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 Regarding topics discussed at April 1, 2019 Technical Conference and PREPA's Clarification Questions.

RESOLUTION AND ORDER

I. Introduction and Procedural Background

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

On February 15, 2019, the Energy Bureau issued a Resolution and Order taking notice of PREPA's February 13, 2019 filing of its proposed IRP, and the motion for limited waivers of filing requirements.[2] The Energy Bureau also ordered all non-confidential and redacted documents related to PREPA's IRP filing to be published on the Energy Bureau's website.[3]

On March 14, 2019, the Energy Bureau issued a Resolution and Order ("March 14 Resolution and Order") pursuant to the provisions of Section 3.02(A) of Regulation 9021[4], regarding the completeness of PREPA's IRP, PREPA's request for confidential treatment of portions of the IRP, and the multiple waivers PREPA requested.[5] As part of the March 14 Resolution and Order, the Energy Bureau ordered PREPA to, within thirty (30) days from the

[1] *See PREPA's Petition and Informative Motion Regarding its Accompanying Integrated Resource Plan Filing* ("IRP Filing"), February 13, 2019, Case No. CEPR-AP-2018-0001.

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

[3] *Id.* at 2.

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

[5] *See* Resolution and Order, 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, March 14, 2019, Case No. CEPR-AP-2018-0001.

issuance of said Resolution and Order, refile its IRP to correct the identified deficiencies as outlined by the Energy Bureau. PREPA was given the option to request, within ten (10) days of the issuance of the Resolution and Order, additional time to comply.[6] Furthermore, the Energy Bureau ordered PREPA to, on or before March 25, 2019, file any clarification questions regarding the March 14 Resolution and Order, and to attend a Technical Conference Call on April 1, 2019.[7]

On March 26, 2019, PREPA filed a document titled *PREPA's Clarification Questions and Motions Regarding Schedule*.[8] PREPA's filing included: "(1) PREPA's clarification questions regarding the Energy Bureau's Resolution and Order issued on March 14, 2019; (2) PREPA's motion that the Energy Bureau and its consultants expedite the process for answering PREPA's clarification questions, if reasonably possible; and, (3) that the Energy Bureau revise the schedule for PREPA's compliance filing under the March 14th order, to allow PREPA to propose a new deadline after it has received answers to all of the clarification questions, and, as an interim measure, to set the due date as no earlier than 35 calendar days from the date on which it has received answers to all of the questions."[9]

On April 1, 2019, the Energy Bureau held a Technical Conference Call ("April 1 Technical Conference Call") with the purpose of clarifying any questions from PREPA regarding the March 14 Resolution and Order.

II. Clarification of Requirements of the March 14 Resolution and Order

Through this Resolution and Order, the Energy Bureau sets out the explicit set of requirements for modeling renewable resources and defining scenarios in a manner consistent with the March 14 Resolution and Order. Furthermore, on Appendix A of this Resolution and Order, the Energy Bureau addresses PREPA's clarification questions as filed on March 26, 2019, and as discussed during the April 1 Technical Conference Call.

A. Requirements for all modeling runs

There are certain areas, specified below, that PREPA must address in its modeling runs to provide clarifying information to the Energy Bureau.

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[6] *Id.* at 19.

[7] *Id.*

[8] *See PREPA's Clarification Questions and Motions Regarding Schedule,* March 25, 2019, Case No. CEPR-AP-2018-0001.

[9] *Id.*

1. Modeling of wind resources

In the April 1 Technical Conference Call, PREPA, through its outside consultant, Siemens, stated that the Long-Term Capacity Expansion ("LTCE") model uses wind resources and profiles derived from PREPA's Renewable Integration Study.[10] PREPA also stated that, even with capacity factors consistent with the National Renewable Energy Laboratory ("NREL") Advanced Technology Baseline ("ATB"), wind remains more expensive than solar on a levelized cost of energy ("LCOE") basis in each case, and therefore it is not expected that the LTCE will select wind resources. After PREPA's clarification, it remains unclear whether PREPA modeled wind, or screened it out based on LCOE, in its filed IRP.

Regulation 9021 requires that resource selection be conducted by a LTCE model unless use of some other approach is justified to the Energy Bureau's satisfaction. The Energy Bureau is not convinced that an LCOE screening approach justifies exclusion of onshore wind from the LTCE model runs.

