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

NEPR

Received:

Jun 7, 2024

9:58 PM

IN RE: REVIEW OF THE PUERTO RICO ELECTRIC POWER AUTHORITY INTEGRATED RESOURCE PLAN	**CASE NO.:** NEPR-AP-2023-0004 **SUBJECT**: Motion Submitting Responses to the Third Set of IRP Prefiling Period Requests of Information and Request for Confidential Treatment

MOTION SUBMITTING RESPONSES TO THE THIRD SET OF IRP PREFILING PERIOD REQUESTS OF INFORMATION AND REQUEST FOR CONFIDENTIAL TREATMENT

TO THE HONORABLE PUERTO RICO ENERGY BUREAU:

COME NOW LUMA Energy, LLC ("ManagementCo"), and **LUMA Energy ServCo, LLC** ("ServCo"), (jointly referred to as "LUMA"), and respectfully state and request the following:

1. On May 17, 2024, the Energy Bureau entered a Resolution and Order in which it instructed LUMA to respond on or before June 7, 2024, to a *Third Set of Requests of Information during the 2024 IRP - Prefiling Process (Phase 1)* set forth in Attachment A to the Resolution and Order ("May 17th Order"). The Energy Bureau determined that LUMA's responses to existing Requests of Information and the Energy Bureau's expectations of further responses to follow-on questions in a third set of requests of information is sufficient to prepare for the forthcoming 2024 Integrated Resource Plan ("IRP") filing and hearings.

2. In compliance with the May 17th Order, LUMA hereby submits as Exhibit 1 its responses to the *Third Set of Requests of Information during the 2024 IRP - Prefiling Process (Phase 1)* ("LUMA's Response to Third Pre-Filing Period RFI"). LUMA provides these responses supported by preliminary information. Data, estimates, and other information provided now may change and be revised as LUMA develops the 2024 IRP.

3. LUMA's Response to Third Pre-Filing Period RFI includes several attachments. One of those attachments, RFI-LUMA-AP-2023.0004-20240517-PREB-001c_list_legacy_units.xlsx, is being filed under seal of confidentiality. In compliance with the Energy Bureau's Policy on Management of Confidential Information," CEPR-MI-2016-0009, issued on August 31, 2016, as amended on September 21, 2016 ("Energy Bureau's Policy on Management of Confidential Information"), under separate cover and expediently, within the next ten days, as set forth in Section A.2 of the Energy Bureau's Policy on Management of Confidential

Information, LUMA will submit a memorandum of law in support of its request to file said attachment under seal of confidentiality.

WHEREFORE, LUMA respectfully requests the Energy Bureau to **take notice** of the foregoing and **deem** that LUMA complied with the Resolution and Order dated May 17, 2024.

RESPECTFULLY SUBMITTED.

WE HEREBY CERTIFY that this Motion was filed using the electronic filing system of this Energy Bureau and that electronic copies of this Motion will be notified to the Puerto Rico Electric Power Authority: lionel.santa@prepa.pr.gov and through its attorneys of record González & Martínez, Mirelis Valle-Cancel, mvalle@gmlex.net; and Alexis G. Rivera Medina, arivera@gmlex.net; and Genera PR, LLC: brannen@genera-services.com; kbolanos@genera-pr.com; regulatory@genera-pr.com, lrn@roman-negron.com.

RESPECTFULLY SUBMITTED.

In San Juan, Puerto Rico, on June 7, 2024.

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Exhibit 1

2024 Integrated Resource Plan (2024 IRP)

NEPR-AP-2023-0004

Responses to May 17, 2024

Third 2024 IRP Prefiling R&O

JUNE 7, 2024

PREFILING PROCESS OF THE 2024 INTEGRATED RESOURCE PLAN (2024 IRP)

NEPR-AP-2023-0004

RESPONSE: RFI-LUMA-AP-2023.0004-20240517-PREB-001-010

The Energy Bureau issued on May 17, 2024, a Resolution and Order (May 17th R&O) ordering LUMA to submit responses to the Third 2024 Integrated Resource Plan (2024 IRP) Prefiling Requests of Information (RFI). LUMA hereby complies and submits its response to Attachment A of the May 17th R&O addressing questions on: 1) PLEXOS® modeling regarding a. capacity of legacy units; b. forced and planned outages; c. generation fleet; d. generation resources; 2) FEMA Emergency generation; 3) Improvements planned by Genera; 4) LOLE target risk measures; 5) core load and load modifiers (storage, DPV); 6) LCOE solar resources under “more land” scenario.

Please note that LUMA is providing the following responses on a preliminary informational basis.

Data, estimates, or other information provided now may change and may be revised as LUMA develops the 2024 IRP.

