understands its prudent to further discuss with the Energy Bureau. Therefore, on November 5, 20202, the Authority filed a Request for Technical Conference (the "Request"). In the Request, the Authority informed that a technical conference to discuss the Draft Procurement Plan would be beneficial and also, an opportunity for the Authority to present the Energy Bureau with additional matters for which the Authority would like to receive feedback. A technical conference would also serve to clarify any questions that the Energy Bureau might have regarding the Draft Procurement Plan.

6. The Authority has prepared a presentation to be discussed during the technical conference (the "Presentation"). Exhibit A. The Presentation will serve as basis for the discussion during the conference.

WHEREFORE, the Authority requests the Energy Bureau to schedule a technical conference to discuss the Draft Procurement Plan and also, to note the filing of the Presentation.

RESPECTFULLY SUBMITTED.

In San Juan, Puerto Rico, this 17th day of November 2020.

[2] See *Motion Submitting Draft Procurement Plan* filed by the Authority on October 23, 2020.

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Exhibit A

Presentation

Puerto Rico
Electric Power
Authority

Puerto Rico Electric Power Authority

Renewables and Energy Storage

November 6, 2020

Discussion Topics

Renewable Energy Integration Study

- Purpose
- Generation System Modeling
- Electrical Reliability Analyses
  - Analyzed impact of renewable energy and energy storage penetration on system reliability

Renewable and Energy Storage RFP Timeline

Energy Storage

- Procurement Strategy
- Contract Strategy

Distributed Energy Resources

- Enhancing the Prospects that DERs can be Cost-Competitive
- Justification for Recommending Rescheduling of DER Procurement

Renewable Energy Integration Study

As PREPA works to move away from traditional thermal generation and towards cleaner, renewable sources of energy, it is focused on the following three areas:

1) Adhering to Act 17 requirements
2) Improving overall system reliability and grid stability
3) Developing optimal portfolios of generation resources (i.e., renewable generation and energy storage) to minimize system operation and production costs

Transitioning away from thermal generation to renewable generation requires an effective strategy to address challenges associated with renewable integration, such as:

- How best to manage the impacts of a reduction in electrical system inertia as a result of a transition to primarily inverter-based generation sources
- Ensuring the electrical system has sufficient generation flexibility to be able to operate both economically and reliably
- How to address / mitigate potential renewable generation curtailment in a cost-effective manner
- Planning existing thermal unit retirements such that system reliability is not adversely impacted

How best to address these items is not unique to Puerto Rico - many utilities across the U.S. and globe are also working to integrate more renewable energy

Renewable Energy Integration Study

PREPA is currently working with Sargent & Lundy (S&L) to understand the system impacts of various renewable and energy storage penetration levels. The work focuses on two areas:

1. Large-scale, generation system modeling, investigating the impacts on:
   - System dispatch and generation
   - The risk of unserved load
   - System production costs
2. Static and dynamic electrical reliability analyses, investigating the impacts on:
   - System electrical frequency
   - System inertia
   - System strength
   - Voltage stability

Analyses are ongoing and will be documented in an integration study report

Generation System Modeling

S&L has developed a PLEXOS electrical system simulation model of PREPA's system and evaluated different cases for 2024. The model incorporates the following key inputs and assumptions:

Generation:

- Existing renewable projects (182 MW solar and 121 MW wind) and approximately 270 MW of distributed generation (per the IRP's assumption for 2024) are modeled
- All currently operational thermal units are modeled, accounting for environmental limitations
- Costa Sur 6 is modeled to be repaired and operational
- Hydro unit repairs are assumed to be incomplete, thus these units are not modeled as operational

Fuel and PPOA Prices:

- Fuel oil, diesel, and natural gas prices are based on fuel commodity price forecasts from the 2020 EIA Annual Energy Outlook, adjusted for PREPA's existing fuel supply agreements
- The first 150 MW of new solar resources (shovel-ready projects) have a price of $100/MWh
- Additional new renewable and energy storage resources are analyzed at various contract prices

S&L is currently analyzing the following scenarios using PLEXOS:

1. Integration of 150 MW of new solar resources (shovel-ready PPOAs)
2. Integration of 600 MW of new solar resources and 250 MW of energy storage
3. Integration of 1,150 MW of new solar resources and 500 MW of energy storage

S&L is separately investigating the impact of unit retirements through our strategic planning work

Results are based on probabilistic representations of Puerto Rico demand, forced outages, and annual renewable generation (Monte Carlo simulations)