Therefore, the Energy Bureau **ORDERS** PREPA to include onshore wind in all LTCE model runs conducted for the re-filed IRP, in accordance with the conditions established herein. PREPA shall use the best available information regarding wind generators' projected performance, including temporal load shapes based on Puerto Rico's low wind regime resource, in characterizing and modeling the resource. PREPA must describe (including temporal detail) how the modeled performance parameters reflect the NREL ATB TRG-8 patterns and must explicitly state the extent to which the modeling presumes (or does not presume) Santa Isabel wind farm historic diurnal and seasonal output profiles as representative of the performance of projected new onshore wind resources. PREPA must include diurnal and seasonal output profiles used for the wind resource offered to the model. PREPA must also state how onshore wind capacity contribution during peak evening periods is considered in the resource selection process, including the level of capacity contribution (as a percentage of nameplate capacity) assigned to such resource, if or as applicable.

2. Renewable Requirements

Senate Bill 1121 ("SB 1121")[11] outlines the public energy policy including the objective to reduce, and then eliminate, the use of fossil fuels for the generation of energy, through the integration of renewable energy.[12] For this purpose, the aforementioned bill establishes a Renewable Energy Portfolio of a minimum of twenty percent (20%) renewable energy resources by or before 2022; forty percent(40%) by or before 2025; sixty percent (60%) by or before 2040; and one hundred percent (100%) by or before 2050.

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[10] PREPA Renewable Generation Integration Study, February 14, 2014.

[11] Proposed Bill for the Public Energy Policy Act of Puerto Rico.

[12] Senate Bill 1121, Article 1.6(7).

It is imperative that the IRP conform to the current policy at the time of submission to the Energy Bureau. In light that SB 1121 will be signed by the Governor, the coming week, PREPA shall make the necessary adjustments to the IRP in order for it to represent the appropriate levels of renewable energy generation to comply with the percentages necessary to meet the Renewable Energy Portfolio Standards as set forth in SB 1121.

As a result, the Energy Bureau **ORDERS** PREPA to require in its refiled IRP that the considered scenarios meet the Renewable Energy Portfolio standards set forth in SB 1121, namely: a minimum of twenty percent (20%) renewable energy resources by or before 2022; forty percent(40%) by or before 2025; sixty percent (60%) by or before 2040; and one hundred percent (100%) by or before 2050.[13] PREPA shall model compliance with these standards in expected generation, assuming typical weather, such that resources are operational at the start of the year in which each target is established. PREPA shall ensure that the renewable percentage rises smoothly during the periods between target years and avoids spikes immediately preceding each target. (Strict linear transitions between the set dates are not required, if other smooth trajectories would be lower cost.) Furthermore, in light of the one hundred percent (100%) renewable standard for 2050, PREPA shall model any non-renewable generator as being fully depreciated and ready for retirement without stranded costs by or before 2050.

3. High efficiency generation

In *PREPA's Motion for Limited Waivers of Filing Requirements Under Regulation No. 9021* accompanying its proposed IRP, PREPA requested a waiver from the Regulation 9021 requirement that PREPA describe how each supply-side resource contributes to meeting the requirement for "high efficiency" generation because the Energy Bureau had not yet defined "high efficiency" generation.[14] Specifically, Sections 2.03(D)(1)(c)(viii) and (F)(1)(b)(viii) of Regulation 9021, require a "description, with quantitative information and analysis as required, of how the resource contributes to meeting the requirement for 'high efficiency' generation, as that term is defined by the [Energy Bureau] in accordance with Section 6.29(a) of Act 57."[15]

In response to this request, the Energy Bureau required PREPA to provide a description of how existing and proposed resources meet, or do not meet, "high efficiency" definition requirements, as they existed in draft form.[16]

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[13] *Id.*, Article 4.2.

[14] *See PREPA's Motion for Limited Waivers of Filing Requirements Under Regulation No. 9021*, February 13, 2019, p. 3-4, Case No. CEPR-AP-2018-0001.

[15] *Regulation on Integrated Resource Plan for the Puerto Rico Electric Power Authority*, Regulation No. 9021, April 14, 2018.