EXECUTIVE SUMMARY

LUMA is committed to supporting and advancing the transformation of Puerto Rico's energy system into one that is more resilient, cleaner, and sustainable for everyone.

As operator of the transmission and distribution system, LUMA is responsible for developing an Integrated Resource Plan (IRP) that maps out the transformation of the island's energy resources over the next two decades. LUMA is developing an IRP that best reflects the energy needs and priorities of our customers, while reliably and responsibly progressing towards the clean energy goals that will best serve the interests of Puerto Rico for generations to come.

This comprehensive response by LUMA addresses inquiries from the Energy Bureau regarding various aspects of the 2024 Integrated Resource Plan.

LUMA's approach to energy planning incorporates diverse considerations such as resource constraints, land usage, cost dynamics, and technological integration. LUMA's goal is to ensure that the IRP presents a diverse and analytically robust set of future scenarios and resource portfolios in order to map a sustainable and reliable energy future for Puerto Rico that is responsive to customer needs and Puerto Rico energy public policy objectives.

List of Responses and Attachments

Response ID	Document Type	Response Subject
RFI-LUMA-AP-2023.0004-20240517-PREB-001c	Response* REDACTED	PLEXOS® modeling inputs for legacy units
RFI-LUMA-AP-2023.0004-20240517-PREB-001c	Response*	Fuel costs trajectory of the different legacy units
RFI-LUMA-AP-2023.0004-20240517-PREB-007	Response*	Core load and load modifier data for the "high" and "low" trajectories
RFI-LUMA-AP-2023.0004-20240517-PREB-008	Response*	Load modifiers cost information in the "high" and "low" trajectories for DER
RFI-LUMA-AP-2023.0004-20240517-PREB-009	Response*	Hourly shape in 8760 format of the DPV resource

*Note: *Denotes attachments that have been provided in Microsoft Excel format.*

Attachment A

NEPR-AP-2023-0004

Response: RFI-LUMA-AP-2023.0004-20240517-PREB-001a

SUBJECT

Available capacity of legacy units used in PLEXOS® modeling.

REQUEST

Reference: Resource Adequacy report December 2023, Appendix 5. Model Inputs - Generation Fleet, and legacy units used in PLEXOS® modeling.

a. Re: Table A-3: Summary of Expected Operating Thermal Generators, FY2024. Confirm or explain otherwise if this table represents the list of legacy units, with associated "available capacity", for use in the PLEXOS® modeling.

RESPONSE

LUMA confirms that the list of units in the Resource Adequacy report, December 2023 is correct. However, there have been modifications to the available capacity of certain units for the PLEXOS® modeling.

Table 1: Summary of Expected Operating Thermal Generators, highlights in red these modifications since the "RA report December 2023, Appendix 5. Model Inputs - Generation Fleet", with changes marked in red.

Table 1: Summary of Expected Operating Thermal Generators

Generator Name	Start of Operations	Fuel	Nameplate Capacity (MW)	Available Capacity (MW)	Historic Forced Outage Rate (%)
AES 1	2002	Coal	227MW	227MW	5%
AES 2	2002	Coal	227MW	227MW	5%
Aguirre 1 CC	1977	Diesel	296MW	100MW	40%
Aguirre 2 CC	1977	Diesel	296MW	100MW	30%
Aguirre Steam 1	1971	Bunker	450MW	300MW	20%
Aguirre Steam 2	1971	Bunker	450MW	350MW	15%
Costa Sur 5	1972	Bunker/ Natural Gas	410MW	250MW	12%
Costa Sur 6	1973	Bunker/ Natural Gas	410MW	350MW	15%
EcoElectrica	1999	Natural Gas	535MW	534.38MW	2%

2024 INTEGRATED RESOURCE PLAN

Generator Name	Start of Operations	Fuel	Nameplate Capacity (MW)	Available Capacity (MW)	Historic Forced Outage Rate (%)
Palo Seco 3	1968	Bunker	216MW	160MW	12%
Palo Seco 4	1968	Bunker	216MW	160MW	18%
San Juan 7	1965	Bunker	100MW	70MW	30%
San Juan 9	1968	Bunker	100MW	90MW	8%
San Juan CC 5	2008	Diesel/ Natural Gas	220MW	210MW	12%
San Juan CC 6	2008	Diesel/ Natural Gas	220MW	210MW	12%
Cambalache 2	1998	Diesel	82MW	75MW	10%
Cambalache 3	1998	Diesel	82MW	75MW	10%
Mayagüez 1	2009	Diesel	55MW	47.5MW	30%
Mayagüez 2	2009	Diesel	55MW	47.5MW	30%
Mayagüez 3	2009	Diesel	55MW	47.5MW	30%
Mayagüez 4	2009	Diesel	55MW	47.5MW	30%
Palo Seco Mobile Pack 1-3	2021	Diesel	27MW x3	27MW each (81MW total)	9%
7 Gas Turbines (Peakers)	1972	Diesel	21MW x7	21MW each (147MW total)	40%
TOTAL			**4976 MW**	**3906.38 MW**	**-**

Attachment A

NEPR-AP-2023-0004

Response: RFI-LUMA-AP-2023.0004-20240517-PREB-001b

SUBJECT

PLEXOS® modeling of forced and planned outages for legacy units.