Generation System Modeling – Preliminary Findings

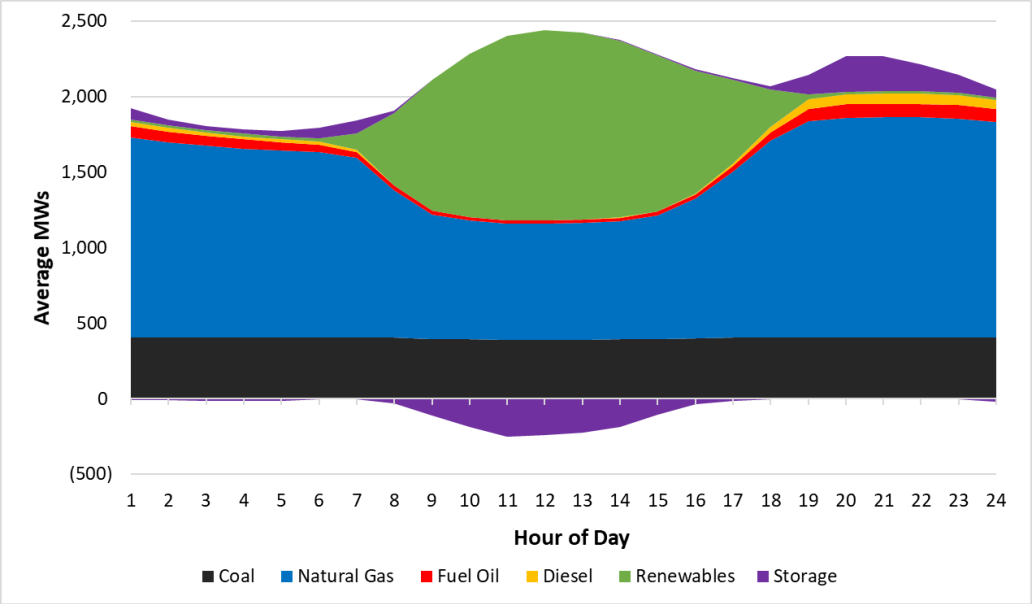
- With higher levels of renewable generation, natural gas generation falls most significantly
  - Model results indicate that reductions in fuel oil, diesel, and coal generation will be modest
- Modeling indicates that it is increasingly important to have flexible generation (i.e., quick starting and fast ramping units) to minimize the risk of unserved load as renewable penetration increases
  - Common flexible generators include energy storage systems, engines, and combustion turbines
- As renewable penetration increases, the probability of renewable curtailment rises – this can be managed through energy storage, different contract or payment structures, or other means
- Despite having low overall utilization, existing fuel oil and diesel fuel generators help to meet load during infrequent but critical times

Generator Marginal Costs $/MWh

Coal	$55/MWh (AES)
Natural Gas	$70/MWh (EcoEléctrica)
	$80/MWh (San Juan)
	$100/MWh (Costa Sur)
Fuel Oil	$150/MWh (Aguirre & Palo Seco)
	$160/MWh (San Juan)
Existing Renewables	$160/MWh (Existing)
	$100/MWh (Shovel Ready PPOAs)
	TBD $/MWh (New)
Diesel Fuel	$190/MWh +

Energy storage is assumed to be a fixed, not variable, expense

Average Hourly Generation (Over the Year)

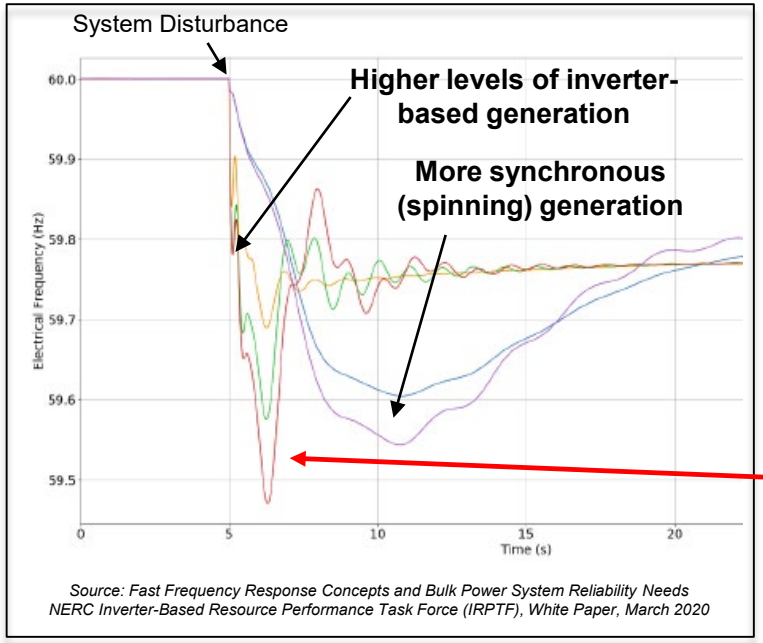


Electrical Reliability Analyses

Technical Challenges from High Instantaneous Penetration of Renewable Generation

- A large presence of synchronous (spinning) generation on the grid (traditionally thermal and hydro generation) provides system inertia, which helps to prevent a system disturbance from causing too rapid of a change in system frequency (leading to a loss of load situation)
- As inverter-based power sources such as PV, battery storage and wind replace synchronous generation, the system dynamic changes become faster – this poses new technical and operational challenges to the maintenance of system reliability
- With higher penetrations of inverter-based generation, challenges are magnified

