

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: Resolution and Order on the Completeness of the Puerto Rico Electric Power Authority's Integrated Resource Plan Filing, Confidential Treatment of Portions of the Integrated Resource Plan, and Requested Waivers.

RESOLUTION AND ORDER

I. Introduction

On February 13, 2019, the Puerto Rico Electric Power Authority ("PREPA") filed before the Puerto Rico Energy Bureau ("Energy Bureau") its proposed Integrated Resource Plan ("IRP"), as part of a motion titled *PREPA's Petition and Informative Motion Regarding its Accompanying Integrated Resource Plan Filing* ("IRP Filing").¹ PREPA's IRP Filing included:

1. PREPA Exhibit 1.0, which includes the IRP Main Report (a document with ten parts plus Attachments A and B) and five Appendices;
2. PREPA Exhibit 2.0, which comprises the work papers of the IRP;
3. PREPA Exhibits 3.0 through 7.0, which include Direct Testimony with attachments and notarizations.

In its IRP Filing, PREPA requests that the Energy Bureau accept PREPA's IRP and approve its Action Plan.²

Pursuant to Section 3.02(A) of Regulation 9021,³ PREPA's filing of its IRP moves the proceeding into Phase 2 of the IRP process. Upon receiving the IRP Filing, the Energy Bureau reviewed it to determine whether it complies in full with the requirements of Regulation

¹ See *PREPA's Petition and Informative Motion Regarding its Accompanying Integrated Resource Plan Filing*, February 13, 2019, p. 3, Case No. CEPR-AP-2018-0001

² See IRP Filing, p. 12. Note that Section 1.08 (B)(1) of Regulation 9021 defines "Action Plan" as "a plan that identifies the specific the actions PREPA will perform during the first five (5) years of the Planning Period in order to implement the Preferred Resource Plan."

³ *Regulation on Integrated Resource Plan for the Puerto Rico Electric Power Authority*, Regulation No. 9021, April 24, 2018.



9021. The Energy Bureau has completed its review and determined that PREPA's proposed IRP is not in compliance with the IRP Regulation and prior Energy Bureau orders. PREPA must therefore re-file its proposed IRP to correct the deficiencies as specified herein.

Together with the filing of its proposed IRP, PREPA filed two additional motions. The first, titled *PREPA's Motion for Confidential Treatment of Portions of Its Integrated Resource Plan*, requested approval of confidentiality designations outlined in PREPA's motion based on PREPA's assertions that the information is protected as Critical Energy Infrastructure Information ("CEI") or as trade secrets.⁴ The second motion, titled *PREPA's Motion for Limited Waivers of Filing Requirements Under Regulation No. 9021*, outlined information for which PREPA requested a waiver from the filing IRP requirements of Regulation 9021.⁵ This Resolution and Order addresses those motions as well.

II. Procedural Background

On March 15, 2018, the Energy Bureau determined that authorizing PREPA to file an updated IRP prior to the mandatory review established in Act 83 and Act 57-2014 was appropriate in order to determine the impacts of Hurricanes Irma and María which devastated the Island.⁶

On May 29, 2018, based on information from PREPA that it had begun development of an updated IRP with an expected completion date of September 2018, the Energy Bureau ordered PREPA to file an updated IRP for Energy Bureau review no later than October 31, 2018.⁷

On July 2, 2018, the Energy Bureau set forth a procedural schedule for the IRP Prefiling process pursuant to Regulation 9021.⁸ That schedule required PREPA to respond to the Energy Bureau information requirements on or before August 1, 2018, and to attend a Technical Conference on August 14, 2018.⁹

⁴ See *PREPA's Motion for Confidential Treatment of Portions of Its Integrated Resource Plan*, February 13, 2019, Case No. CEPR-AP-2018-0001.

⁵ See *PREPA's Motion for Limited Waivers of Filing Requirements Under Regulation No. 9021*, February 13, 2019, Case No. CEPR-AP-2018-0001.

⁶ See Resolution and Order, Commencement of Review Proceeding and Order Establishing Initial Submission Timeline, March 15, 2018, p. 3, Case No. CEPR-AP-2018-0001.

⁷ See Order, May 29, 2018, Case No. CEPR-AP-2018-0001.

⁸ See Order, IRP Prefiling Process (Phase 1) Procedure Before the Commission, July 2, 2018, p. 2, Case No. CEPR-AP-2018-0001.

⁹ *Id.*



On August 8, 2018, the Energy Bureau issued an order regarding PREPA's August 1, 2018 filing, made pursuant to the Energy Bureau's July 2, 2018 Order.¹⁰ Specifically, the Energy Bureau expressed concern that: "(i) PREPA may not provide required load forecast ranges in its scenarios; (ii) it is not sufficiently clear that PREPA will use a capacity expansion model to develop a least cost plan that can be the basis of a preferred plan, and not just use it as a resource screening tool; (iii) the proposed IRP may not include reasonable assumptions on, or clear methodologies for, the development of energy efficiency and demand response programs; and (iv) PREPA may not have adequately addressed planned deployment of distributed generation."¹¹ The Energy Bureau noted that these elements are required by Regulation 9021, and ordered PREPA to file additional information by August 13, 2018.¹²

On August 14, 2018, the Energy Bureau held a Technical Conference to provide an opportunity for PREPA to share information on initial methodologies and assumptions regarding the IRP process and analysis.

On August 17, 2018, following the August 14, 2018 Technical Conference, the Energy Bureau ordered PREPA to submit additional information. The Energy Bureau determined that the information was required to develop additional scenarios or topics that PREPA shall be required to evaluate and include in the updated IRP.¹³ The Energy Bureau required PREPA to file this information by August 24, 2018, for some responses, and by August 31, 2018, for others.¹⁴

On September 5, 2018, upon review of PREPA's filing pursuant to the Energy Bureau's August 17, 2018 Order, the Energy Bureau ordered PREPA to evaluate the scenarios and conditions listed in an appendix to such order "to ensure a more robust assessment of the least-cost path for electrical resource development in Puerto Rico."¹⁵ The Energy Bureau noted that the scenarios included a mix of assumptions for key variables, including: "Gross load; Incremental Energy Efficiency and Demand Response; a 'Strategy' consideration, allowing for a 'Strategy 1' scenario that does not assume minigrid constraints when estimating an optimal resource mix; and the cost and availability of battery energy storage

¹⁰ See Resolution and Order, IRP 2018 Prefiling Process, Determination of Completeness of August 1, 2018 Compliance Filing with the Energy Bureau's July 2, 2018 Order, p. 2, Case No. CEPR-AP-2018-0001.

¹¹ *Id.* at 1.

¹² *Id.* at 2.

¹³ See Resolution and Order, Requirement of Information after Technical Conference, August 17, 2018, Case No. CEPR-AP-2018-0001.

¹⁴ *Id.*

¹⁵ See Resolution and Order, Evaluation of Additional Scenarios as part of the IRP Development, September 5, 2018, Case No. CEPR-AP-2018-0001.



systems ("BESS") and solar PV."¹⁶ The Energy Bureau further required PREPA to provide, within seven days of the issuance of the order, **a complete list of the scenarios to be incorporated into the development of the updated IRP.**¹⁷

On September 11, 2018, PREPA filed a motion seeking expedited technical clarifications from the Energy Bureau on the additional scenarios.¹⁸ On September 13, 2018, the Energy Bureau held a Technical Conference call with PREPA to answer questions regarding additional scenarios set forth in the Energy Bureau's September 5, 2018 Resolution and Order.¹⁹ On September 18, 2018, the Energy Bureau issued an Resolution and Order to which it attached its responses to PREPA's questions, and ordered PREPA to file, within seven days of the notification of its Resolution and Order, **a complete list of the scenarios it intended to include in the updated IRP.**²⁰

On September 26, 2018, PREPA filed a motion titled *PREPA's (1) Compliance with the Energy Bureau's September 5th and 18th Orders and (2) Informative Motion Regarding IRP Timeline* ("September 26 Compliance Filing").²¹ Attached to its September 26 Compliance Filing, PREPA provided a description of the proposed combination of strategies, scenarios, sensitivities and risk analysis to be submitted and evaluated as part of the updated IRP.²² PREPA also noted in that filing that "the 2018 IRP will not and cannot be completed by October 2018."²³ On September 28, 2018, the Energy Bureau determined that, in accordance with the requirements set forth in the September 5th and 18th Orders, the September 26 Compliance Filing was complete, and ordered PREPA to file a final timeline for the submission of the IRP within fifteen (15) days from the notification of that Resolution and Order.²⁴

¹⁶ *Id.*

¹⁷ *Id.*

¹⁸ See *PREPA's Motion for Expedited Clarification of Certain Aspects of the Energy Bureau's Resolution and Order of September 5, 2018*, September 11, 2018, Case No. CEPR-AP-2018-0001.

¹⁹ See Resolution and Order, PREPA's request for clarification of certain aspects of the September 5, 2018 Resolution and Order, September 18, 2018, Case No. CEPR-AP-2018-0001.

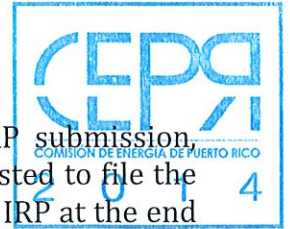
²⁰ *Id.* (Emphasis added.)

²¹ See *PREPA's (1) Compliance with the Energy Bureau's September 5th and 18th Orders and (2) Informative Motion Regarding IRP Timeline*, September 26, 2018, Case No. CEPR-AP-2018-0001.

²² *Id.* at Attachment 1.

²³ *Id.* at 3.

²⁴ See Resolution and Order, PREPA's Compliance with the September 5th and 18th Orders and Informative Motion Regarding IRP Timeline, September 28, 2018, Case No. CEPR-AP-2018-0001.



On October 15, 2018, PREPA filed a proposed timeline for the IRP submission, pursuant to the Energy Bureau's September 28, 2018 Order.²⁵ PREPA requested to file the final IRP by January 21, 2019. PREPA also proposed to submit a preliminary IRP at the end of November 2018 and to make an informal presentation around the first week of December 2018.²⁶ On November 6, 2018, the Energy Bureau determined that the preliminary report filed as part of a motion for an expedited technical conference is part of the record, and ordered PREPA to file its proposed IRP by January 21, 2019.²⁷

On November 2, 2018, the Energy Bureau held a technical conference call to discuss the preliminary results of the IRP and possible modifications to Scenario 3 of the IRP.²⁸

On November 9, 2018, following the technical conference call held on November 2, 2018, the Energy Bureau made several determinations about the IRP.²⁹ The Energy Bureau determined that PREPA must allow the capacity expansion model to deploy a reasonable amount of renewable resources in years 2019, 2020, and 2021.³⁰ As part of that determination, the Energy Bureau required PREPA to allow the model to provide optionality for the system to deploy solar PV in 2019, 2020, and 2021, in order to achieve compliance with the RPS goal by the end of 2021.³¹ In addition, the Energy Bureau required PREPA to allow the model to select a reasonable ramp up in the deployment of battery capacity, starting with 20 MW in 2019 and ramping up in each following year, becoming unlimited in 2022, and with at least as much battery capacity deployed as one half of the solar PV capacity allowed each year. The Energy Bureau also specified that the IRP must provide explicit assumptions, **with justifications, for each limitation placed on solar or batteries prior to 2022.**³² In addition, the Energy Bureau required that Scenarios 2 and 4 be combined unless PREPA showed that the least cost solution for Scenario 4 does not meet the restrictions of Scenario 2.³³

²⁵ See PREPA's Compliance with the Energy Bureau's September 28th Order, October 15, 2018, p. 2, Case No. CEPR-AP-2018-0001.