REQUEST

Reference: RA report December 2023, Appendix 5. Model Inputs - Generation Fleet, and legacy units used in PLEXOS® modeling.

b. Explain how forced and planned outages for legacy units are to be modeled in PLEXOS®.

RESPONSE

Forced and planned outage rates for legacy units are critical factors in ensuring the accuracy of the PLEXOS® model with regard to availability and reliability. Forced and planned outage rates are modeled in the manner below:

- Forced outages occur when generation units unexpectedly shut down or experience capacity reductions due to unforeseen issues. In PLEXOS®, each energy resource is assigned a forced outage rate (FOR), which represents the percentage of time the unit is expected to be offline. To simulate these outages, PLEXOS® employs stochastic processes that generate random projections to determine whether a unit will experience a forced outage based on its assigned FOR.
- Planned outages are scheduled shutdowns for maintenance and other planned activities (e.g., testing, inspections and other activities that can be scheduled in advance). PLEXOS® allows the input of detailed outage patterns, including the frequency and duration of planned activities. These patterns ensure that the units are taken offline during the predefined schedule in the simulation.

Attachment A

NEPR-AP-2023-0004

Response: RFI-LUMA-AP-2023.0004-20240517-PREB-001c

SUBJECT

PLEXOS® modeling of forced and planned outages for legacy units.

REQUEST

Reference: RA report December 2023, Appendix 5. Model Inputs - Generation Fleet, and legacy units used in PLEXOS® modeling.

c. In Excel file format, provide the list of legacy units used in the PLEXOS® modeling, with the following attributes as represented in PLEXOS®, for all years of the planning horizon inclusive of changes to any of these parameters over the planning horizon:

   i. Available Maximum Capacity and representation in model
   ii. Forced outage rate and representation in model
   iii. Planned outage rate and representation in model
   iv. Primary fuel
   v. Secondary fuel, if applicable if dual fuel
   vi. Variable operating costs in $/MWh
   vii. Fixed operating costs in $/kW-year
   viii. Heat rate curve, by capacity segment, as applicable / as modeled
   ix. Trajectory of fuel costs by unit, noting if there are any differences from the fuel cost trajectory already provided in response to 2nd ROI question 10, "cost trajectory of fuels" attachment
   x. Emission rates by unit as represented in the modeling
   xi. Starting and stopping parameters, minimum operating levels, minimum run time and minimum down times, and related parameters as applicable, by unit

RESPONSE

Attaching a redacted version of the RFI-LUMA-AP-2023.0004-20240517-PREB-001C_list_legacy_units and RFI-LUMA-AP-2023.0004-20240517-PREB-001c_Trajectory_of_fuel_costs

Attachment A

NEPR-AP-2023-0004

Response: RFI-LUMA-AP-2023.0004-20240517-PREB-002

SUBJECT

Generation Fleet represented in PLEXOS®.

REQUEST

RA report December 2023, Appendix 5. Model Inputs - Generation Fleet and Table A- 4: Summary of Operating Renewable Generators.

a. Confirm or explain otherwise that the units in Table A-4 will be represented in PLEXOS®.

RESPONSE

The units in Table A-4 will be represented in the PLEXOS® modeling.

LUMA confirms that the list of renewable generators is correct. However, there have been some modifications to the start date of certain power plants for the PLEXOS® modeling based on changes from the time at which the information was presented.

Table 2: Summary of Expected Operating Thermal Generators, highlights in red the start dates that have been modified since the "RA report December 2023, Appendix 5. Model Inputs - Generation Fleet and Table A- 4: Summary of Operating Renewable Generators".