[16] *See* Resolution and Order, 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

On March 20, 2019, the Energy Bureau issued a Resolution adopting the definition of the term "Highly Efficient Fossil Generation."[17] The Energy Bureau's definition states that a generation unit is considered "Highly Efficient" if it meets two requirements: (1) "The yearly unit total cost of generating electricity cannot exceed $100/MWh . . . ;" and (2) "The average annual rate of carbon dioxide emissions from the generating unit, as measured in pounds per megawatt-hour (lbs/MWh), is lower than the United States national average for plants with the same primary fuel type. . . ."[18]

Given the aforementioned adoption of the "Highly Efficient Fossil Generation" term, the Energy Bureau **ORDERS** PREPA to use said definition in its description of how existing and new supply-side resources meet the "high efficiency" generation requirements as set forth in Sections 2.03(D)(1)(c)(viii) and (F)(1)(b)(viii) of Regulation 9021.

4. Definition of Scenario 1

During the April 1 Technical Conference, PREPA provided further detail regarding the options for modeling cases in which additional natural gas generation and fuel infrastructure is limited. The relevant resources are primarily located in the San Juan area (where gas could be modeled as not available, as available via a ship-based resource for San Juan Units 5 and 6, or available in larger quantities via a land-based resource) and in the South (where gas could either be restricted to the existing EcoEléctrica and/or Costa Sur 5&6 plants or be allowed to power a new combined cycle facility). The Energy Bureau has identified four cases that represent the spectrum of potential limitations and facilities, spanning Scenario 1 and Scenario 2. These four cases are:

1) Scenario 1: Ship-based gas available to power San Juan 5 and 6; no new plant in the South

2) Scenario 1, low gas availability sensitivity: No conversion of San Juan 5 and 6; no new plant in the South

3) Scenario 2: Land-based LNG in the North; model may select any resource in the South; and

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Plan, and Requested Waivers, Appendix B, item 24, March 14, 2019, Case No. CEPR-AP-2018-0001, *citing* Resolution, August 30, 2018, Case No. CEPR-MI-2016-0001.

[17] *See* Resolution adopting the definition of Highly Efficient Fossil Generation, March 20, 2019, Case No. CEPR-MI-2016-0001.

[18] *Id.* at 6.

4) Scenario 2, sensitivity 4:[19] Ship-based LNG in the North; model may select any resource in the South.

Modeling these four cases would provide the relevant information that the Energy Bureau was seeking from items II.A.1 and II.A.2 of Appendix A to its March 14 Resolution and Order. Therefore, the Energy Bureau **ORDERS** PREPA to model the four cases described above, combined with Strategies as described in Section III (B) of this Resolution and Order.

B. Minimal set of cases and LTCE model runs

In this section, the Energy Bureau develops, and orders, a minimal set of required cases to be modeled. PREPA may model additional cases, but this set is required to present sufficient information regarding the options facing the island and PREPA. In the following discussion, the Energy Bureau uses the nomenclature for "scenarios", "strategies", and "sensitivities" as described previously in the March 14 Resolution and Order.[20]

1. LTCE runs

The Energy Bureau requires the inclusion of the four scenarios that have some resource restrictions, Scenarios 1 through 4, in the two strategies that reflect the minigrid formulation (Strategies 2 and 3), and all in the case of the "base" load forecast, specifically:

S1S3B, S2S3B, S3S3B, S4S3B, S1S2B, S2S2B, S3S2B, S4S2B.

PREPA is required to model high and low load forecast results only in the case of the lower cost Strategy for each Scenario. That is, if S2S2B is lower cost than S2S3B, PREPA would model S2S2H and S2S2L, but need not model the different load trajectories for S2S3. This eliminates the need to model cases that are unlikely to be selected for further examination because they are higher cost.

Strategy 1, which allows resources of any size and does not require meeting supply requirements in each minigrid area, must also be modeled. For this strategy, PREPA must models Scenarios 1, 2, 4 and 5. It is not required to model Scenario 3 (high availability and low cost of solar and storage) in the context of this Strategy. This adds S1S1B, S2S1B, S3S1B, and S4S1B, which complete the set of cases required without sensitivities. The Energy Bureau will not require modeling of high or low load sensitivities for a determination of completeness but may require these results later through an information requirement or access to the modeling software.