The challenges of high amounts of inverter-based generation are not unique to Puerto Rico. Other regions have addressed them. But, each location requires its own system-specific solutions



Source: Fast Frequency Response Concepts and Bulk Power System Reliability Needs NERC Inverter-Based Resource Performance Task Force (IRPTF), White Paper, March 2020

- Locations experiencing high instantaneous penetration of inverter-based generation in excess of 50% to 60% of demand include Hawaii, Tasmania, South Australia, Texas, and Ireland
- These locations are using various amounts of synchronous condensers, spinning generation, and advanced inverter technologies

Not properly addressing the rate of change of frequency can lead to loss of load or blackouts

Puerto Rico Electric Power Authority

Electrical Reliability Analyses

S&L is using the electrical power system PSS/E simulation model of PREPA's system for the electrical reliability analysis

Objective: Study the integration of 1,000 MW of renewable energy and 500 MW of energy storage into the existing PREPA grid and determine what grid upgrades / improvements are needed to ensure system reliability

System reliability will be quantified via:

- System strength calculations (the weighted short circuit ratio is used to calculate system strength)
- Testing system reliability against the largest credible system disturbance

System upgrades / improvements that S&L is analyzing include:

- Battery energy storage with fast frequency response
- Battery energy storage with grid forming technology (new technology)
- Synchronous condensers for inertia support and grid strengthening
- New synchronous generators for inertia support and grid strengthening

Based on preliminary analysis, if none of the above upgrades / improvements are made, the total maximum renewable penetration (non-hydro) that can be achieved while maintaining system reliability is **650 MW** (300 MW of existing renewables + new renewables)

- S&L is currently investigating how system reliability can be improved as the above grid upgrades / improvements are included for additional renewables penetration

Renewable and Energy Storage RFP Timeline

- The schedule shown for administration of the RFP is approximately 36 weeks (9 months)
- This is considered an aggressive RFP schedule compared to similar RFPs
- This schedule assumes that PREPA will be able to get approvals from PREB and FOMB in a timely manner

No.	Milestone	Date
1	RFP Released to Public	December 16, 2020
2	Proponent Notice of Intent Due	January 13, 2021
3	Proponent Clarification Submittal Deadline	March 17, 2021
4	Proponent Proposal Submission Deadline	March 24, 2021
5	PREPA Proposal Evaluation Period	March 25, 2021 – June 18, 2021
6	Selection of Proposals by PREPA for Contract Negotiation	June 25, 2021
7	Due Diligence and Contract Negotiation Period	August 2021
8	PPOAs finalized between Selected Proponent(s) and PREPA	September 2021

Renewable and Energy Storage RFP Development and Construction Timeline

After finalization of a PPOA, the subsequent tasks up to COD can be split into three broad categories:

- Development
- Construction
- Interconnection

Development

- In the development phase, Developers will finalize permits and site control, place purchase orders for major equipment, and execute EPC contracts.
- PREPA can engage with the Permit Management Office (OGPe), Department of Natural and Environmental Resources (DNER), and other permitting agencies ahead of the RFP. Engaging permitting agencies prior to the RFP and providing early notification of expected projects can help expedite the permitting process.

Construction

- The duration of construction is a balance between the resources available and cost.
- Expediting the construction phase of a project may translate to higher construction costs which may result in a higher total project cost to PREPA.

Renewable RFP Development and Construction Timeline

Interconnection

- The process of studying, approving, designing and constructing facilities for the interconnection of a project into the PREPA grid can be the longest duration task in a generation project timeline
- Interconnection of a project requires a multi-phase interconnection study as well as procurement and installation of sometimes substantial transmission and network system upgrades
- Upfront planning by PREPA can provide Developers with valuable information to help shorten the time it takes to interconnect into the PREPA grid. PREPA can:
  - Identify areas where new generation can be accepted with minimal network upgrades
  - Identify substations that have physical space and injection capacity available for new generation
  - Begin interconnection studies in Phase 2 of the RFP after the shortlist is developed
  - Assist in identifying rights-of-way for new transmission or other required facilities additions

Energy Storage Procurement Strategy

- The electrical grid in Puerto Rico will need energy storage to supply both capacity and ancillary services to maintain grid stability and reliability
- This becomes increasingly important as thermal units are retired
- It will also be of critical importance that PREPA have rights to dispatch the energy storage systems
- The proposed procurement strategy for energy storage systems will target three types of configurations to meet PREPA's needs for grid stability and reliability:

1) *Renewable energy projects compliant with the PREPA minimum technical requirements (MTRs)*. These projects will be required to provide battery systems for ancillary services per the MTRs. The batteries will be charged from the coupled renewable energy resource.