Table 2: Summary of Expected Operating Thermal Generators

Generator Name	Start of Operations	Fuel	Nameplate/ Available Capacity (MW)
AES Ilumina	2012	Sun	20
Fonroche Humacao	2016	Sun	40
Horizon Energy	2016	Sun	10
Yarotek (Oriana)	2016	Sun	45
San Fermin Solar	2015	Sun	20
Windmar (Cantera Martino)	2011	Sun	2.1
Windmar (Vista Alegre/ Coto Laurel)	2016	Sun	10
Pattern (Santa Isabel)	2012	Wind	75
Fajardo Landfill Tech	2016	Methane Gas	2.4

2024 INTEGRATED RESOURCE PLAN

Generator Name	Start of Operations	Fuel	Nameplate/ Available Capacity (MW)
Toa Baja Landfill Tech	2016	Methane Gas	2.4
Punta Lima Wind	Mar 2024	Wind	26
Ciro 1 Solar	Dec 2024	Sun	90
Xzerta Solar	Jan 2026	Sun	60
TOTAL			**402.9 MW**

Attachment A

NEPR-AP-2023-0004

Response: RFI-LUMA-AP-2023.0004-20240517-PREB-003

SUBJECT

Generation resources currently planned or contracted for deployment used in PLEXOS®.

REQUEST

As necessary, update the information provided in slides 30-34 of the 10/31/2023 presentation from the technical conference. List the generation resources currently planned or contracted for deployment that will be used in PLEXOS®, for the following categories. Indicate the MW size, energy duration (for battery resources), the modeled Puerto Rico deployment date (year, or month and year), estimated average annual capacity factor, and any other relevant information for use in PLEXOS® that will impact the results of the long-term expansion plan outcomes:

a. Tranche 1 Solar PV resources
b. Tranche 1 Battery Energy Storage Resources
c. Tranche 1 Virtual Power Plan resources
d. Tranche 2 Solar PV resources
e. Tranche 2 Battery Energy Storage Resources
f. Emergency generation and black start generation, RICE, and CT units, under procurement by Genera using FEMA funding
g. Additional Battery Energy Storage Resources proposed by Genera using FEMA funding, up to 430 MW of 4-hour duration units
h. Additional Battery Energy Storage Resources proposed by LUMA as "accelerated storage addition program" (ASAP)

RESPONSE

Tranche 1:

Table 3: Tranche 1 Resources

Project Name	Power Source	Start of Operations	Expected Capacity (MW)
AES Jobos Solar	Solar	Oct - 2025	80
AES Jobos (BESS) - ITC	BESS	Oct - 2025	100
AES Salinas Solar	Solar	Oct - 2025	120
AES Salinas (BESS) - ITC	BESS	Oct - 2025	100

Project Name	Power Source	Start of Operations	Expected Capacity (MW)
Pattern Barceloneta Solar ITC	Solar	Oct - 2025	60
Ciro Two Salinas	Solar	Oct - 2025	43
Guayama Solar Energy	Solar	Oct - 2025	25
Yabucoa YFN	Solar	Oct - 2025	32.1
Yabucoa Energy Park Solar ITC	Solar	Oct - 2025	38.7
Tetris Power	Solar	Nov - 2025	45
Coamo Solar	Solar	Oct - 2025	100
Caguas Energy Storage	BESS	Mar - 2026	25
Peñuelas Energy Storage	BESS	Mar - 2026	100
Ponce Energy Storage	BESS	Mar - 2026	25
Solaner San German	Solar	Sep - 2025	35

Tranche 2:

[redacted]

Peaking and Battery Resources:

Table 5: [redacted]

Table 6: Battery Energy Storage System (BESS) Resources proposed by Genera.

Location	Power Source	Expected Capacity (MW)
Costa Sur	BESS	40
Aguirre	BESS	142
Yabucoa	BESS	40
San Juan	BESS	48
Palo Seco	BESS	28
Vega Baja	BESS	52
Cambalache	BESS	80
TOTAL		**430**

Additional BESS Resources proposed by LUMA as "Accelerated Storage Addition Program" (ASAP):

LUMA has received initial approval from the Energy Bureau to negotiate the addition of 360 MW of Energy Storage resources at existing IPP facilities. 185 MW, 740 MWh to be installed in CY 2025, and phase 2 of 175 MW, 700 MWh installed in CY 2026.

Table 7: Additional BESS Resources proposed by LUMA as ASAP Program

Implementation Date	Expected Capacity (MW)	Expected Energy (MWh)
Phase 1- CY 2025	185	740
Phase 2 - CY 2026	175	700

LUMA plans to include the first phase of the ASAP batteries (185 MW) as a fixed decision in the 2024 IRP. The second phase of the project (175 MW) is currently planned as an option that can be selected by PLEXOS.

Unit Capacity Factors:

LUMA will provide the expected capacity factors of the generation and storage assets as part of the 2024 IRP filing.

Attachment A

NEPR-AP-2023-0004

Response: RFI-LUMA-AP-2023.0004-20240517-PREB-004

SUBJECT

FEMA emergency generation.