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[19] See definition of Sensitivity 4, PREPA Ex. 1.0 IRP Main Report, p. 5-6, February 13, 2019, Case No. CEPR-AP-2018-0001.

[20] *See* Resolution and Order, 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, Section V, March 14, 2019, Case No. CEPR-AP-2018-0001.

The Energy Bureau further requires adding two sensitivity cases that require the LTCE. These are the cases discussed above regarding access to natural gas and new gas generation limitations. The first is a sensitivity case to S1S3B or S1S2B (whichever is lower cost) without the conversion of San Juan 5 & 6 to ship-based LNG. This sensitivity will be labeled as Sensitivity 7, so this is S1S3S7B or S1S2S7B. This sensitivity will allow a direct comparison with its base case to determine the standalone impact of the San Juan 5 & 6 conversion. The second sensitivity is to apply Sensitivity 4 (ship-based rather than land-based LNG in the San Juan area) to S2S2B or S2S3B (whichever is lower cost).

Additionally, PREPA must apply Sensitivity 3 (allow economic retirement of AES and EcoEléctrica outside of the contract timeline) to any relevant case that PREPA proposes to use as the foundation or a component of its Preferred Resource Plan.

PREPA may run further LTCE cases and sensitivities at its discretion. If PREPA decides to retain the "Energy System Modernization Plan" and comply with the requirements regarding this plan as set forth on the March 14 Resolution and Order,[21] it must run at least base, high, and low load cases.

2. Non-LTCE sensitivities

The Energy Bureau has identified fourteen (14) required sensitivity cases that do not depend upon additional LTCE runs. These are cost sensitivities on the runs already described above, but reflecting higher or lower costs of solar, storage, or natural gas. Nine of these simply change the capital cost of solar and storage and can be done with only post-processing of the model results.

Sensitivity 6 (higher renewable energy prices) must be applied to Scenarios 1, 2, and 4, paired with their lower cost Strategies (either Strategy 2 or Strategy 3), as well as S5S1S6B.

Scenario 3 must be analyzed using the base case renewables prices (which are higher than the prices used for Scenario 3), paired with its lower cost Strategy (either 2 or 3); which will be referred to as Sensitivity 8.

The Energy Bureau requires four additional cases with lower renewables prices (defined as those prices used for Sensitivity 1 and Scenario 3). These are Scenarios 1, 2, and 4, paired with their lower cost Strategies (either Strategy 2 or Strategy 3), as well as S5S1S1B.

Five sensitivity runs would require additional modeling, but not capacity expansion. Instead, these high natural gas price cases (Sensitivity 5) must re-run the dispatch model with higher gas prices but retain the capacity expansion derived for each in the base natural gas forecast cases. Four of these are Scenarios 1, 2, 3, and 4, again paired with their lower cost Strategies (either Strategy 2 or Strategy 3). Finally, the fifth would be S5S1S5B.

[21] *Id.* pp. 11-12.

3. Summary of required model runs

To summarize, with assuming that the lower cost Strategy in each case is Strategy 2, the full list of cases to be provided by PREPA would be as follows (recall that many of these cases would switch to Strategy 3 if that is lower cost at base load levels):

LTCE runs:

1) Distributed and mixed minigrid cases: S1S3B, S2S3B, S3S3B, S4S3B, S1S2B, S2S2B, S3S2B, S4S2B.

2) High and low load: S1S2H, S1S2L, S2S2H, S2S2L, S3S2H, S3S2L, S4S2H, S4S2L.

3) Central system cases: S1S1B, S2S1B, S4S1B, S5S1B.

4) Gas access sensitivities: S1S2S7B; S2S2S4B.

5) Sensitivity 3, if it would be relevant, to any case that forms the basis of the Preferred Resource Plan or Action Plan.

Sensitivities without LTCE runs:

1) High renewable prices: S1S2S6B, S2S2S6B, S4S2S6B, S5S1S6B.

2) Base renewable prices: S3S2S8B.

3) Low renewable prices: S1S2S1B, S2S2S1B, S4S2S1B, S5S1S1B.

4) High gas prices (re-dispatched): S1S2S5B, S2S2S5B, S3S2S5B, S4S2S5B, S5S1S5B.

Additional LTCE Runs – at PREPA's discretion:

1) ESM base, high, and low load – if retained as option and justified.