²⁶ *Id.*

²⁷ See Resolution and Order, PREPA's Compliance with the September 28th Order and IRP Timeline, November 6, 2018, p. 1, Case No. CEPR-AP-2018-0001.

²⁸ See Resolution and Order regarding topics discussed at the November 2, 2018 Technical Conference, November 9, 2018, p. 1, Case No. CEPR-AP-2018-0001.

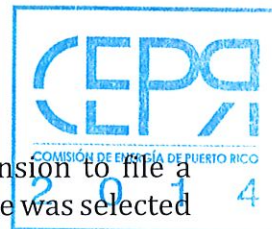
²⁹ *Id.*

³⁰ *Id.* at 1.

³¹ *Id.*

³² *Id.* at 1-2. (Emphasis added.)

³³ *Id.* at 2.



On January 23, 2019, PREPA filed a motion requesting another extension to file a completed IRP on February 12, 2019.³⁴ In its motion, PREPA stated that the date was selected after careful consideration of remaining tasks and “with the intention of avoiding any further motion for an extension of time.” With its motion, PREPA filed a partial/incomplete version of the IRP.³⁵ On January 25, 2019, the Energy Bureau granted PREPA’s request to extend the deadline to February 12, 2019 and ordered that the partial/incomplete IRP be included in the record for the benefit of interested parties and the general public.³⁶

On February 11, 2019, PREPA requested a three-day extension of time.³⁷ On February 12, 2019, the Energy Bureau responded to PREPA’s extension request.³⁸ Noting the numerous delays, and the impacts on stakeholders’ and investors’ trust, the Energy Bureau imposed an administrative fine of five thousand dollars (\$5,000.00) on PREPA.³⁹ At the same time, the Energy Bureau granted the motion and ordered the proposed IRP to be filed on February 15, 2019.

On February 15, 2019, the Energy Bureau issued an order noting PREPA’s February 13, 2019 filing of its proposed IRP, and the filing of a motion for limited waivers of filing requirements.⁴⁰ The Energy Bureau ordered all non-confidential and redacted documents related to PREPA’s IRP Filing to be published on the Energy Bureau’s website.⁴¹

III. Determination on Waiver Requests

PREPA’s February 13, 2019 filing included a motion requesting limited waivers of several sections of Regulation 9021 (“Waivers Request”).⁴² In general, the Energy Bureau

³⁴ See *PREPA’s Motion for a Limited Extension of Time*, January 22, 2019, p. 3, Case No. CEPR-AP-2018-0001.

³⁵ *Id.*

³⁶ See Resolution and Order, *PREPA’s Motion for Limited Extension of Time and Request for Confidential Treatment of Information*, January 25, 2019, p. 2, Case No. CEPR-AP-2018-0001.

³⁷ See *PREPA’s Motion for a 3-Day Extension of Time*, February 11, 2019, p. 2, Case No. CEPR-AP-2018-0001.

³⁸ See Resolution and Order, *PREPA’s Motion for a 3-day Extension of Time; Imposition of Administrative Fine*, February 12, 2019, p. 2, Case No. CEPR-AP-2018-0001.

³⁹ *Id.* at 3.

⁴⁰ See Resolution and Order, *PREPA’s Petition and Informative Motion Regarding Its Accompanying Integrated Resource Plan Filing*, February 15, 2019, p. 2, Case No. CEPR-AP-2018-0001.

⁴¹ *Id.* at 2.

⁴² See *PREPA’s Motion for Limited Waivers of Filing Requirements Under Regulation No. 9021*, February 13, 2019, Case No. CEPR-AP-2018-0001



approves PREPA's requests for waivers that result from the sudden and unexpected changes in Puerto Rico's energy system resulting from Hurricanes Irma and Maria. Specifically, the Energy Bureau **GRANTS** PREPA's request for waivers of the following Sections of Regulation 9021: Section 2.02(D)⁴³ regarding Appendix 2 to the IRP ("Prior Action Plan Implementation Status") and Section 2.03(C)(1)(e)⁴⁴ ("Prior Load Forecast Evaluation"). PREPA did not request a waiver for Section 2.03(L) of Regulation 9021 ("Prior Action Plan Implementation Status Update"), which defines the contents of Appendix 2 to the IRP. Since the Energy Bureau granted the waiver of Section 2.02(D) of Regulation 9021 regarding Appendix 2 of the IRP, consequently the Energy Bureau **WAIVES** the requirements of Section 2.03(L).

The Energy Bureau **DENIES** PREPA's request for waivers for the following Sections of Regulation 9021: Section 2.03(D)(1)(c)(viii)⁴⁵, Section 2.03(F)(4)(b)⁴⁶, Section 2.03(J)(1)(a)(ii) and (iii)⁴⁷, Section 2.03(J)(1)(b)(i)⁴⁸, Section 2.03(J)(1)(c)⁴⁹, Section 2.03(J)(1)(d)(ix) and (x)⁵⁰, Section 2.03(J)(1)(e)(i)⁵¹, Section 2.03(J)(2)(a)⁵², Section 2.03(J)(2)(c)⁵³, and Section 2.03(N)⁵⁴. Appendix B of this Resolution and Order provides a specific and self-explanatory guide as to how PREPA can fulfill, to the Energy Bureau's satisfaction, the requirements of each referenced Section of Regulation 9021.

PREPA's Waivers Request also included a proposed approach to the subject of Computer Modeling and Software, stemming from Section 2.02(F)(2) of Regulation 9021, and suggests that this is not a waiver request.⁵⁵ PREPA proposes to make available to the Energy Bureau the databases used to conduct its analysis and the Energy Bureau then either (a) provides PREPA the modifications it wishes to analyze and permits PREPA to run the

⁴³ See Waivers Request, p.1.

⁴⁴ *Id.*, p.3.

⁴⁵ *Id.*, p.3.

⁴⁶ *Id.*, p.4.

⁴⁷ *Id.*

⁴⁸ *Id.*

⁴⁹ *Id.*, p.5.

⁵⁰ *Id.*

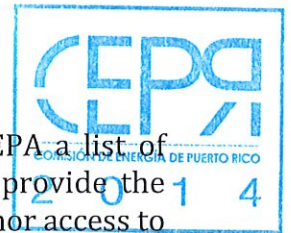
⁵¹ *Id.*

⁵² *Id.*, p.6.

⁵³ *Id.*

⁵⁴ *Id.*

⁵⁵ *Id.*, p.2.



software and provide the results to the Energy Bureau, or (b) provides PREPA a list of changes and permits PREPA to modify the database, run the software, and provide the output. PREPA further states that it makes a similar proposal regarding intervenor access to modeling and software. PREPA notes that modeling inputs contain CEII and must be treated as such.⁵⁶

The Energy Bureau agrees that this is not a waiver request. Consistent with the provisions of Regulation 9021, the Energy Bureau believes that PREPA's proposed approach to modeling and software will suffice for the time being. However, pursuant to the provisions of Regulation 9021, should analytical questions arise concerning results of any scenario runs that require a more detailed technical analysis into PREPA's modeling platform that cannot be sufficiently answered through iteration with PREPA, the Energy Bureau retains its authority to require a more careful examination of the modeling framework. While the Energy Bureau does not anticipate that this situation would require a licensing arrangement for the Energy Bureau or its consultants to use the software directly (though the IRP Regulation expressly contemplates it), the Energy Bureau may require on-site oversight of model configuration and model-running exercises at PREPA or Siemens sites, or in a similar vein via remote access.

IV. Determination on Confidentiality

PREPA argues that the information contained in several attachments, appendices, and workpapers to the IRP Filing should be kept confidential.⁵⁷ This includes information which is deemed CEII, which is protected under Federal and Puerto Rico Law. PREPA also argues that some information for which confidential treatment is requested contains trade secrets information, pursuant to Act 80-2011.⁵⁸ PREPA states that "the [Energy] Bureau's IRP regulation contains multiple provisions that recognize CEII and other grounds for confidentiality designations."⁵⁹

Upon examining PREPA's arguments, the Energy Bureau **GRANTS** the confidentiality designation request for the extant attachments, appendices, and workpapers submitted as part of the IRP Filing. The Energy Bureau makes one exception regarding the minigrid proposal in the refiled IRP as discussed below.

⁵⁶ *Id.* at 2-3.

⁵⁷ IRP Main Report Attachment B Transmission & Distribution; IRP Appendix 1 Attachments F and G Transmission Maps and Schematic; IRP Appendix 1; Existing Resources Workpaper – Existing Units Parameters; New Resources Workpaper – Distributed Generation Totals and Forecast; Resource Plan Modelling Input Files; Resource Plan modeling output files – Minigrids Files; Steady State Analysis Workpaper; Post-processing Analysis Workpaper files.

⁵⁸ Known as the *Industrial and Trade Secret Protection Act of Puerto Rico*, as amended.

⁵⁹ *PREPA's Motion for Confidential Treatment of Portions of Its Integrated Resource Plan*, February 13, 2019, Case No. CEPR-AP-2018-0001 at p. 3.

Having access to the information related to PREPA's "minigrid" proposal for the configuration of the Island's transmission system is of critical importance to the Energy Bureau and to the public, since it represents one of the options for the Preferred Resource Plan. The only detailed description of this proposal is present in Appendix 1 to the IRP Filing, which PREPA has claimed is CEII. In recognition of the importance of having access to the information related to the "minigrid" proposal, the Energy Bureau **ORDERS** PREPA to develop and file a version of Appendix 1 that is not confidential yet conveys the essentials of minigrid identification, design, and associated considerations. This version of Appendix 1 shall include much of the material presented in Sections 2.1 and 2.2 of the filed Appendix 1, including discussions of resource selection and the designation of categories of load and associated levels of service.

V. Nomenclature for Scenarios, Strategies, and Sensitivities

In the IRP Filing, PREPA uses the combination of "scenarios," "strategies," and "sensitivities" to define cases that are modeled and analyzed. These terms are described in detail in Part 5 of the IRP Filing.⁶⁰ They are summarized here to establish the nomenclature and numbering for references in this Resolution and Order. Scenarios, as defined by PREPA, are used to reflect the availability of different resources. Exhibit 5-2, reproduced here, shows the resources available in each Scenario:

Exhibit 5-2. PREPA IRP Scenario Definition

Scenario	New Gas				Renewable & Storage	
	AOGP	Land-based LNG at San Juan	Ship-based LNG at Yabucoa	Ship-based LNG at Mayagüez	Costs	Availability
1	No	No	No	No	Reference	Reference
2	No	Yes	No	No	Reference	Reference
3	No	Yes	Yes	Yes	Low	High
4	No	Yes	Yes	Yes	Reference	Reference
5	Yes	Yes	Yes	Yes	Reference	Reference
ESM	No	Yes	Yes	Yes	Reference	Reference

Strategies reflect different approaches to meeting resource needs, spanning a range from a "traditional, centralized" program (Strategy 1) to a "distributed system" (Strategy 2), with Strategy 3 being "a mixture of the first two strategies."⁶¹

⁶⁰ See PREPA Ex. 1.0 IRP Main Report, Part 5 Resource Needs Assessment, February 13, 2019, Case No. CEPR-AP-2018-0001.

⁶¹ *Id.* at 5-3.