REQUEST

RA report December 2023, P. 12, concerning the 350 MW of FEMA emergency generation:"... 350 MW of highly available generation reduces the risk [of generation shortfalls] substantially. There is currently uncertainty over the duration of this generation and therefore it was not included as part of the Base Case assumptions."

a. Confirm, or explain otherwise, that the 350 MW of "FEMA" emergency generation will be included as a firm resource in the PLEXOS® modeling for the 2024 IRP.

b. The total nameplate capacity associated with the total number of units of "FEMA" generation is greater than 350 MW. PREPA's Motion indicates that 7 units totaling 219 MW is in place at Palo Seco, for a firm capacity of 150 MW; and 10 units totaling 310 MW is in place at San Juan, for a firm capacity of 200 MW.7 Confirm, or explain otherwise, that the effective or firm capacity contribution as will be modeled in PLEXOS® for the units at these locations is 350 MW, with no further reduction in availability or rating due to forced or planned outage.

RESPONSE

a. The "FEMA" emergency generation will be included as a firm resource in the PLEXOS® modeling for the 2024 IRP. However, there will be a total 340MW of installed capacity considered as a fixed resource as showcased in Table 8: *FEMA Emergency Generation*.

b. A total of four units are considered at Palo Seco, with a total capacity of 90MW (two units at 20MW each and two units at 25MW each). Additionally, a total amount of 10 units will be considered at San Juan, with a total capacity of 250MW (25MW per unit). Combined, these FEMA units account for 340MW installation. These values are detailed in Table 8: *FEMA Emergency Generation*.

c. While there is no further reduction to the unit ratings, PLEXOS® does include the estimated forced outage rates and planned maintenance when assessing the availability of a unit in the calculation of the system loss of load potential.

Table 8: FEMA Emergency Generation

Generator Name	Start of Operations	Fuel	Nameplate Capacity (MW)	Available Capacity (MW)	Historic Forced Outage Rate (%)
Palo Seco TM Gen 4-1	2023	ULSD / Natural Gas	20	20	3
Palo Seco TM Gen 4-2	2023	ULSD / Natural Gas	20	20	3
Palo Seco TM Gen 6-1	2023	ULSD / Natural Gas	25	25	3
Palo Seco TM Gen 6-2	2023	ULSD / Natural Gas	25	25	3
San Juan TM Gen 6-1	2023	ULSD / Natural Gas	25	25	3
San Juan TM Gen 6-2	2023	ULSD / Natural Gas	25	25	3
San Juan TM Gen 6-3	2023	ULSD / Natural Gas	25	25	3
San Juan TM Gen 6-4	2023	ULSD / Natural Gas	25	25	3
San Juan TM Gen 6-5	2023	ULSD / Natural Gas	25	25	3
San Juan TM Gen 6-6	2023	ULSD / Natural Gas	25	25	3
San Juan TM Gen 6-7	2023	ULSD / Natural Gas	25	25	3
San Juan TM Gen 6-8	2023	ULSD / Natural Gas	25	25	3
San Juan TM Gen 6-9	2023	ULSD / Natural Gas	25	25	3
San Juan TM Gen 6-10	2023	ULSD / Natural Gas	25	25	3
TOTAL			**340**	**340**	**-**

Attachment A

NEPR-AP-2023-0004

Response: RFI-LUMA-AP-2023.0004-20240517-PREB-005a

SUBJECT

Improvements planned by Genera.

REQUEST

RA report December 2023, P. 15: "LUMA is also optimistic that improvements planned by Genera to the PREPA-owned thermal generation facilities will improve overall reliability in the future".

a. How is LUMA representing this optimism concerning the availability or reliability of the Genera-operated legacy units in the PLEXOS® modeling?

RESPONSE

While LUMA remains optimistic that the Genera efforts will result in material improvements to the legacy generators, LUMA has chosen to be conservative in its resource planning inputs for the legacy units. LUMA has not included any of Genera's forecasted improvements in available capacity or forced outage rates to the legacy units in its PLEXOS® model inputs.

Attachment A

NEPR-AP-2023-0004

Response: RFI-LUMA-AP-2023.0004-20240517-PREB-005b

SUBJECT

Improvements planned by Genera.

REQUEST

RA report December 2023, P. 15: "LUMA is also optimistic that improvements planned by Genera to the PREPA-owned thermal generation facilities will improve overall reliability in the future."

b. Confirm or explain otherwise that any specific changes to outage rates and the year in which such changes are considered are included in response to question 1.c) ii) and iii) above, as applicable. If not applicable, explain how the modeling accounts for the possible improvements.

RESPONSE

LUMA remains optimistic that the Genera efforts will result in material improvements to the legacy generators, however chosen to be conservative in its resource planning inputs for the legacy units. LUMA has not included any of Genera's forecasted improvements in available capacity or forced outage rates to the legacy units in its PLEXOS® model inputs.