2) *Renewable energy projects compliant with the PREPA MTRs and coupled with long-term energy storage.* The coupled battery systems will provide ancillary services and dispatchable capacity. The batteries will be charged from the coupled renewable energy resource.

3) *Standalone energy storage projects compliant with the PREPA MTRs.* These systems will charge from the grid.

Energy Storage Contract Strategy

- PREPA needs full rights to dispatch all battery energy storage systems in order to maintain grid stability and reliability
- The existing structure of energy only payments ($/MWh) for renewable energy projects may not properly compensate Developers for owning, operating and maintaining a battery energy storage system that PREPA dispatches

1) For renewable generation projects compliant with the MTRs:
   - Sellers will receive energy only payments. The cost of MTR compliance will continue to be factored into the contractually established energy payments
2) For renewable generation projects compliant with the MTRs and coupled with long-term energy storage:
   - Seller will receive an energy payment ($/MWh) for energy discharged to the grid. The cost of MTR compliance will continue to be factored into the energy payments
   - Seller may also receive a capacity payment ($/kW-yr) for availability and the rights to dispatch the long-term energy storage, depending on contract structure.
3) For standalone energy storage projects:
   - Offtaker (PREPA) pays the Seller a fixed monthly capacity payment ($/kW-yr) plus a variable monthly energy payment ($/MWh) based on dispatch.
   - Offtaker (PREPA) has authority to charge and discharge the battery system within the energy storage system's operating limitations.
   - Offtaker (PREPA) pays for and delivers all charging energy from the grid to the battery.

Procurement of Distributed Energy Resources and VPPs

- The Energy Bureau, PREPA and stakeholders have discussed various DER programs:
  - Individual distributed generation facilities capable of delivering into the grid, generally under net metering arrangements
  - Demand Response/Load Management: Offered in the form of demand side management and demand response programs
  - Virtual Power Plants: Aggregated generation, storage and controllable loads, generally connected at the distribution level at multiple locations, with a single control system
- Puerto Rico has an existing net metering program to compensate existing DERs, but has little experience with load management programs and no experience with VPPs.
- To enhance the likelihood of success in the procurement of DERs and VPPs at scale, PREPA, the Energy Bureau and other stakeholders need to resolve a number of threshold issues.

Procurement of Distributed Energy Resources and VPPs

- Threshold issues to be addressed in the procurement of DERs and VPPs :

1) What will the Energy Bureau's regulation governing demand response (Case No. NEPR-MI-2019-0015) ultimately require? How should PREPA and potential proponents proceed in the meantime?

2) How will net metering coexist with other DER programs, particularly those involving VPPs?

   – How will new distributed resources and VPPs be permitted to price their services?

   – How will VPP aggregators attract consumer commitments to be aggregated and dispatched if the alternative is the retail rate paid to net metering customers?

3) Will PREPA or LUMA be permitted to act as VPP aggregators?

4) Will PREPA and LUMA be allowed to give preference to DERs that interconnect where their addition would enable PREPA to minimize transmission and/or distribution upgrades?

5) Provisions specific to VPP agreements:

   – How to give the procuring entity comfort that the aggregated resource can be depended upon to perform as contractually required?

   – In what ways must agreements with VPP aggregators differ from PPOAs offered to standalone utility scale renewable and storage resources?

Need for Market Input on Procurement of Distributed Energy Resources and VPPs

- In the interest of efficiency and cost minimization, PREPA should be permitted to defer the procurement of DERs and VPPs into later phases of the renewables RFP process.
  - This would give PREPA and the Energy Bureau the time necessary to –
    - Finalize and implement the Demand Response regulation
    - Resolve other identified threshold issues involving DERs and VPPs
    - Identify the criteria that should be included in RFPs for DERs and VPPs to maximize the benefits they can provide
- While PREPA is seeking to procure utility scale renewable and storage resources through the December 2020 RFP, PREPA and the Energy Bureau should jointly issue a Request for Information seeking input from the market for provision of DERs and VPPs.
  - That RFI could seek specific input on –
    - Alternative ways aggregators might assemble customers and resources
    - Contractual mechanisms that would ensure VPP performance
    - Provisions that should be included in power purchase agreements with VPP aggregators