Sensitivities “isolate the impacts of certain important variables while holding other assumptions constant.”⁶² The variables tested via the sensitivity analysis reflect different kinds of uncertainty, primarily uncertainty in the cost and availability of different resources. The sensitivities analyzed by PREPA are numbered 1 through 6:

1. Deeper reduction in cost of solar and storage, coupled with high availability of storage and solar;
2. Lower energy efficiency penetration;
3. Economic retirement of AES and EcoEléctrica regardless of contract term;
4. Ship-based LNG at San Juan could achieve permitting approval. It has reduced capacity in comparison to the land-based LNG option;
5. High gas prices;
6. High cost of solar and storage.

High, Base, and Low load forecasts are not treated as sensitivities *per se*. Instead, they may be applied to any case.

A given case modeled by PREPA is named based on the Scenario, Strategy, and Sensitivity that it reflects, in that order. High, Base, and Low load forecasts are labeled by the addition of the letter “H”, “B”, or “L” in the case name. For example, case “S4S2S5B” is Scenario 4, Strategy 2, and Sensitivity 5 with the Base load forecast, while case “S3S2H” is Scenario 3, Strategy 2, with a high load forecast. Exhibit 5-4 in the IRP Filing lists the cases that PREPA modeled.

VI. Determination on Completeness

Pursuant to Section 3.02 of Regulation 9021, the Energy Bureau is required to review the proposed IRP within thirty (30) days from the date on which PREPA makes its IRP filing “to determine whether it complies in full with the requirements of this Regulation.”⁶³ If the Energy Bureau determines that the proposed IRP filing complies with the requirements of Regulation 9021, it should issue a resolution stating that the IRP is complete and that the adjudicative process may begin.⁶⁴ If the Energy Bureau finds that the IRP is not complete, the Energy Bureau “will identify the specific areas in which PREPA’s filing is deficient and the information required to correct such deficiency.” The Energy Bureau “shall grant a reasonable term for PREPA to refile its proposed IRP.”⁶⁵

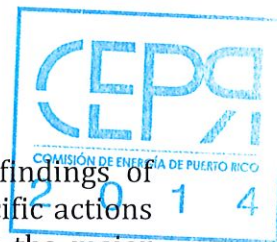
The Energy Bureau has reviewed PREPA’s IRP Filing, and, pursuant to Section 3.02(A)(2) of Regulation 9021, finds that the proposed IRP filed by PREPA on February 13,

⁶² *Id.* at 5-6.

⁶³ See Regulation 9021, Section 3.02(A).

⁶⁴ *Id.* at Section 3.02(A)(1).

⁶⁵ *Id.* at Section 3.02(A)(2).



2019, is not in compliance with Regulation 9021. The Energy Bureau's findings of deficiency are summarized below. Appendix A, attached hereto, identifies specific actions that the Energy Bureau **ORDERS** PREPA to take in its refiled IRP to address the major deficiencies summarized in this Resolution and Order. Appendix B, also attached hereto, identifies minor areas of incompleteness in the IRP Filing and identifies how PREPA can address them in its refiled IRP.

A. Resource Plan Development Analysis

Section 2.03(H)(2)(a) of Regulation 9021 requires the use of "a Capacity Expansion Model to develop least cost Resource Plans that meet customer needs under the reference case scenario and various future scenarios. If PREPA does not use a Capacity Expansion Model to develop Resource Plans, the utility must seek, and receive, a waiver from the [Energy Bureau] to use any other kind of Resource Plan Development model for this purpose ...".⁶⁶

PREPA used a capacity expansion model for the bulk of its analysis. However, in its filed IRP, PREPA included an additional scenario, the "Energy System Modernization" ("ESM") Plan. The ESM Plan does not utilize a capacity expansion model for the bulk of its capacity additions. It includes as "fixed decisions" a set of resource choices: replacing gas turbines with new mobile units; developing a liquified natural gas ("LNG") import terminal at Yabucoa and an associated 302 MW F-Class combined cycle gas turbine ("CCGT") in 2025; developing an F-Class CCGT at Palo Seco by 2025 fueled by land-based LNG at San Juan; developing new ship-based LNG at Mayagüez and conversion to dual fuel of the Aero Mayagüez units; and developing a new 114 MW thermal plant in the San Juan area.⁶⁷ In addition, this plan assumes more restricted deployment of solar and battery storage than in any other scenario, which has the effect of nearly fixing the amount of solar and storage in a fashion such that the capacity expansion model has little choice when deploying these cost-effective resources. PREPA conducted a "Nodal Run" of its model for the ESM Plan but did not run the Aurora capacity expansion model for this case.⁶⁸

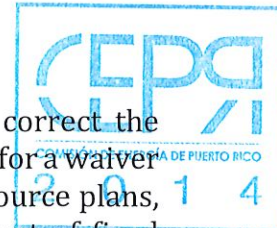
PREPA used the ESM Plan as a major component of its proposed Action Plan. PREPA's February 13, 2019 formal filing is the first time (except for its informal, and draft, filing on January 23, 2019) that PREPA has informed the Energy Bureau of the existence of the ESM Plan.

PREPA did not seek a waiver to employ the fixed-resource approach used to develop the central aspects of the ESM scenario as required under Section 2.03(H)(2)(a) of Regulation 9021.

⁶⁶ *Id.* at Section 2.03(H)(2)(a).

⁶⁷ See PREPA Ex. 1.0 IRP Main Report, Section 8.3 "The ESM Plan", Page 8-34.

⁶⁸ *Id.* At Exhibit 5-4 on Page 5-8.



Section I(A) of Appendix A includes specific information required to correct the identified deficiencies including, but not limited to, providing an express request for a waiver of the requirement to use a capacity expansion model to develop optimized resource plans, with a justification as to why PREPA believes it is essential to consider the set of fixed resources that compose the ESM Plan in addition to the optimized portfolios developed by the capacity expansion model. It is important to note that the Energy Bureau's requirement that PREPA file a waiver request in no way either (i) indicates that the Energy Bureau will grant such a waiver, or (ii) if it does grant a waiver, indicates any agreement with PREPA that the ESM Plan, as described, is part of a Preferred Resource Plan; but rather is a recognition that, before making such determination, additional information is needed.

B. Resource Plan Sensitivity Analysis

Section 2.03(H)(2)(b) of Regulation 9021 requires the use of sensitivity analysis to explore a "reasonable range of uncertainty in forecast assumptions to examine the robustness of resource plans created in the optimization analysis (i.e., how each resource plan would be affected by changes in input assumptions)." Critically, subsection (i) states that the "sensitivity analyses shall hold the resources developed in each Resource Plan constant and examine the impacts of changing uncertain forecasts."⁶⁹ PREPA failed to meet the requirements of this section in multiple ways:

1. Section 2.03(H)(2)(b)(v) of Regulation 9021, requires that "sensitivity analyses should be used to inform the selection of the Preferred Resource Plan." By not conducting a sensitivity analysis of the ESM plan on which the proposed Action Plan is largely based, PREPA has failed to comply with critical requirements necessary to conclude that the IRP filing is complete.
2. PREPA performed a high gas price sensitivity analysis on S4S2, the companion scenario to the ESM that makes up a portion of the Preferred Plan. This analysis results in a very high \$16.2 billion net present value ("NPV") cost to ratepayers as compared to alternative scenarios.⁷⁰ PREPA fails to point out this difference in its filing. Furthermore, PREPA states that "there is significant agreement on results, which can be used to identify the preferred robust decisions."⁷¹ This statement, however, is not supported by the evidence, which shows significantly higher cost for S4S2 under the high-gas price sensitivity.
3. Sensitivities 1, 5, and 6 reflect "uncertain forecasts" (for the costs of renewable resources, battery storage, and natural gas) in the manner specified in the IRP Regulation, and PREPA should have therefore held "the resources developed in each Resource Plan constant." However, PREPA did not hold the resources constant. For

⁶⁹ See IRP Regulation, section 2.03(H)(2)(b)(i).

⁷⁰ See PREPA Ex. 1.0 IRP Main Report, at Exhibit 8-1.

⁷¹ *Id.*, at Page 8-8 (top paragraph).

example, Exhibit 1-1 of the IRP Main Report shows that sensitivity cases S1S2S1B, S4S2S5B, S4S2S6B, and S5S1S5B all have different capacity expansion plans.



4. The actual least cost plans were S3S2 and S3S3, which include greater availability and lower costs for solar PV and battery storage. Rather than perform a sensitivity to determine whether these plans remain low cost with the standard costs of solar PV and storage, PREPA instead dismissed these plans from consideration because they used an assumption of lower cost solar and storage. PREPA also notes that large renewable capacity “would strain the remaining resources on the system.”⁷² However, one metric around system reliability – in the form of loss of load hours expected – is zero for both S3S2 and S3S3, indicating that even if resource “strain” exists, reliability remains intact.⁷³ That renewable resources may be double the peak load “over the long term”⁷⁴ is not a sufficient justification for dismissing this resource plan, especially when the plans include more than 2,000 MW of storage resources (S3S2) and almost 4,000 MW of storage resources (S3S3) over the long term.⁷⁵ PREPA failed to account for the possibility that the storage resources could be used to cost-effectively offset increases in solar generation relative to daytime peak load.
5. PREPA did not consider uncertainty in the construction and other costs associated with land-based LNG in San Juan. PREPA assumed that it would bear “only a portion” of the costs of the land-based LNG terminal.⁷⁶ If PREPA had informed the Energy Bureau of this modeling assumption in its scenario definition, the Energy Bureau would likely have required PREPA to run a sensitivity under which the full cost is borne by PREPA customers.

Section I(B) of Appendix A includes specific information required to correct these identified deficiencies.

C. Preferred Resource Plan Selection

Section 2.03(H)(2)(d) of Regulation 9021 establishes requirements for the selection of a Preferred Resource Plan. In particular, it requires that the minimum value of the Present Value of Revenue Requirement (“PVRR”) be the primary selection criterion, and that other criteria, such as system reliability, risk, environmental impacts, implications for the transmission and distribution grids, financial impacts on PREPA, and the public interest also

⁷² *Id.*, at Page 8-6.

⁷³ See “Metrics” tab for the following documents: S3S2B_Metrics_V5.xlsx, S3S2H_V5 Metrics.xlsx, S3S2L_V5 Metrics.xlsx, S3S3B_Metrics_V5.xlsx, S3S3H_V5 Metrics.xlsx, S3S3L_V5 Metrics.xlsx.

⁷⁴ See PREPA Ex. 1.0 IRP Main Report, Page 8-6.

⁷⁵ *Id.* Exhibit 1-1.