Attachment A

NEPR-AP-2023-0004

Response: RFI-LUMA-AP-2023.0004-20240517-PREB-006

SUBJECT

“Target risk measure" metrics considered for in jurisdictions / LOLE.

REQUEST

Reference: RA report December 2023, Table A-2, P. 50-51. This table contains "target risk measure" metrics considered for other jurisdictions. For Hawaii and Guam, a LOLE standard of 1 day per 4.5 years is used; for the Virgin Islands, a LOLE target of 1 day in ten years is planned for 2044, but the current target is 1 day per year (in 2020). Page 39, Section 3.2, lists "Sensitivity Analyses" with various aims, including "Meeting Industry LOLE Benchmarks".

Reference: Response to 2nd ROI, Question 1 b), re: parameters for LOLE metric acceptable to the model: "The targeted LOLE criterion for the 2024 IRP will be less than or equal to 1 day of loss of load in 10 years. However, due to the current RA shortfall, LUMA does not yet know if the LOLE target is reasonably achievable in the early years of the 2025 to 2044 IRP. The LOLE target is an input into the long-term expansion planning model of PLEXOS® (the Long-Term model), which determines an expansion plan that is then run through the short-term production costing model in PLEXOS®."

a. Provide the specific LOLE parameters that will be used as inputs to the Long Term PLEXOS® model. How will they vary for "the early years" of the 2025-2044 period? Provide this information by year for all years of the planning horizon.

b. If such targets are to be relaxed in the early years of the modeling, explain how this is being implemented.

c. On what basis is LUMA using a one-day-in-ten years LOLE standard considering that other island jurisdictions use less stringent standards of (such as the Virgin Islands) seek to ramp up over a time to a more stringent LOLE level?

RESPONSE

a. LUMA is using less than or equal to 0.1 day/year as its Loss of Load Expectation (LOLE) planning target, which is the commonly used industry target[1,2] and is what LUMA intended and should have stated originally.

LOLE is the expected loss of load over a study horizon. In its original statement of its 2024 IRP LOLE planning target, LUMA made the error that is frequently made of equating a LOLE of 1 day in 10 years to a LOLE target of 1/10th of a day per year (i.e., 0.1 days/year) when in fact they are not equivalent. A LOLE of 1 day in 10 years allows for only a single loss of load event in a 10-year period. While a LOLE of 0.1 days/year allows for a single loss of load event each year. If a utility had a single loss of load event each year it would achieve a LOLE target of 0.1 day/year but would also result in 10 events over a ten-year period (i.e., 10-days in 10-years), which would be ten times the result allowed in a 1 day in 10-year LOLE target. In addition, an annual LOLE target is easier to understand and apply in planning compared to a target that requires forecasting performance over a 10-year period.

While PLEXOS® does not use LOLE as a direct planning input for the PLEXOS® LT model, the model results can be used to calculate LOLE. After consultation with the IRP Technical Consultant, it was decided that using Loss of Load Probability (LOLP) as a planning input in PLEXOS® was the most appropriate approach to achieve the desired LOLE in the resulting portfolio. LOLP represents the probability of demand exceeding the available generation capacity during a given period.

The LUMA planning LOLE target of 0.1day/year implemented in PLEXOS® as a progressively more LOLP planning target. The LOLP target input is first implemented in the year 2030 and is gradually reduced to a value of 1 day in 10 years in the year 2038. One day in 10 years can be represented numerically as 24 hours per 10 years, and as approximately, 24 hours per 87,600 hours (24 / 87,600 = 0.000274 hours/hour = 0.0274%). As such, the list of LOLP targets implemented in the PLEXOS® modeling is shown in Table 9: PLEXOS® LOLP Planning Inputs.

Table 9: PLEXOS® LOLP Planning Inputs

Date from	Date to	LOLP Target (%)
1/1/2030	1/1/2031	2.34233
1/1/2031	1/1/2032	1.7635
1/1/2032	1/1/2033	1.18466
1/1/2033	1/1/2034	0.60583
1/1/2034	1/1/2035	0.3
1/1/2035	1/1/2036	0.175
1/1/2036	1/1/2037	0.1
1/1/2037	1/1/2038	0.054

[1] See EPRI Resource Adequacy Practices and Standards for a list of LOLE targets used in US system planning, https://msites.epri.com/resource-adequacy/metrics/practices-and-standards

[2] See EPRI Metrics Explainers, https://msites.epri.com/resource-adequacy/metrics/metrics-explainers#4257225834-1165899977

1/1/2038	-	0.0274

b. LUMA has assumed that 2030 was the earliest new capacity that could be added in the 2024 IRP that was not already a "fixed" decision for which the procurement was underway.