2) Any additional LTCE or non-LTCE sensitivity runs.

III. Conclusion

This Resolution and Order shall serve to clarify the March 14 Resolution and Order for the preparation of PREPA's IRP refiling. Based on the above, and on PREPA's request to revise the schedule for PREPA to refile its proposed IRP, the Energy Bureau **ORDERS** PREPA to refile its proposed IRP within thirty five (35) days of the issuance of this Resolution and Order.

For the benefit of all parties involved, the Energy 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.

Be it notified and published.

Edison Avilés Deliz
Chairman

Ángel R. Rivera de la Cruz
Associate Commissioner

Lillian Mateo Santos
Associate Commissioner

Ferdinand A. Ramos Soegaard
Associate Commissioner

CERTIFICATION

I hereby certify that the majority of the members of the Puerto Rico Energy Bureau has so agreed on April 5, 2019 and on this date a copy of this Order was notified by electronic mail to the following: j-morales@aeepr.com, n-vazquez@aeepr.com, c-aquino@aeepr.com, and n-ayala@eepr.com. I also certify that today, April 5, 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. Vazquez Rodriguez; 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, April 5, 2019.

María del Mar Cintrón Alvarado
Clerk

Appendix A
Answers to PREPA's Clarification Questions

Item	Energy Bureau Request	PREPA Question	Response
App. A, Items I.A.3.a through I.A.3.f	• S4FCS2B. Provide a re-run of the original S4S2B scenario changing the LNG infrastructure cost parameter. • S4FCS3B. Provide a re-run of the original S4S3B scenario changing the LNG infrastructure cost parameter. • S3FCS2B. Provide a re-run of the original S3S2B scenario changing the LNG infrastructure cost parameter. • S3FCS3B. Provide a re-run of the original S3S3B scenario changing the LNG infrastructure cost parameter. • S5FCS1B. Provide a re-run of the original S5S1B scenario changing the LNG infrastructure cost parameter. • S5FCS1S5B. Provide a re-run of the original S5S1S5B scenario changing the LNG infrastructure cost parameter.	• Background: The order correctly notes that the referenced analyses involve the costs of particular San Juan land-based LNG Infrastructure being apportioned in a manner such that the associated resources bear only their respective portion of the total terminal costs. This approach reflected a reasonable assumption that the terminal, to the extent that it had import capacity in excess of that required for the associated resources, could sell excess capacity to other purchasers, and, thus, the costs would be borne by other purchasers as well as by the associated resources. • Background: When PREPA and its outside expert IRP consultants, Siemens, were development this component of the IRP analysis, they did not know, in advance, the results that the relevant LTCE runs would yield in terms of what would be the associated resources and, thus, what would be the aggregate LNG needs of the resources. • **Question:** Now that PREPA and Siemens have the results of the relevant LTCE runs under the IRP, which require less LNG capacity than the LNG infrastructure that was modeled in the IRP, would the Energy Bureau accept as compliance with these March 14th order items an	Yes, the proposed approach is acceptable.

Item	Energy Bureau Request	PREPA Question	Response
		approach under which PREPA and Siemens would "right-size" the LNG infrastructure, use a cost figure for that reduced size, and fully allocate the new cost figure to the associated resources in the six new LTCE runs required by these items?	
App. A, Items I.A.3.g through I.A.3.l	• 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. • 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. • 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. • 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	• **Question:** May PREPA combine these six LTCE runs with the six LTCE runs called for by Items I.A.3.a through I.A.3.f? That would cut in half the number of new LTCE runs required by these two sets of items, which are required for RPS compliance in 2019-2021 and the request from the Energy Bureau to include improved wind performance consistent with NREL assumptions. A preliminary evaluation by the Siemens team of the levelized cost of energy (LCOE) for onshore wind vs. solar PV (using NREL's higher Capacity factors for wind) shows that solar PV is still more economical. We expect the model to pick wind over solar, even under Scenario 3. The preliminary findings can be provided to the Energy Bureau prior to the Technical Conference Call.	Yes. See the main text of this Resolution and Order for a discussion of a minimal satisfactory set of cases to model with the LTCE.