⁷⁶ *Id.*, at Page 10-7.

be considered. The IRP Regulation requires a “detailed discussion” of these factors in support of the preferred resource plan.⁷⁷ PREPA failed to meet the requirements of this section in multiple ways:



1. According to Exhibit 8-1 in the IRP Main Report, the least cost case (in the base load forecast) modeled is Scenario 3, Strategy 2 (S3S2, case 11). Because PREPA has not evaluated this resource plan with the standard cost assumptions for solar PV and batteries, neither PREPA nor the Energy Bureau has the information to determine if this case remains low cost under common cost assumptions with the other scenarios.
2. The second-lowest cost case is Scenario 5, Strategy 1 (S5S1, case 29). Despite this fact, PREPA does not address Scenario 5 in the Action Plan section and describes the ESM plan as “least cost”.⁷⁸ PREPA implicitly rejects Scenario 5⁷⁹ with discussions of the Value of Lost Load (“VOLL”). However, the IRP filing does not contain a “detailed discussion” of each of the factors required by Regulation 9021 that could be used to develop a case for the superiority of Scenario 4 or the ESM plan to Scenario 5.
3. While Section 8.1 of the IRP Main Report provides some discussion of the relative performance of different Scenarios under a limited set of metrics, PREPA does not provide the required “detailed discussion” of the relative merits of the preferred plan to each of the other Scenarios studied under the list of required factors. For example, PREPA does not address the aspects of risk associated with each of the evaluated sensitivities (such as higher or lower renewable energy, storage, or gas prices).
4. The filed IRP lacks a detailed discussion of optimizing the minigrid configuration, and associated generation requirements. The only explanation of the minigrid configuration can be found in Section 2 of Appendix 1. If the island were divided not into 8 minigrids, but instead into 4 or 10, or if only portions of the island were covered with minigrids, or if only microgrids were installed to serve critical loads, but no minigrids were established, the costs of the transmission and distribution system would surely be different, as would be the required geographical distribution of generation resources and the VOLL. PREPA uses a VOLL argument to justify the minigrid investments but has not tested sensitivities between different levels of minigrid investment and resulting variation in the VOLL. The combined PVRP of generation, transmission, and distribution investments is what Puerto Rico’s customers will pay. As such, PREPA should demonstrate that it is striving to optimize the total cost of the electricity system.

⁷⁷See IRP Regulation, section 2.03(H)(2)(d)(iii).

⁷⁸ See PREPA Ex. 1.0 IRP Main Report, Page 10-2.

⁷⁹ *Id.* at Pages 8-6 and 8-66.

5. The filed IRP does not explain how the ESM plan can appear to meet the constraints of Scenario 4 and have a lower present value of revenue requirements than the modeled Scenario 4 cases.



Section I(C) of Appendix A includes specific information required to correct these identified deficiencies.

D. Minor Items

The Energy Bureau has identified numerous further sections of Regulation 9021 which PREPA's IRP Filing fails to meet, either in total or in part. Appendix B to this Resolution and Order identifies those items and provides explicit guidance regarding how they can be met to the Energy Bureau's satisfaction.

VII. Noncompliance with Energy Bureau's Orders

The Energy Bureau has issued numerous Orders in this proceeding providing instructions to PREPA regarding the conduct of its IRP analysis. The review of PREPA's February 13, 2019 filing shows that PREPA violated several aspects of those Orders. In this Resolution and Order, the Energy Bureau identifies those violations, directs PREPA to conduct additional analyses, and to revise the IRP prior to refiling.

A. Inconsistency of Scenario 1 Definition

PREPA used inconsistent definitions and descriptions of Scenario 1 in its various filings prior to the filed IRP, and within the filed IRP itself. The question is whether Scenario 1 represents either "no new gas-fired generation"⁸⁰ or "no new natural gas delivery infrastructure"⁸¹ in Puerto Rico. The modeling conducted for the filed IRP uses the latter definition: the capacity expansion model selects two new CCGTs in Costa Sur, and the modeling section describes how this scenario does not convert San Juan units 5 & 6 to natural gas because "this Scenario assumes no new gas terminals are added to the island."⁸²

Prior to the Energy Bureau's September 5 Order that required PREPA to consider additional scenarios for the IRP, PREPA had not described Scenario 1 in terms other than "no new gas-fired generation".⁸³

⁸⁰ See PREPA Ex. 1.0 IRP Main Report, Page 5-4.

⁸¹ *Id.* Page 1-3.

⁸² *Id.* Page 8-51.

⁸³ See PREPA's Compliance Filing for Items due August 1, 2018, Answers to Questions 32 and 34, August 1, 2018. Case No. CEPR-AP-2018-0001.

PREPA violated Energy Bureau orders by changing the definition of Scenario 1 without informing the Energy Bureau. Scenario 1 as modeled in the IRP filing is valuable and should remain in the IRP. However, PREPA should also model a scenario with “no new gas-fired generation.”

Section II(A) of Appendix A includes specific information required to correct this failure to comply with the Energy Bureau’s Order.

B. Scenarios 2 and 4

In its November 9, 2018 Order, the Energy Bureau stated that “Scenarios 2 and 4 must be combined unless PREPA shows that the least cost solution for Scenario 4 does not also meet the restrictions of Scenario 2.”⁸⁴ PREPA’s witness, Dr. Bacalao, repeats this language in his testimony, in the context of describing how Scenarios 2 and 4 were combined. However, PREPA’s final IRP shows that Scenario 4 does not also meet the restrictions of Scenario 2. That is, the capacity expansions for Scenario 4 include new natural gas imports in the East or West, rather than only in the North (see cases 17 through 19 and 21 through 23, and 25 through 28 in Exhibit 1-1 in the IRP Main Report). Therefore, the Order to combine Scenarios 2 and 4 was no longer applicable and PREPA should have continued to model Scenario 2.

Section II(B) of Appendix A includes specific information required to correct this failure to comply with the Energy Bureau’s Order.

C. Resource Modeling Requirements

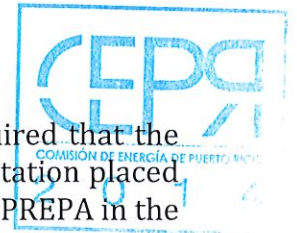
a. Solar and battery limitations

The Energy Bureau’s November 9, 2018 Order explicitly specified the manner in which PREPA should model solar and batteries in the IRP.⁸⁵ Specifically, the Energy Bureau ordered PREPA to allow its model to select solar PV up to the amount consistent with compliance with the Commonwealth’s renewable portfolio standard by the end of 2021.⁸⁶ Act 82 of 2010 sets the renewable portfolio standard level at fifteen percent (15%) for years between 2020 and 2027. In its IRP Filing, PREPA has not provided documentation that RPS compliance is achieved in 2021. In fact, the “metrics” workpapers for each scenario include calculations of RPS compliance and show that RPS compliance is not achieved in 2021 for any case except Scenario 3 (in which solar PV is less constrained in 2021). Therefore, PREPA has overly limited the deployment of solar PV in its modeling of the 2019 to 2021 period.

⁸⁴ See Resolution and Order regarding topics discussed at the November 2, 2018 Technical Conference, November 9, 2018, p. 2, Case No. CEPR-AP-2018-0001.

⁸⁵ *Id.* at 1-2.

⁸⁶ *Id.*



Furthermore, in its November 9, 2018 Order the Energy Bureau required that the “IRP filing must provide explicit assumptions, with justifications, for each limitation placed on solar and batteries prior to 2022.”⁸⁷ The sum total justification provided by PREPA in the IRP filing for the annual limits chosen is the statement that “there are limits on the amount of annual installation that can effectively be carried out in parallel.”⁸⁸ This response provides insufficient information to evaluate the reasonableness of PREPA’s assumptions.

Section II(C) of Appendix A includes specific information required to correct these non-compliances with the Energy Bureau’s Order.

b. Wind and solar cost and performance assumptions

Following the September 13, 2018 Technical Conference call, the Energy Bureau documented written responses to PREPA’s questions regarding the IRP and modeling in a Resolution and Order dated September 18, 2018.⁸⁹ One of those questions and answers (# 13) related to the modeling of wind resources. The Energy Bureau stated that as “with all resources offered as alternatives for the capacity expansion model, the characteristics, presumed output profiles, and assumed cost trajectories should be fully and clearly documented.”⁹⁰ PREPA has failed to meet this requirement for wind or solar PV generation.

PREPA included a “Puerto Rico Solar Overnight Cost Adder” of sixteen percent (16%) for both wind and solar. The IRP filing provides no justification for the use of such a factor, nor for why it is the same for wind and solar, nor for it being the same regardless of the overall quantities of solar or wind considered, since scale economies could affect any potential change in costs associated with delivery to Puerto Rico. This factor could have a substantial impact on the relative economics of wind, solar, and fossil fueled resources, and should be “fully and clearly documented,” as the Energy Bureau stated in its Resolution and Order.⁹¹

PREPA utilized the cost trajectory for wind and solar capital and operating costs from the National Renewable Energy Laboratory “Annual Technology Baseline” (“NREL ATB”). However, PREPA did not utilize the corresponding improvements in technology performance that accompany the cost trajectories, even though those improvements are directly included and readily accessible in the Excel workpapers in PREPA’s IRP Filing.

⁸⁷ *Id.* at 2.

⁸⁸ See PREPA Ex. 1.0 IRP Main Report, at 6-21.

⁸⁹ See Resolution and Order, PREPA’s request for clarification of certain aspects of the September 5, 2018 Resolution and Order, September 18, 2018, Case No. CEPR-AP-2018-0001.

⁹⁰ *Id.* at Appendix A, p. 8.

⁹¹ *Id.*



This omission is of particularly critical importance for wind, where technology improvements are resulting in substantial increases in capacity factor in low-to-moderate wind regimes, which is exactly the area of relevance for Puerto Rico. As PREPA states in the IRP filing, “a capacity factor of 30% would be required for the Low Wind Case to reach the same levels as the Mid Case Solar PV.”⁹² The NREL ATB capacity factor trajectory corresponding to the “mid” price trajectory that PREPA used reaches thirty percent (30%) in 2029, and for the “low” price trajectory in 2021.

If PREPA were to consider wind using a consistent treatment of cost and performance, the relative competitiveness of wind, solar, and other resources might be substantially different. PREPA’s use of a wind performance metric based on the apparent actual output of the Santa Isabel wind farm (commercial operation date 2012) is inappropriate because the technology that would actually be used, based on the NREL ATB TRG-8 (“techno-resource group”) would be different, designed to capture more wind using larger blades. The costs associated with this difference are captured by PREPA in its input assumptions, but the performance is not.

In addition, PREPA failed to “fully and clearly” document the output profiles used for wind generation modeling. The IRP filing includes an example profile from one wind facility but does not say if or how PREPA used this in its modeling. While this profile shows substantial overlap with a solar generation profile, the seasonal, evening, and overnight performance of wind and solar could be substantially different and PREPA has not indicated if, or how, this was accounted for.

Section II(D) of Appendix A includes specific information required to correct these non-compliances with the Energy Bureau’s Order.

VIII. Additional Ordered Items

In the review of the IRP Filing, the Energy Bureau has identified several pieces of information, modeling results, or areas where greater detail would be beneficial to the Energy Bureau’s and the public’s subsequent review. These are not strictly matters of completeness, because the minimum requirements of the regulation have been achieved in these areas. However, the provision of these items in the refiled IRP would expedite review and reduce the burden of discovery for any intervenor. Furthermore, if consideration of these items results in PREPA changing assumptions for modeling, it would be more efficient for PREPA and the Energy Bureau to reflect those changes as early as possible to potentially minimize the need for additional model runs.

To that end, Section III of Appendix A includes several items for PREPA to include, and questions for PREPA to answer, in its filing of a complete IRP.

⁹² See PREPA Ex. 1.0 IRP Main Report, at 6-33.



IX. Conclusion

As a result of its findings that the proposed IRP is not in compliance with Regulation 9021 and prior Energy Bureau's Orders, the Energy Bureau **ORDERS** PREPA to correct the deficiencies noted above and in the attached Appendices A and B, and to refile its proposed IRP within thirty (30) days from the date of the issuance of this Resolution and Order. If PREPA believes that it will require more than thirty (30) days to comply, PREPA shall file a motion within ten (10) days of the issuance of this Resolution and Order, with a date certain on which PREPA will file the revised IRP and outlining the reasons for which PREPA is requesting additional time. To expedite our review, the Energy Bureau further **ORDERS** PREPA to provide, along with its refiled IRP, a document with references to the pages (and if necessary, files) that illustrate how PREPA has addressed each of the items in Appendices A and B.