c. LUMA is using a target of 0.1 day/year LOLE to ensure a high level of reliability in Puerto Rico's energy system. This objective aligns with industry standard practices and typical regulatory expectations for maintaining a stable and reliable power supply. Although some other island jurisdictions such as Virgin Islands or Guam may use less stringent standards, these islands are small in comparisons to Puerto Rico's system. For example, the 2022 Total Net Electricity Generation of US Virgin Islands was 1 million MWh and for Guam the figure was 2 million MWh. These values are small compared to 2022 Puerto Rico Total Net Electricity Generation of 19 million MWh[3]. LUMA believes that Hawaiian Electric Company (HECO) provides a much better system and planning methodology for comparison to Puerto Rico. HECO's largest service territory on Oahu is smaller but reasonable comparable to Puerto Rico; HECO's Oahu service territory had a 2023 peak load of 2,838.07MW + 865 MWh storage[4] vs Puerto Rico's 2023 peak load of 6,862.4MW[5].

Due to its size and ongoing assessments of the impact of increasing variable renewable energy on its system, HECO's resource adequacy planning targets (not a firm requirement) are in the process of migrating from its prior LOLE target of 1 day in 4.5 years to a new set of targets which are all being assessed against a benchmark of 0.1 days/year target. An April 8,2024 filing by HECO[6] summarized the work being done on resource adequacy indicators with Hawaii Public Utility Commission oversite. The referenced HECO filing also includes a summary, and a survey by their consultant on resource adequacy benchmarks in other jurisdictions. LUMA's commitment to a 0.1 day/year target is approximately equivalent to resource adequacy indicator proposed by HECO for its Oahu service, which reflects LUMA's dedication to minimize power outages and enhance overall system dependability.

[3] See EIA metrics: https://www.eia.gov/state/print.php?sid=RQ

[4] See Hawaiian Electric 2023 metrics: https://www.hawaiianelectric.com/Documents/about_us/company_facts/power_facts.pdf

[5] See PPL Electric Utilities Corp. 2023 metrics: https://www.pplelectric.com/-/media/PPLElectric/At-Your-Service/Docs/General-Supplier-Reference-Information/2023/2023-PJM-and-PPL-Zone-Peak-Load-Dates-for-PLC-Calcs.ashx

[6] Letter From: M. Asano To: Commission Re: Docket No. 2018-0165 - Instituting a Proceeding to Investigate Integrated Grid Planning; Comments on Commission Order No. 40651, 4/8/2024, File Number F-304174.

Attachment A

NEPR-AP-2023-0004

Response: RFI-LUMA-AP-2023.0004-20240517-PREB-007

SUBJECT

Core Load and Load Modifiers.

REQUEST

In response to the 2nd set of ROIs, question No. 11 a), LUMA provided an Excel file attachment ("Attachment 1") with data described as "Core Load and Load Modifiers all shown as Impact to System Generation". These data appear to align with "base" load forecast information.

a. Please confirm, or explain otherwise, that the core load and load modifier data in the noted Attachment 1 file are associated with "base" Load Growth trajectory [as listed in LUMA's Exhibit 1, LUMA 2024 IRP, Revised Scenarios and Characteristics, Table 2, and Table 3, from LUMA's Motion Submitting Revised 2024 Integrated Resource Plan Scenarios and Characteristics, dated March 11, 2024].

b. Provide, in Excel file format, the equivalent core load and load modifier data for the "high" (Scenarios 2 and 4) and "low" (Scenarios 5 and 8) Load Growth trajectories listed in Tables 2 and 3 of the aforementioned Exhibit 1.

RESPONSE

a. LUMA can confirm that the core load and load modifier data in the noted Attachment 1 file are associated with the "base" Load Growth trajectory.

b. See attachment RFI-LUMA-AP-2023.0004-20240517-PREB-007_Modifiers_High_Low

Attachment A

NEPR-AP-2023-0004

Response: RFI-LUMA-AP-2023.0004-20240517-PREB-008

SUBJECT

Load modifiers – Energy Storage.