Item	Energy Bureau Request	PREPA Question	Response
	parameters (2019-2021), and the wind performance parameters. • 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. • 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.		
App. A, Items I.A.3.g through I.A.3.l	• 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. • 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. • S3FCS2B_Renew. Provide a re-run of the original S3S2B scenario changing the LNG infrastructure	• The Energy Bureau correctly points out that by 2021 none of the plans with the exception of Scenario 3 achieve 15% compliance. However, PREPA would like to point out that in the November 8th order the Energy Bureau indicated that RPS compliance must be achieved by the end of 2021. Considering that the LTCE's would add 600 MW to be in service by January 1, 2022, and that the 2021 resources are in service by January 1st of that year, PREPA/Siemens selected a deployment plan that would achieve or exceed compliance by January 1st, 2022. For instance, S4S2 has 12.3% for the entire 2021 and by January 2022 there	PREPA shall model the core set of cases, as identified in the main text of this Resolution and Order, to be consistent with the renewable energy requirements in the pending SB 1121, which, based on available information, the Energy Bureau expects the Governor to sign in the near future. Compliance with the twenty percent (20%) renewable requirement for 2022 contained in this bill would settle the issue identified in this question.

Item	Energy Bureau Request	PREPA Question	Response
	cost parameter and the solar PV and battery storage availability parameters (2019-2021), and the wind performance parameters. • 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. • 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. • 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.	are resources in place for 20% compliance. • Question: With this clarification, would the Energy Bureau require the plan modified?	In order to reflect compliance with a hundred percent (100%) RPS requirement in 2050, PREPA shall design amortization and depreciation schedules for any modeled fossil fuel generation resource so it is fully depreciated and ready for retirement by 2050.
App. A, Item I.B.1.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	• Question: Does the Energy Bureau agree that this Item is duplicative of Items A.3.a through A.3.f? However, if the sensitivity requires leaving the LTCE plans constant, assigning the full costs of the LNG terminal to PREPA would only impact fixed costs and the NPV estimates as the dispatch of the generation fleet will not	Yes. The point of this sensitivity was to measure the risk of assuming that the cost would be shared, and choosing the resource on that basis, and then finding out that the cost wouldn't be shared. If PREPA proposes to model a non-

Item	Energy Bureau Request	PREPA Question	Response
	where it applies, PREPA may simply identify which cases it applies to.	be affected by the higher fixed costs. This adjustment can be applied to the relevant Scenarios (all except Scenario 1).	shared land-based LNG system, this risk is moot, and there is no need for the sensitivity.
App. A, Items I.B.1.b and I.B.1.c.	• 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. • Apply sensitivities to S3S2 and S3S3 that hold the resource plan constant but use reference level costs for the solar PV and BESS resources.	• Background: These two Items involve sensitivities where renewables capital costs would be higher or lower, and yet the two Items also direct that renewables be added at the same levels despite the higher or lower capital costs (LTCE plans constant). PREPA and Siemens do not believe that this combination would provide useful information, besides changes in fixed costs. In contrast, the sensitivity on high gas prices, would change the dispatch of the generation. • Question: Does the Energy Bureau agree to withdraw or waive the sensitivities on renewable capital costs?	No, these requirements are not waived. The Energy Bureau requires calculation of the costs under these alternate scenarios so that the extent of the capital cost risk associated with solar and storage can be known and incorporated into a risk analysis of the different scenarios.
App. A, Item II.A.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.)	• Background: In the Energy Bureau case regarding the San Juan 5&6 contract, PREPA asked a clarification question regarding whether the Bureau was requiring PREPA to include the San Juan 5&6 conversions in all IRP Scenarios or just in the applicable Scenarios. The Bureau's November 28, 2018, Resolution stated the latter. • Background: PREPA and Siemens concluded that the San Juan 5&6 conversions were not applicable to Scenario 1, which is the "no new natural gas delivery infrastructure" Scenario.	The set of required cases described in the main text of this Resolution and Order addresses this by defining Scenarios 1 and 2, and associated sensitivities, in detail. The base case of Scenario 1 reflects: 1) San Juan 5&6 conversion, and 2) no other new gas generation or port facilities. EcoEléctrica could continue to operate, but no