The Energy Bureau's Final Order in the previous IRP proceeding, Case No. CEPR-AP-2015-0002, contains a requirement that PREPA collect a specified list of information regarding its generation and loads.⁹³ PREPA is **ORDERED** to file the complete set of information identified and required in Section VII.C.3 of the Energy Bureau's Final Order in proceeding CEPR-AP-2015-0002. PREPA may satisfy this requirement for each type of data by providing a separate document or documents alongside the refiled IRP, or by identifying where in the rest of the IRP Filing it can be found.

The Energy Bureau **ORDERS** PREPA to file any clarifying questions it may have regarding this Resolution and Order on or before March 25, 2019. Furthermore, the Energy Bureau **ORDERS** PREPA to attend a Technical Conference Call scheduled for April 1, 2019 at 9:30 a.m. during which the Energy Bureau and its consultants will clarify any questions PREPA may have regarding this Resolution and Order.


Any party interested in attending the April 1, 2019 Technical Conference Call may request dial-in information by sending an email to legal@energia.pr.gov on or before March 28, 2019. All interested parties are welcomed to listen-in on the call, however, the Energy Bureau will not address questions from interested parties during the call.

For the benefit of all parties involved, the Bureau publishes this Resolution and Order in both Spanish and English. Should any discrepancy arise between these two (2) versions, the provisions of the English version shall prevail.

⁹³ See Final Resolution and Order of the First Integrated Resource Plan of the Puerto Rico Electric Power Authority, September 23, 2016, p. 92-93, Case No. CEPR-AP-2015-0002.

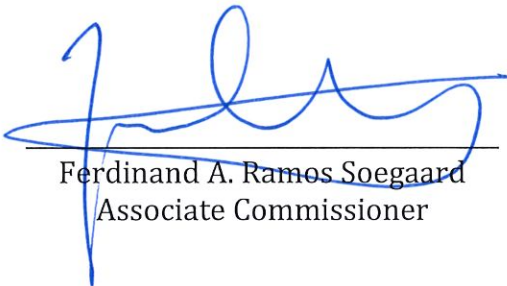
Be it notified and published.




Edison Aviles Deliz
Chairman


Ángel R. Rivera de la Cruz
Associate Commissioner


Lillian Mateo Santos
Associate Commissioner


Ferdinand A. Ramos Soegaard
Associate Commissioner


José J. Palou Morales
Associate Commissioner

CERTIFICATION

I hereby certify that the majority of the members of the Puerto Rico Energy Bureau has so agreed on March 14, 2019 and on this date a copy of this Resolution and Order was notified by electronic mail to the following: astrid.rodriguez@prepa.com, n-vazquez@aeepr.com and jorge.ruiz@prepa.com. I also certify that today, March 14, 2019, I have proceeded with the filing of the Resolution and Order issued by the Puerto Rico Energy Bureau and I have sent a true and exact copy to the following:

Puerto Rico Electric Power Authority

Attn.: Nitza D. Vázquez Rodríguez
Astrid I. Rodríguez Cruz
Jorge R. Ruíz Pabón
P.O. Box 364267
Correo General
San Juan, PR 00936-4267

For the record, I sign this in San Juan, Puerto Rico, today, March 14, 2019.


María del Mar Cintrón Alvarado
Clerk

Appendix A Major Items Required for IRP Completeness



Each of the following sections identify specific major compliance items required of PREPA in order for its re-filed IRP to be complete.

I. Regulation 9021

A. *Resource Plan Development Analysis*

1. Concerning the ESM Resource Plan, provide an explicit request for a waiver of the requirement to use a capacity expansion model to develop optimized resource plans, with a justification as to why PREPA believes it is essential to consider the set of fixed resources that compose the ESM plan in addition to the optimized portfolios developed by the capacity expansion model. The Energy Bureau's requirement that PREPA file a waiver request in no way either (i) indicates that the Energy Bureau will grant such a waiver, or (ii) if it does grant a waiver, indicates any agreement with PREPA that the ESM plan, as described, is part of a Preferred Resource Plan; but rather is a recognition that, before making such determination, additional information is needed.
2. It appears that the ESM contains a mix of resources derived from either the results of LTCE runs, or from other "fixed decision" determinations by PREPA. Provide the following:
 - a. Explicitly identify which resource plan elements of the ESM were subject to optimization in the capacity expansion model, and which were not a result of any optimization runs.
 - b. What are the specific "several generation expansion additions" referenced in the first sentence on page 8-34 of the IRP Main Report?
 - c. What is "The corresponding least cost capacity expansion plan (LTCE)..." referenced in the first paragraph on page 8-34 of the IRP Main Report, and where in the IRP are those results presented? In what way is it different from "the applicable least cost plan (Scenario 4, Strategy 2) ..." noted in the last sentence of the first paragraph on page 8-34 of the IRP Main Report?
 - d. What is the underlying qualitative and quantitative rationale for replacing all 18 existing Frame 5 GT's, "...as a fixed decision to come online by 2021 and with containerized LNG as a fuel option (418 MW total)"? Provide a quantitative assessment of the total costs (capital and operating) associated with this "fixed decision".
 - e. What are the underlying qualitative and quantitative rationales for including each of the four LNG-fueled resources listed in the four sequential bullets



points on page 8-34 that start with “Develop an LNG terminal at Yabucoa (Caguas) and a 302 MW F-Class CCGT in June 2025 to be built as a fixed decision”?

- f. Confirm, or explain otherwise, that the only basis for the fixed payment reduction for EcoEléctrica is that such reduction “is enough for it to be competitive with the CCGT option”.
 - g. On what basis is it assumed that the EcoEléctrica unit is “fully flexible for cycling”, and state with precision the modeled resource characteristics that underlie the meaning of “fully flexible for cycling”.
 - h. What are the underlying reasons for the solar and storage limitations stated on page 8-34 of the IRP Main Report for the ESM Plan? Include in this response any specific, detailed information PREPA is aware of that would limit near-term or longer-term availability of these resources.
3. The underlying resource plans arising from LTCE model runs all presume that any new gas-fired resource relying on San Juan land-based LNG infrastructure would be “assumed to bear only its portion of the total terminal costs”;¹ those total costs are estimated at \$492 million including a pipeline to Palo Seco. A series of sensitivity analyses are Ordered in the next section to determine the effect of full cost apportionment of San Juan land-based LNG infrastructure on the costs of the Filed IRP resource plans that include Palo Seco CCGTs. However, a new set of scenarios are required to be run to determine the optimal LTCE resource plan assuming full-cost apportionment of the land-based infrastructure, and in consideration of the interactive effect of other critical resource option input assumptions. The designation “FC” (Full Cost) following the original Scenario number indicates that the full cost of San Juan LNG-based infrastructure must be included in the capital costs of the potential new resource. In the six Scenario cases listed below, no changes need be made to any other parameters. Provide the following new Scenario runs to address these issues.
- a. S4FCS2B. Provide a re-run of the original S4S2B scenario changing the LNG infrastructure cost parameter.
 - b. S4FCS3B. Provide a re-run of the original S4S3B scenario changing the LNG infrastructure cost parameter.
 - c. S3FCS2B. Provide a re-run of the original S3S2B scenario changing the LNG infrastructure cost parameter.
 - d. S3FCS3B. Provide a re-run of the original S3S3B scenario changing the LNG infrastructure cost parameter.

¹ See Ex. 1.0 IRP Main Report, Section 10.1.4.1, Page 10-7.



- e. S5FCS1B. Provide a re-run of the original S5S1B scenario changing the LNG infrastructure cost parameter.
- f. S5FCS1S5B. Provide a re-run of the original S5S1S5B scenario changing the LNG infrastructure cost parameter.

As noted in the *"Solar PV and Battery Storage Availability Limitations"* and the *"Consistent Treatment of Wind Costs and Wind Performance Parameters"* sections below under Section II of this Appendix, there are other input assumptions used in the Filed IRP that violated previous Energy Bureau Orders. The parameters associated with early-period (2019-2021) solar PV and battery storage availability, and wind performance (across all years of operation), as revised in accordance with the Energy Bureau's prior Orders (detailed in the noted sections below), shall be incorporated into the resource offering parameters for the following six new Scenarios that PREPA must execute. These six Scenarios are to include as input assumption revisions both the changes to the San Juan land-based LNG infrastructure costs noted above, and changes to the solar PV and battery storage availability parameters and the wind performance parameters. The suffix "_Renew" is added to the Scenario numbering terminology to indicate these changes. Provide the following new Scenario runs to address these issues.

- g. S4FCS2B_Renew. Provide a re-run of the original S4S2B scenario changing the LNG infrastructure cost parameter and the solar PV and battery storage availability parameters (2019-2021), and the wind performance parameters.
- h. S4FCS3B_Renew. Provide a re-run of the original S4S3B scenario changing the LNG infrastructure cost parameter and the solar PV and battery storage availability parameters (2019-2021), and the wind performance parameters.
- i. S3FCS2B_Renew. Provide a re-run of the original S3S2B scenario changing the LNG infrastructure cost parameter and the solar PV and battery storage availability parameters (2019-2021), and the wind performance parameters.
- j. S3FCS3B_Renew. Provide a re-run of the original S3S3B scenario changing the LNG infrastructure cost parameter and the solar PV and battery storage availability parameters (2019-2021), and the wind performance parameters.
- k. S5FCS1B_Renew. Provide a re-run of the original S5S1B scenario changing the LNG infrastructure cost parameter and the solar PV and battery storage availability parameters (2019-2021), and the wind performance parameters.
- l. S5FCS1S5B_Renew. Provide a re-run of the original S5S1S5B scenario changing the LNG infrastructure cost parameter and the solar PV and battery storage availability parameters (2019-2021), and the wind performance parameters.

B. Sensitivity Analyses

1. Conduct a series of Resource Plan Sensitivity Analyses as follows, applying cost-based sensitivities in the manner required by Regulation 9021. The Regulation requires leaving the resource plan resulting from the LTCE “constant” and changing the cost-based variables according to the sensitivity definition.²
 - a. Create a new sensitivity in which PREPA faces the full cost of land-based LNG in San Juan and apply it in each case where resources dependent on land-based LNG at San Juan are selected. If this sensitivity adds the same fixed cost to each case where it applies, PREPA may simply identify which cases it applies to.
 - b. Apply sensitivities 1, 5, and 6 to the ESM plan, to Scenario 4 Strategy 2, and to any other Scenario or Strategy that PREPA draws upon to develop its Preferred Resource Plan. Ensure that these sensitivities are applied such that the resource plan from the scenarios is held constant.
 - c. Apply sensitivities to S3S2 and S3S3 that hold the resource plan constant but use reference level costs for the solar PV and BESS resources.

C. Preferred Resource Plan Selection

1. Provide and specify in tabular and, as necessary, narrative form all elements of a Preferred Resource Plan selected from and informed by resource plans developed and evaluated in optimization and sensitivity analyses, including specified new scenario and sensitivity analyses contained in this Resolution and Order. If any elements of a Preferred Resource Plan are not directly supported by the results of resource plan optimization or sensitivity analysis, clearly describe and explain the rationale behind inclusion of such elements in the Preferred Resource Plan.
2. Provide a detailed discussion of each of the factors in Section 2.03 (H)(2)(d)(ii) of Regulation 9021, and the results of the optimization and sensitivity analyses, if PREPA chooses a plan that is not the lowest cost. This discussion must address in detail any underlying reliability, interconnection, curtailment or other reasons given in support of a plan that is not least cost.
3. Include a detailed explanation as to why the proposed minigrid configuration provides an optimal balance between ratepayer costs and improved reliability and resilience. This explanation should include a quantitative assessment of the marginal reduction in quality of service (e.g., increase in VOLL) from completing one or more examples of partial minigrid investments (such as a minigrid configuration only for the island’s major economic and population centers).