REQUEST

In response to the 2nd set of ROIs, question No. 10, LUMA provided a series of Excel file attachments, including: an "Attachment 4" Excel file (labeled in the response as "Attachment 2", pertaining to the Cost trajectory of UBESS and DBESS, and associated with 1st ROI question No. 6 items e, f, g, & h, slide 13); and an "Attachment 2" (labeled in the response as "Attachment 1", pertaining to the Cost trajectory of Onshore - Offshore Wind & UPV-DPV (utility PV and distributed PV) and associated with 1st ROI question No. 6 items a, b, c and d, slides 12-15). These cost data in both Excel files appear to align with "base" cost information.

a. Please confirm, or explain otherwise, that trajectories for DER Growth/PV /BESS, PV Cost, Storage Cost, and Resource Capital Cost fields [as listed in LUMA's Exhibit 1, LUMA 2024 IRP, Revised Scenarios and Characteristics, Table 2, and Table 3, from LUMA's the data in the two referenced Excel attachment files are associated with "base" Motion Submitting Revised 2024 Integrated Resource Plan Scenarios and Characteristics, dated March 11, 2024].

b. Provide, in Excel file format, the equivalent information for the "high" (Scenarios 2 and 4) and "low" (Scenarios 5 and 8) trajectories for DER Growth/PV/BESS, PV Cost, Storage Cost, and Resource Capital Cost fields listed in the Tables 2 and 3 of the aforementioned Exhibit 1.

RESPONSE

a. LUMA confirms that the data in the two referenced Excel file attachments are associated with "base" trajectories for DER Growth/PV /BESS, PV Cost, Storage Cost, and Resource Capital Cost fields was associated with the "base" Load Growth trajectory.

b. Attaching RFI-LUMA-AP-2023.0004-20240517-PREB- 008_High_and_low_scenarios_costs

Attachment A

NEPR-AP-2023-0004

Response: RFI-LUMA-AP-2023.0004-20240517-PREB-009

SUBJECT

Load Modifiers - Incremental distributed solar PV ("DPV") annual MW and GWh quantities.

REQUEST

For all incremental distributed solar PV ("DPV") annual MW and GWh quantities included in the "Attachment 1" load modifiers file in response to 2nd ROI No. 11 a),

a. Provide in Excel file format the 8,760 hourly shape of the DPV resource. If required, provide any further information necessary to explain how the hourly output shape of the DPV resource is modeled as a load modifier in PLEXOS®.

b. Provide an explanation of how LUMA and B&V modeled the "shape" of the “28.5% rebound effect load" and provide all source information documenting the use of a 28.5% magnitude effect and how it is appropriate to use for Puerto Rico.

RESPONSE

a. See attachment RFI-LUMA-AP-2023.0004-20240517-PREB-009_Hourly_shape_DPV to visualize the 8760 hourly shape of the DPV resource.

b. The rebound effect refers to the phenomenon where the installation of a solar PV system in residential settings leads to increased energy consumption. In its modeling, LUMA has assumed a 28.5% rebound effect to reflect the potential changes in energy consumption patterns following the installation of Distributed Photovoltaic (DPV) systems for residential customer in Puerto Rico. The rebound effect load shape is assumed to follow the same load shape pattern as assumed for residential customers.

LUMA has assumed a 28.5% rebound effect based on empirical studies and analyses relevant to Puerto Rico. Published articles that reference a typical 28.5% rebound effect in the United States when installing residential DPV systems are showcased below:

- Ross C. Beppler, Daniel C. Matisoff and Matthew W. Oliver (2021) Electricity consumption changes following solar adoption: Testing for a solar rebound https://onlinelibrary.wiley.com/doi/10.1111/ecin.13031

- Luan Thanh Nguyen, Shyama Ratnasiri, Liam Wagner, Dan The Nguyen, Nicholas Rohde (2024) Solar rebound effects: Short and long term dynamics https://www.sciencedirect.com/science/article/pii/S0960148124001162

Attachment A

NEPR-AP-2023-0004

Response: RFI-LUMA-AP-2023.0004-20240517-PREB-010

SUBJECT

LCOE for solar resources under "More Land"

REQUEST

In response to the 2nd set of ROIs, question No. 6, LUMA references the PR100 report noting that the average levelized cost of energy ("LCOE") for solar resources under "More Land" is less than the LCOE for "Less Land".

a. Explain how LUMA will interpret this average differential cost for solar PV associated with More or Less land when structuring the solar PV supply costs. In particular, will LUMA and B&V segment the supply curve cost for utility scale solar, assuming that all "first selected" utility scale solar will have lower costs, and a second tranche of higher cost utility scale solar PV will be in place for "Less Land" scenarios?

RESPONSE

As discussed in the previous ROI, the PR100 study defined two variations for land use:

- **Less land:** Considers only land that is not designated for agricultural purposes for utility-scale projects.
- **More land:** Considers agricultural land, as well as all land in the Less Land variant for utility-scale projects.

The average levelized cost of electricity (LCOE) is $75/MWh for cases where More Land is available, compared to $79/MWh for cases with Less Land. This represents an average of 5% increase in costs when agricultural land is excluded from development.

However, as seen in the attached document, RFI-LUMA-AP-2023.0004-20240517-PREB-008_High_and_low_scenarios_costs, the building costs for both scenarios are similar.