Item	Energy Bureau Request	PREPA Question	Response
		PREPA and Siemens continue to believe that that is a reasonable conclusion. • Question: Does the Energy Bureau agree to withdraw or waive this Item? • Question: Alternatively, does the Energy Bureau agree that PREPA and Siemens, to comply with this Item, need only run revised versions of S1S2B and S1S3B, rather than having to re-run all of the Scenario1 LTCEs? PREPA notes that S1S1B also could be re-run, if the Bureau deems that necessary, but that no other S1 versions should be re-run.	new gas plant built in Costa Sur, Palo Seco, or elsewhere. We require a sensitivity case in which San Juan 5&6 does not convert to ship-based LNG in order to measure the impact of that conversion on the overall system costs.
App. A, Item II.A.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	• Background: PREPA and Siemens do not understand the rationale for re-running Scenario 1, the "no new natural gas delivery infrastructure" Scenario, to add sensitivities for fuel conversions of existing units to burn natural gas, with or without adding San Juan 5&6 infrastructure as a fixed resource. If San Juan 5&6 is added, then this item is duplicative of Item II.A.1. If San Juan 5&6 is not added, then there are no new natural gas supply sources, and adding the fuel conversions does not appear to generate useful information. • Background: Moreover, other than San Juan 5&6, there are no other units that make practical sense to convert to natural gas. • Background: The new CCGT installed in Costa Sur in some of the plans is using the gas currently burned at Costa Sur 5 & 6	See the previous item.

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	"Nodal Run" and PSSE analysis of case S1AS2B.	and EcoEléctrica. If we don't allow this option to be taken by the plan it is likely that at least EcoEléctrica will stay not giving any additional information. • Question: Does the Energy Bureau agree to withdraw or waive this Item? • Question: Alternatively, does the Energy Bureau agree that PREPA and Siemens, to comply with this Item, need only run revised versions of S1S2B and S1S3B, rather than having to re-run all of the S1 LTCEs? PREPA notes that S1S1B also could be re-run, if the Bureau deems that necessary, but that no other S1 versions should be re-run	
App. A, Item II.C.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: • 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 Bureau's November 9, 2018 Order. If the calculated amount of solar PV required to be compliant with the Bureau's Order exceeds the limits set on solar PV	• Background: This Item would apply only to Scenarios 2, 4, and 5 and potentially the ESM Plan. • Background: See our observations under "App. A, Items I.A.3.g through I.A.3.l", regarding how the deployment was selected. • Question: Does the Energy Bureau agree that this Item does not require its own independent LTCE re-runs and instead can be included in whatever other LTCE re-runs of Scenarios 2, 4, and 5 that PREPA and Siemens otherwise must conduct under other Items in order to comply with the March 14th order after the order is clarified?	This item is addressed by the Ordered approach to RPS compliance in all scenarios, discussed above.

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	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 Bureau's Order.		
App. A, Item II.C.3	• PREPA has provided no justification for its solar and battery limitations imposed for 2022 forward. PREPA must rerun all Scenarios to remove the solar PV and battery availability limitations for post-2022.	• Background: PREPA and Siemens can provide more details on the justifications for the limits. At least some of that information already is available to the Energy Bureau and its consultants. • Background: Scenario 3's LTCE runs already include the results of very high limits on the amounts of solar and battery storage additions, as directed by the Energy Bureau. • Background: The information that is useful here is information on the way forward with practical limits. • Question: Would the Energy Bureau agree to withdraw or waive this Item? • Question: Alternatively, would the Energy Bureau agree that PREPA and Siemens, in order to comply with this Item, need only re-run Scenario 3 in an LTCE run that uses the reference costs of solar and battery storage additions? PREPA and Siemens believe that such a re-run would provide the essential information that appears to be sought by this Item.	PREPA must either remove the limitations or provide, in the IRP, explicit and detailed justifications for how the limits were selected.
App. A, Item II.D.2.a	Utilize consistent cost and performance assumptions for both wind and solar PV in all model runs.	• Background: PREPA and Siemens understand Item II.D.2.a to be the specific	PREPA shall include onshore wind as a resource choice in all of its LTCE model runs, using