² Section 2.03 (H)(2)(b)(i) of Regulation 9021.

4. Explain the relationship between the capacity expansion model's optimization and the costs of the ESM plan.



II. Previous Energy Bureau Orders

A. *Scenario 1 Definition*

1. Incorporate new model runs of Scenario 1 as modeled by PREPA (namely, with “no new natural gas delivery infrastructure”), with one change: the contracted conversion of San Juan 5 & 6 to ship-based natural gas shall be included as a fixed resource, in a consistent fashion to how it has been included in the other scenarios. Apply this change to each of the strategies and sensitivities included. (Sensitivity 4 may no longer be required.)
2. Provide a new model run Scenario 1A that models “no new gas-fired generation.” This scenario would be defined as including no construction of new generating facilities that burn natural gas, and no new natural gas delivery infrastructure. Dual-fuel generators would be allowed (including peakers that could use trucked natural gas or diesel). The scenario would also allow fuel conversion of existing generators to burn natural gas, and the continued operation of and contracts for generation at EcoEléctrica. As with Scenario 1, the contracted conversion of San Juan 5 & 6 to ship-based natural gas shall be included as a fixed resource, in a consistent fashion to how it has been included in the other scenarios. Complete a “Nodal Run” and PSSE analysis of case S1AS2B.

B. *Scenario 2*

1. Incorporate model runs for Scenario 2 under Strategies 2 and 3, with Base, High, and Low load. Test the impacts of uncertainties by applying sensitivities 5 and 6 (with fixed resource plans derived from the S2S2 case with base load). Complete a “Nodal Run” and PSSE analysis of case S2S2B.

C. *Solar PV and Battery Storage Availability Limitations*

1. Re-run all Scenarios under the previously Ordered Solar and Battery Storage Availability limitations, modifying the limitations in place for solar PV and battery storage for the period 2019 to 2021, to reflect the following:
 - a. Document PREPA's calculation of the minimum amount of solar PV and battery energy storage that its models must allow to be deployed in 2019, 2020, and 2021 to comply with the Energy Bureau's November 9, 2018 Order. If the calculated amount of solar PV required to be compliant with the Energy Bureau's Order exceeds the limits set on solar PV or battery storage in any modeled scenario or sensitivity, PREPA shall re-run that scenario or sensitivity with solar PV amounts that are in compliance with the Energy Bureau's Order.

2. Provide a more detailed justification for the annual assumptions on the limitations of solar and battery deployment for each of years 2019, 2020, and 2021.
3. PREPA has provided no justification for its solar and battery limitations imposed for 2022 forward. PREPA must re-run all Scenarios to remove the solar PV and battery availability limitations for post-2022.

D. Consistent Treatment of Wind Costs and Wind Performance Parameters

1. Provide a detailed justification (including external references) for any cost adder utilized for wind and/or solar PV.
2. Utilize consistent cost and performance assumptions for both wind and solar PV in all model runs.
 - a. Re-run all Scenarios with consistent wind cost and wind performance parameters taken from the 2018 NREL ATB for wind resource group TRG-8, accounting for performance (*i.e.*, annual capacity factors) that aligns with the potential in-service date of the wind resource.
3. Provide full and clear documentation of the presumed wind and solar output profiles.

III. Additional Ordered Items

- A. Provide a more complete discussion regarding how the price of natural gas imported to Puerto Rico is (or is not) coupled with the cost of various U.S. markets, such as the Henry Hub natural gas price. PREPA should describe in detail how this relationship is reflected in the gas price projections used for its IRP analysis. This discussion should address, but not be limited to, the following questions: Does PREPA assume that Jones Act-compliant LNG ships will be available? Does PREPA assume that the price of LNG as a global commodity from sources other than the U.S. will be coupled with the Henry Hub price? If so, through what mechanisms would this coupling take place, and when? If not, what is an appropriate benchmark for non-U.S. LNG prices as delivered to Puerto Rico?
- B. Provide explanation as to why PREPA chose to model energy efficiency acquisition as stopping after 10 years, and discussion of what the impact of continued acquisition after that period would have on the IRP results.
- C. Provide a more careful assessment of offshore wind alternatives for inclusion as a resource offering in this IRP. Dramatic price reductions have been seen for recent offshore wind solicitations in the Northeast US, relative to prices seen for the first offshore wind farm in the US (COD 2016) and relative to prices in Europe for earlier installations.

Appendix B
Fully or Partially Incomplete Items Not Expressly Addressed in the Resolution and Order



Item	Citation	Regulation 9021 Requirement	Reference	Further Request
1	Section 2.02 (E)(2)	Source documents not publicly available or readily accessible are included electronically		Provide all sources (in electronic form if possible) used in the development of the load and fuel price forecasts that are not readily accessible (such as forecasts made by others including Moody's, FOMB, and fuel market sources).
2	Section 2.02 (E)(3)	Copies of relevant pages from studies, reports, books, or periodicals that are not readily accessible		Matlab regression model (discussed on page 3-2 of the IRP Main Report) has not been provided. In addition, the Matlab model used to develop stochastic load forecasts has not been provided. Provide these models along with all other workpapers, as required.
3	Section 2.02 (F)(1)(a)	Load Forecast Development workpapers	Files provided	Formulae have not been left intact as required by the rule. Provide the file with all formulae intact.
4	Section 2.02(F)(1)(b)	Fuel Price Forecast Development workpapers	Files provided	Provide a single index that lists each table and figure in the IRP and identifies which electronic file and worksheet it comes from.
5	Section 2.02(F)(1)(f)	Electronic, spreadsheet-based versions of all tables and figures	There does not appear to be a map of the IRP with the workpapers. For example, Exhibit 1-1 and Exhibit 3-1 of the IRP Main Report are not obviously marked or mapped.	Waiver request granted for analysis of prior forecasts. PREPA shall provide updates to Exhibits 3-9, 3-16, and 3-21 that supplement existing gross forecast data with information on net energy and demand forecasts. Net energy and demand are to reflect the effect of forecasted EE and DG that lowers the net load seen on the PREPA transmission grid. Workpapers and Appendix 4 contain this level of detail, but the main body of
6	Section 2.03(C)	Load forecast of future capacity and energy demand requirements and an analysis of prior forecasts	Ex. 1.0 IRP Main Report Part 3; Ex. 1.04 Appendix 4; Workpapers.	

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Item	Citation	Regulation 9021 Requirement	Reference	Further Request
				the IRP must include this information in amended Exhibits.
		Historic Peak Demand and Energy covering the ten-year period prior to the first year of the IRP period:		Provide historical total annual generation for PREPA system, to complement Exhibit 3-1.
7	Section 2.03(C)(1)(c)(i) and (ii)	The total annual electricity generation and sales for the utility and consumption for each customer class The coincident peak electricity demand for the utility and each customer class	Ex. 1.0 IRP Main Report Part 3	Provide as supplemental Exhibits or workpapers actual or estimated historical peak demand (MW) for the total system including losses, and by customer class, to complement the data shown in Exhibit 3-1, at least back to 2008. If historical peak losses are available by customer class, please provide. State if based on actual or estimated amounts; if estimated, describe the method used.
8	Section 2.03(C)(2)(g)	Considers the impacts of existing demand-side resources, anticipated changes to rate design, building codes and standards, deployment of distributed generation, and other important factors	Ex. 1.0 IRP Main Report Part 3 and Workpapers - load forecast	In reference to the updated Exhibits 3-9, 3-16, and 3-21 that address the effect of EE and DG on gross load, explain if any building code changes are built into the forecast.
9	Section 2.03(C)(2)(n)	Considers the impact of technical losses		Provide an estimate of how different levels of distributed generation could reduce overall loss levels, both in absolute (e.g., energy x baseline loss factor) and relative (e.g., reduced baseline loss factor) terms, explicitly including the potential for reduced losses for scenarios with more DG.
10	Section 2.03(D)(1)(b)	Existing Supply-Side Resource Table		Provide the single comprehensive table (or table by type of resource) with each sub-item required by the rule.
11	Section 2.03(D)(1)(b)(iii)	Annual capacity factor for each of the last five years	Provided in Ex. 1.05 Appendix 5, but not in Main Report	
12	Section 2.03(D)(1)(b)(vii)	Commercial operation date	Provided for CCGTs (page 4-5) and AES and EcoEléctrica (page 4-8), but not for STs, GTs, or Hydro. Provided in total in Ex. 1.05 Appendix 5.	

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Item	Citation	Regulation 9021 Requirement	Reference	Further Request
13	Section 2.03 (D)(1)(b)(viii)	Remaining service life	Not presented	Provide each of the required elements in a table or tables in Appendix 5.
14	Section 2.03(D)(1)(b)(xi)	Average annual heat rate over the last five years	Exhibit 4-1 of IRP Main Report provides heat rate at maximum capacity, but not the actual annual average heat rates	
15	Section 2.03 (D)(1)(b)(xi)	Current fuel cost in dollars per MMBtu	Ex. 1.0 Part 7 provides projections, with the 2018 values informed by actual prices, but no actual prices are provided	
16	Section 2.03 (D)(1)(b)(xvi)	Average annual capital expenditures over the last five years in total dollars		
17	Section 2.03(D)(1)(c)	Existing Supply-Side Resource Supplemental Data	Part of Ex. 1.05 Appendix 5	Provide each of the required elements in a table or tables in Appendix 5.
18	Section 2.03(D)(1)(c)(ii)	Expected retirement date for any resource expected to retire within the first ten years of the IRP period, and an explanation of the reason	Exhibit 10-5 of IRP Main Report has unit retirements under Action Plan, no explanation for why units are necessarily retired in Section 8.2.3.	
19	Section 2.03 (D)(1)(c)(iii)	Dates for renewal of operating licenses and permits		
20	Section 2.03(D)(1)(c)(iv)	Compliance schedule with current, proposed, and reasonably anticipated regulatory and legal requirements	Section 8.2.6 addresses some environmental compliance. There are not schedules provided.	
21	Section 2.03 (D)(1)(c)(v)	Expected capital and operating costs for compliance with current, proposed, and reasonably anticipated regulatory and legal requirements	Section 8.2.6 addresses environmental compliance. There are no schedules or compliance costs provided.	Provide each of the required elements in a table or tables in Appendix 5.
22	Section 2.03(D)(1)(c)(vi)	Expected yearly non-environmental capital expenditures for the first ten years of the IRP period	Section 8.2.2 provides capital expenditures for NEW generation assets through 2028, but there is no info	

Item	Citation	Regulation 9021 Requirement	Reference	Further Request
		Any important changes to the resources since the approval of the most recent IRP or expected to occur prior to the filing of a review, update or amendment IRP, including: A. A description of each large capital project (over \$5,000,000) expected in the next (5) years B. Changes in fuel types, or procurement sources or strategies C. Operational changes expected to result from economic restrictions or environmental regulations	about capital investment in EXISTING generation. Exhibit 10-8 of IRP Main Report contains some capital expenditures without explanation. Exhibit 6-12 of IRP Main Report contains some fuel conversion costs information. Section 4.2 of IRP Main Report addresses some environmental regulations	
<u>23</u>	Section 2.03(D)(1)(c)(vii)			
<u>24</u>	Section 2.03(D)(1)(c)(viii) and (F)(1)(b)(viii)	A description of how the resource contributes to meeting PREPA's requirement for "high efficiency" generation	PREPA has requested a waiver since there is no established definition for "high efficiency".	Provide a description of how existing and proposed resources meet (or don't meet) "high efficiency" definition requirements, as they exist in draft form (Commission Resolution, August 30, 2018, CEPR-MI-2016-0001).
<u>25</u>	Section 2.03(E)(1)	Planning Reserve Margin Assessment	Section 8.7 of IRP Main Report.	Provide further discussion to justify the selection of a 30% planning reserve margin.
<u>26</u>	Section 2.03(F)(1)(a)(vi)	Effective load carrying capacity	No discussion of peak coincidence or ELCC in Part 6 of IRP Main Report.	Add discussion of peak coincidence and ELCC of wind and solar resources. Account for locational variability in distribution peaks, such as commercial and industrial peaks that occur during daylight hours, as required.
<u>27</u>	Section 2.03(F)(2)	Projections by customer class	Ex. 1.04 Appendix 4 - DG	Provide estimate of DG by customer class. Provide estimate of loss reduction impacts of increased DG.

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Item	Citation	Regulation 9021 Requirement	Reference	Further Request
28	Section 2.03(F)(2)(b)	Inclusion as an expected reduction from baseline load forecasts	Ex. 1.0 IRP Main Report Part 3; Ex. 1.04 Appendix 4, Workpapers	Provide table of gross and net load including the effect of DG, as noted above for compliance with Section 2.03 (C) of Regulation 9021 as updates to Exhibits 3-9, 3-16, and 3-21.
29	Section 2.03(F)(4)(a)	Description of each storage option's anticipated use		For each resource scenario: describe storage use, and provide at least sampled modeled output (e.g., one 24-hour day) indicating what services it is providing in each hour. Provide hourly production cost output files for at least one full year at maximum storage penetration, for those runs where available.
30	Section 2.03(F)(4)(b) and sub-parts	Includes valuation framework for energy storage options Ancillary services, which may include avoidance of load shedding Load-shaping services Locational benefits	Waiver requested.	Provide a valuation framework that quantitatively assigns value to storage for all ancillary service provisions benefits. Also describe how Aurora treats these resources as part of the commitment and dispatch process. Provide at least example days for each scenario that shows charging / discharging patterns. Provide hourly output workpapers for storage resources from Aurora runs, for at least the top 5 NPV resource scenarios including S3S2, S3S3, and S5S1. Provide information on the load-shaping aspects of the storage resource. Provide information on the relative value of location for storage resource.
31	Section 2.03 (G)(1)(b) and (G)(2)(a)(vi)	Annual emission prices and emission costs	Ex. 1.0 IRP Main Report Section 4.2, but no sensitivity appears to use the prices shown	Describe how emission prices (for any pollutants) are used in the modeling. If they are not, provide a justification for why this requirement should be waived.
32	Section 2.03(G)(2)(a)(i)	Economic conditions	Ex. 1.0 IRP Main Report Exhibit 3-18.	Describe in detail how the economic forecasts impact the gross sales projections, and why the

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Item	Citation	Regulation 9021 Requirement	Reference	Further Request
				range selected (which appears to correspond to the 25th and 85th percentiles) is an appropriate choice.
<u>33</u>	Section 2.03(G)(2)(a)(iv)	Customer-sited distributed generation	Ex. 1.04 Appendix 4.	Provide a discussion of the range of possible outcomes for customer-sited DG and show how this range is reflected in the load forecasts used in IRP analysis.
<u>34</u>	Section 2.03(G)(2)(a)(v)	Fuel prices	Ex. 1.0 IRP Main Report Exhibit 7-13 et seq. present +/- 1 Std Dev.	Provide 5th and 95th percentile fuel prices and explain why PREPA chose to use either +/- 1 standard deviation or 5th and 95th percentile fuel prices for high and low fuel price sensitivities.
<u>35</u>	Section 2.03(G)(2)(a)(vii)	Capital costs	Ex. 1.0 IRP Main Report Exhibit 6-13.	Capital costs presented as point estimate. Provide a range of capital costs for capital projects included in the IRP analysis, including at least for each generation resource and large components of supporting infrastructure (such as fuel import facilities) and for the transmission and distribution system costs (in aggregate, if necessary).
<u>36</u>	Section 2.03(G)(2)(d)	Includes reference case scenario consisting of median probability outcomes	Ex. 1.0 IRP Main Report Parts 3, 4.2, and 7.	Explicitly identify the reference case for assumptions and forecasts of modeling parameters and describe how it reflects median probability outcomes.
<u>37</u>	Section 2.03(H)(1)(a)(i)	Documentation of resource plan development modeling mechanisms.	Ex. 1.0 IRP Main Report Part 8.	Part 8 provides the results of scenarios runs, but it does not provide a clear description of resource plan development tools and how they are employed. Provide a specific description of the way in which the Aurora LTCE was employed to produce scenario results. Include all of the key

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				<p>steps used and how input assumptions were incorporated.</p> <p>Provide comprehensive Excel workpapers that clearly include all input assumption parameters, "switches" selected by the user and justification for doing so, and critical algorithms employed to determine the LTCE result. This should include the model's technical parameters for end effects treatment, convergence of solutions, and related optimization engine parameters, as used in the Aurora input file setup. Please provide this for at least the top 10 least-cost plans and all related sensitivity runs, if not for all LTCE runs conducted.</p>
<u>38</u>	Section 2.03(H)(1)(a)(iii)	Table illustrating the key differences between resource plans	Ex. 1.0 IRP Main Report Part 8, Part 1.	<p>Provide three coherent tables, one for each of "base", "high", and "low" load scenario groupings, that reflect revisions of Exhibit 8-1 and/or Exhibit 1-1, combining the core parameters provided in these Exhibits. These tables must clearly show resource additions and year, retirements and years, NPV, gas infrastructure elements and their associated total costs and the PREPA-apportioned costs, other key parameters from Exhibit 8-1, and transmission and distribution spending and relative differences in T&D assumptions (if any) across each plan. Include for each table any additional sensitivity run results Ordered by the Energy Bureau, for the applicable load scenario case.</p>
<u>39</u>	Section 2.03(H)(1)(a)(v) and (H)(1)(b)(v)	a) v) Load and resource table for the preferred resource plan showing values year by year	Ex. 1.0 IRP Main Report Part 8, workpapers.	<p>Provide a single table in the IRP body and in an Excel workpaper showing peak load and resource summaries by year for the Preferred plan, including PREPA's net position (short or long on capacity) relative to expected needs and</p>

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Item	Citation	Regulation 9021 Requirement	Reference	Further Request
		b) v) A cash-flow table comprised of annual cost values for, at a minimum, fuel spending by type of fuel, generation capital, transmission capital, fuel infrastructure capital, total generating unit variable O&M, total generating unit fixed O&M, fuel infrastructure O&M, Co2, NOx, and SO2 emissions; fossil power purchase agreements; and renewable power purchase agreements.		confirm what planning reserve margin is used for "expected needs". Provide a summary cash flow table for the body of the IRP and as a worksheet, for the Preferred Resource Plan, and for at least the top 5 least-cost plans (base load scenario), including all elements identified in 2.03 H) 1) b) v). Produce and provide a worksheet "metrics" for the Preferred Resource plan, as a complement to the metrics files provided for all individual resource plans.
<u>40</u>	Section 2.03(H)(2)(b)(v)	These sensitivity analyses should inform the selection of the Preferred Resource Plan.		Provide a detailed description of how the results of the sensitivity analyses conducted, including the new sensitivity analyses specified in this Order, inform the selection of the Preferred Resource Plan.
<u>41</u>	Section 2.03(I)	The IRP shall include an annotated list of key caveats and limitations of its analysis, including the impact of uncertainty, the modeling mechanism, key regulatory and project execution assumptions, and costs. The purpose of this section is to illustrate PREPA's certainty with respect to the Preferred Resource Plan.	Ex. 1.0 IRP Main Report Part 9.	PREPA should amend this chapter to discuss relevant uncertainties in the capital and operating cost (including fuel cost) and performance of fossil fuel resources.
<u>42</u>	Section 2.03(J)(1)	Transmission and Distribution System Documentation	Ex. 1.01 Confidential Appendix 1, Section 3, Integrated Steady State Analysis. Section 4, Integrated System Stability Analysis.	Integrated system steady state and stability analyses are provided for some, but not all "low NPV" resource plans. Provide at least an integrated system steady state analysis of the two base load least-cost plans, S3S2B and S5S1B. If necessary, also provide an integrated system stability analysis of these plans.

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Item	Citation	Regulation 9021 Requirement	Reference	Further Request
43	Section 2.03(1)(a)	Existing Transmission Facilities Descriptions- The IRP shall include a brief narrative description of the existing electric transmission system and identify any transmission constraints and critical contingencies. The information shall include at a minimum:	Ex. 1.0 IRP Main Report Part 1, page 1-7; Part 10, page 10-10; Ex. 1.01 Confidential Appendix 1. Minigrid detail and suggested improvements are listed, but no overview per the Regulation 9021 is provided.	Provide a narrative description of the transmission system, including a description of the main transmission constraints, if any, and the critical contingencies.
44	Section 2.03(1)(a)(i)	A summary of the characteristics of all existing transmission and subtransmission facilities of thirty- eight kilovolts (38 kV) or higher;	Ex. 1.01 Confidential Appendix 1. No high-level summaries are provided. Minigrid discussions and recommended improvements are provided without any summary background documentation.	Provide a summary of the transmission and sub-transmission system characteristics.
45	Section 2.03(1)(a)(ii)	A discussion of whether the transmission system constrains the transfer of electricity from existing projects, potential new projects, or projects under development or consideration, including a description of its ability to interconnect intermittent renewable generation projects and microgrids, as applicable, and with as much specificity as practical;	Ex. 1.01 Confidential Appendix 1. Ex. 1.0 IRP Main Report Chapter 8. Waiver request.	Specify formally whether or not the system constrains potential new projects for interconnection; and generally describe what limitations may exist, if any. As noted in the Rule, provide as much specificity as is practical. If the primary concern associated with the waiver request pertains to transmission required directly for interconnection to a resource from the grid, specify this, including the extent to which this is a broad concern or just a concern associated with the normal course of interconnection activity required to connect a new resource.