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	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.	statement of what is intended by Item II.D.2. • Background: PREPA and Siemens are unclear on what is the concern or objective underlying this Item. • Background: PREPA and Siemens conducted a screening assessment using LCOE and even with higher capacity factors the wind resources have higher projected costs than solar. • Background: PREPA and Siemens respectfully submit that they do not see this Item as a compliance Item, and instead see it as a new requirement to re-run up to all 34 LTCEs, possibly with additional permutations, using different data. • Question: Would the Energy Bureau agree for PREPA to account for this item in the screening phase of the study? • Question: Alternatively, would the Energy Bureau confirm that this Item is intended to apply only to such other LTCE runs that are required to be re-run under other Items in order to comply with the March 14th order, and not to all 34 LTCEs	the appropriate technical performance and cost characteristics from the NREL ATB along with the best available wind resource information.
App. A, Item III.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.	• Background: PREPA submitted to the Energy Bureau the programs that identified as viable for EE and DR in Puerto Rico with levels of adoption that considered as viable for implementation. • Background: The Energy Bureau ordered PREPA to include 2% per year reduction	The item is not waived. PREPA has started to provide the required justification in the context for its question. PREPA should elaborate on that response and include it in the re-filed IRP, while ensuring

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		in EE and in response to this PREPA increased the levels of adoption so the limit would be met and by year 10 most of the eligible customers (95% in most cases) have been subscribed to the plan. • Background: Further gains in EE could not be substantiated at this time and would have very little impact on the IRP decisions and implementation plan. • Question: Would the Energy Bureau agree to withdraw or waive this Item? • Question: Alternatively, would the Energy Bureau agree to running a sensitivity on the preferred plans?	that the modeled energy efficiency acquisition is consistent with the justification.
App. A, Item III.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.	• Background: PREPA and Siemens currently are not aware of reliable analysis and data that indicates that the offshore wind potential of Puerto Rico is comparable -- in terms of the potential as such and also taking into account other factors such as location, permitting feasibility, project costs, resulting energy prices, etc. -- to situations in the Northwest US mainland or Europe. • Background: Preliminary studies for Puerto Rico do identify potential, but the projected costs are significantly higher than those of photovoltaic. • Background: To provide an authoritative, detailed answer on this subject would require an expensive and time-consuming new study. For example, water depths and other factors would have to be assessed to determine where	PREPA shall include assessment of the issues involved in offshore wind resources to serve Puerto Rico. It may build from the discussion provided here. Further discussion after the IRP has been determined to be complete may be appropriate, including discussion regarding the idea that PREPA would look beyond solar PV when it issues RFPs for renewable resources.

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		offshore turbines might be practical from an engineering perspective. • Background: The IRP as filed includes very substantial amounts of solar PV installations. If offshore wind were to turn out to be practical and to be cost-competitive with solar PV, then, offshore wind can be expected to replace some of the solar PV. The same consideration applies to onshore wind generation. • Question: Would the Energy Bureau agree to withdraw or waive this Item or to supplementation with a requirement of adding to the IRP the requirement than in its implementation PREPA should not limit the RFP's to only PV, but open it to all renewable options in the island in particular wind onshore and offshore.? • Question: Alternatively, would the Energy Bureau agree to withdraw or waive this Item at this time, subject to the possibility of the Bureau issuing this Item as a requirement of information at a time after the refiled IRP is found to be complete?	
App. B, Item 3	• Matlab regression model (discussed on page 3-2 of the IRP) 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.	• Background: The Matlab model regression model was developed by Siemens for carrying out load forecasts and was not specifically developed for the Puerto Rico IRP. • Question: Would the Energy Bureau agree to withdraw or waive this item at this time, subject to the possibility of the Bureau issuing this Item as a requirement	The Energy Bureau will treat these models under the provisions of Section 2.02(F)(2) of Regulation 9021, regarding access to models and software. The Energy Bureau will work with PREPA and Siemens to develop the appropriate processes to

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		of information, for any particular sensitivity that the Bureau deems should be run by Siemens, at a time after the refiled IRP is found to be complete?	evaluate and utilize these models under that provision after PREPA files a complete IRP.
App. B, Item 4	Formulae have not been left intact as required by the rule. Provide the file with all formulae intact.	• Background: This item correctly assumes that formulae have been removed for some items in the referenced work papers. The referenced work papers are tied to model outputs from the GCPM gas model and others, and the reason for not including all formulae in the reference work paper. Siemens can provide a version of the work paper with formulas referencing the raw model output data as well.	PREPA shall provide the version of the file with formulas that is described in its response.