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Item	Citation	Regulation 9021 Requirement	Reference	Further Request
46	Section 2.030(1)(a)(iii) and (iv)	<p>iii. A schematic map of the transmission and subtransmission network showing transfer limits, which shall be treated as critical energy infrastructure information and handled in accordance with the procedures set forth in CEPR-MI-2016-0009 as currently amended and may be amended from time to time; and</p> <p>iv. A map showing the actual, physical routing of the transmission and subtransmission lines, geographic landmarks, major metropolitan areas, and the location of substations and generating plants, and interconnections with distribution substations. The map shall be treated as critical energy infrastructure information and handled in accordance with the procedures set forth in CEPR-MI-2016-0009 as currently amended and may be amended from time to time. The IRP shall include two copies of this map on a 1:250,000 scale</p>	<p>Ex 1.01 Confidential Appendix 1, Appendices F and G.</p> <p>Waiver request for (iii).</p>	<p>Provide PREB with 2 hard copies of the complete schematic map.</p> <p>Provide PREB with 2 hard copies of the complete transmission map.</p> <p>Provide a separate copy of the complete schematic map with annotations on transfer limits, if any, or a summary table of limits, if any, with a clear mapping to the critical circuits on the schematic diagram.</p>
47	Section 2.030(1)(b)	<p>Existing Description</p> <p>Distribution</p> <p>Facilities</p> <p>The IRP shall include a brief narrative description of the distribution system, including description of its ability to accommodate incremental penetration of distributed generation, including intermittent distributed generation, and its ability to receive new loads over time, such as, for example, increasing penetrations of electric vehicles. In</p>	<p>Ex 1.01 Confidential Appendix 1, Section 5. Ex. 1.04 Appendix 4, DG section.</p> <p>Waiver request.</p>	<p>Provide a narrative description of the current distribution system, with inclusion of core parameters (e.g., # and size of feeders, range of loading on feeders, etc.), summary statistics, and underlying basic design criteria.</p> <p>Summarize current status of distribution system repair post-hurricanes.</p> <p>Provide at least a high-level summary beyond the material provided in the minigrid design sections that describes at least in broad terms</p>



Item	Citation	Regulation 9021 Requirement	Reference	Further Request
		<p>addition, the IRP shall provide PREPA's current distribution system design criteria. Information of PREPA's current distribution system shall include: ...</p>		<p>the ability of the distribution system to absorb a fraction of the overall expected solar PV, potentially beyond the distribution-connected DG assumed in the modeling runs. Provide rough timetables (next five years) of what distribution system investment could be required to absorb increasing amounts of DG, and/or provide a clear direction as to where in the IRP filing this information can be gleaned.</p> <p>Provide any summary information PREPA has on the overall thermal or voltage concerns that exist across the distribution system, without having to rely on a comprehensive load flow analysis of a large set of feeders.</p>
48	Section 2.03(j)(1)(c)	<p>Existing Advanced Grid Technologies Description- The IRP shall identify the areas within the service territory where advanced meters and other advanced grid technologies have been installed, along with any plans to expand the integration of any such technologies into its system. The IRP shall include a brief description of the installed advanced grid technologies.</p>	Waiver request.	<p>Provide any summary information available on the pilot programs that resulted in some smart meter installations across the island. Provide further information on other advanced technologies in place or under consideration, such as transmission and distribution system technologies.</p>
49	<p>Section 2.03(j)(1)(d) and (j)(1)(d)(vi)</p>	<p>The IRP shall provide a detailed narrative description of any planned electric transmission and subtransmission facilities, and a description of the plans for development of facilities during the next ten years of the Planning Period. The description shall include, at a minimum, all information regarding: ...</p> <p>PREPA shall submit a justification of its transmission development plans, including: ...</p>	<p>Ex. 1.01 Confidential Appendix 1.</p>	<p>Provide a summary description, with detailed metrics/parameters as available, on any planned transmission separate from that described for the minigrids. Provide a summary overview of current status of planned "hardening" projects. Differentiate between what would or is required based on current planning, and that which is proposed under minigrad planning constructs.</p>

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Item	Citation	Regulation 9021 Requirement	Reference	Further Request
<u>50</u>	Section 2.0300(1)(d)(ix)	A high-level analysis of PREPA's transmission system's ability to permit power interchange with microgrids and other independent power producers. PREPA should provide examples of interconnection studies from recent renewable integration projects.	Waiver request.	As already indicated in "Existing Transmission Facilities Description", provide a narrative description of the transmission system, including a description of the main transmission constraints, if any, and the critical contingencies, adding any new information required if non-minigrid transmission is planned as part of the Preferred Resource plan.
<u>51</u>	Section 2.0300(1)(d)(x)	A diagram showing PREPA's import and export transfer capabilities and identifying the limiting element(s) during each season of the next ten years. In addition, PREPA will provide a listing of transmission loading relief (TLR) procedures called during the last two seasons for which actual data are available. For each TLR event, the listing shall include the maximum level, and the duration at the maximum level, and the magnitude (in MW) of the power curtailments.	Waiver request.	Provide at least high-level information on the transmission schematic diagram already included indicating any limitations, if applicable. Indicate via MW or MVA limitations associated with a defined "cut plane" or other similar transfer path line grouping. No TLR information is required.

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Item	Citation	Regulation 9021 Requirement	Reference	Further Request
<u>52</u>	Section 2.03(1)(1)(e)	The IRP shall provide a detailed narrative description of any planned changes in approach, standard practice, or broadly applicable substation, circuit, or feeder design for PREPA's distribution system for the next ten years. This description shall address any changes in distribution facilities that impact the ability to accommodate incremental penetration of distributed generation, including intermittent distributed generation, and the ability to receive new loads over time. PREPA shall submit a substantiation of distribution development plans, including, if available: ...	Ex. 1.01 Confidential Appendix 1, Ex. 1.04 Appendix 4. Waiver requested	Provide at least a high-level description of plans for distribution system repair, how DG deployment and required distribution system investment will be coordinated with such repairs, and any related direct or conceptual plans for distribution system grid modernization.
<u>53</u>	Section 2.03(1)(2)(a)	The IRP shall identify PREPA's transmission standards and shall confirm that the PREPA transmission standards are in compliance with the standards of the North American Electric Reliability Corporation. If any of PREPA's transmission standards are inconsistent with standards from the North American Electric Reliability Corporation, then PREPA shall identify each such inconsistent standard and provide the explanation and rationale for the inconsistency.	The filed IRP does not mention NERC or compare PREPA's transmission planning standards with NERC standards. Waiver requested	Regulation 9021 requires that PREPA identify what transmission planning standards it abides by, and whether they are the same as the NERC standards.

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Item	Citation	Regulation 9021 Requirement	Reference	Further Request
54	Section 2.03(j)(2)(c)	The IRP shall identify thermal and voltage reliability issues in PREPA's transmission system and distribution systems. Such information shall be treated as critical energy infrastructure information and handled in accordance with the procedures set forth in CEPR-MI-2016-0009 as currently amended and may be amended from time to time;		PREPA must indicate where the Transmission Report provides the requested information for the transmission system. PREPA must also provide, at least at a high level, an identification (Regulation 9021 section states "identity") of at least the major thermal and voltage reliability "issues" across the distribution grid similar to the discussion of Section 2.03 (j)(1)(b)(i). PREPA need not identify, by location, each and every concern on the distribution grid - instead Regulation 9021 requires that the "issues" be identified.
55	Section 2.03(j)(2)(e)	The IRP shall document the transmission and distribution implications of the Preferred Resource Plan, including assessing if the plan requires incremental transmission or distribution mitigation or changes.	Ex. 1.01 Confidential Appendix 1, Ex. 1.0 IRP Main Report Chapter 8.	1. Provide, separate from minigrid investment plans, a description and tabular summary of transmission and distribution investment requirements to support resource plans in the event of a Preferred Plan that does not include the minigrid construct as envisioned. 2. Provide a discussion including, as feasible, quantitative indications of differences in transmission and investment associated with a minigrid approach under the different resource plans considered. Confirm (or explain otherwise) that there is no differentiation in costs for the minigrid approach across different resource plans. As applicable, explain why there is no differentiation in potential costs of an optimized minigrid approach across different resource plans. 3. Describe exactly how, if applicable, an optimization of the total costs associated with supply resource deployment, and transmission/sub-transmission resource deployment, was undertaken. If no such optimization was undertaken, explain why not.

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Item	Citation	Regulation 9021 Requirement	Reference	Further Request
				 <p>given the considerable reliance on the minigríd approach and the total investment costs associated with that approach.</p>
56	Section 2.03(K)(1)	<p>Action Plan Documentation- The Action Plan shall include a table of key actions in the first five years after approval of the IRP including, at a minimum, expected procurement processes for supply-side resources and energy efficiency, permitting requirements, construction activities, required studies, and other significant events. The Action Plan shall cover intended acquisitions of demand-side, supply-side, transmission, distribution, and/or fuel infrastructure resources; retirements and/or retrofits of existing generating resources; entrance into, renegotiation or cessation of power purchase agreements; and any other resource commitments.</p>	Ex. 1.0 IRP Main Report Part 10; Exhibit 10-7.	<p>Revise Exhibit 10-7 to include all key actions that comprise the Action Plan. For example, the EcoEléctrica contract renegotiation and the provision of energy efficiency are currently excluded. The table itself should also either i) include specific cost data for the major expected resource acquisitions, and the specific financing plan for that cost as a separate descriptive field; or ii) be directly consistent with the information contained in Exhibit 10-8. If the costs for any key action are different than the capital expenditures listed in Exhibit 10-8, those total costs must also be listed and described. In particular, land and ship-based LNG infrastructure capital expenditures are listed as zero in Exhibit 10-8, while non-zero capital costs for this infrastructure is described in the text. The table or tables must clearly include the total cost for all fuel infrastructure, and the portion of such costs PREPA is assigning to the key action, especially for all LNG infrastructure, and must also include a clear description of the financing plan or arrangements for each major action. Identify any potential costs or financial costs associated with the 2025 resource delivery dates that will be incurred thru 2023. The financing plan must make clear in which years costs will be seen and expected to be borne by ratepayers.</p> <p>The key actions associated with transmission and distribution and minigríd investments must</p>

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Item	Citation	Regulation 9021 Requirement	Reference	Further Request
				be clearly listed in one new table that combines and fully reconciles the costs currently listed in Exhibits 10-9, 10-11, 10-13, and 10-21, with total costs for each major action and the financing plan for each listed and described. To the extent PREPA is expecting some of the costs to be borne directly by ratepayers, and other costs to be borne through FEMA grants or the equivalent, PREPA must list this for each T&D and mini-grid key action. PREPA must also indicate, at least at a high level, for each key action, if and/or how the listed costs might change across different possible final Preferred Resource plans.
57	Section 2.03(K)(2)(a)	The Action Plan shall be based on the Preferred Resource Plan described in subsection (H)(2)(d) above.	Ex. 1.0 IRP Main Report Part 10.	Provide a table that identifies each key action of the Action Plan, as listed in the revised Exhibit 10-7, with the analyzed scenario (such as the ESM plan or SAS2 case) that supports inclusion of that key action.
58	Section 2.03(K)(2)(d)	The Action Plan shall comply with all laws and regulations enacted that address requirements for demand-side resources and supply-side resources, including but not limited to Act 82-2010.	Ex. 1.0 IRP Main Report Part 10.	If not already provided in the new entry for energy efficiency in revised Exhibit 10-7, provide the missing portion of the Action Plan relating to demand-side resources.
59	Section 2.03(N)	Demand-Side Resources Status Update- The IRP shall include an assessment of new and contracted demand-side energy and capacity projects, including energy efficiency, demand-response, distributed generation, and load control programs. This update shall be comprised of an itemized list of each new demand-side resource program under contract but not yet implemented or built at the time of the IRP filing.	Ex. 1.04 Appendix 4 Waiver request.	Demand side resources include distributed generation in addition to energy efficiency and demand response. Provide an assessment of the demand-side resources currently available to PREPA. PREPA must confirm, or explain otherwise, if the distributed generation assessment contained in Appendix 4 represents the entirety of its DG assessment included in this IRP.
60	Section 2.06	The IRP shall include a certification regarding PREPA's compliance with the	No certification has been supplied.	Provide the required certification. In the event that PREPA has not consulted with the Energy

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Item	Citation	Regulation 9021 Requirement	Reference	Further Request
		requirements of Section 6B (h) (vi) of Act 83.		Policy Office as required, PREPA shall undertake the required consultation and report on any resulting changes to the IRP.

