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

IN RE: LUMA RESOURCE ADEQUACY STUDY	**CASE NO.: NEPR-MI-2022-0002** SUBJECT: Motion to Submit Interim Update for Summer 2025 of LUMA's Fiscal Year 2025 Resource Adequacy Study

MOTION TO SUBMIT INTERIM UPDATE FOR SUMMER 2025 OF LUMA'S FISCAL YEAR 2025 RESOURCE ADEQUACY STUDY

TO THE HONORABLE PUERTO RICO ENERGY BUREAU:

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

1. In attention to Section 5.13(d) of the Puerto Rico Transmission and Distribution System ("T&D System") Operation and Maintenance Agreement by and among LUMA, the Puerto Rico Electric Power Authority ("PREPA") and the Puerto Rico Public-Private Partnerships Authority dated as of June 22, 2020 (the "T&D OMA")[1], on October 31, 2024, LUMA submitted

[1] Under Section 5.13(d) of the T&D OMA, LUMA is required to:

> (i) prepare risk assessments and analyses in support of Resource Adequacy and Generation Project or Generation Supply Contract procurement prioritization and planning, which shall take into account the Integrated Resource Plan and [applicable laws] (and which assessments and analyses PREB may request from time to time);
> (ii) […];
> (iii) meet with PREB on an annual basis to review and assess the prepared analyses, demand projections (prepared in accordance with the Integrated Resource Plan), existing System Power Supply, Legacy Generation Assets and generation assets owned by [independent power producers] related to the supply of Power and Electricity, and determine whether additional power supply sources are needed; […]
> […]

"Generation Projects" are projects or transactions with respect to "any function, service or facility of [PREPA] related to the generation of Power and Electricity […] and in respect of which [PREPA] or the Government of Puerto Rico to this Puerto Rico Energy Bureau of the Public Service Regulatory Board ("Energy Bureau") a Resource Adequacy Report containing LUMA's assessment of the Puerto Rico electricity generation sufficiency needs for Fiscal Year ("FY") 2025, titled "Puerto Rico Electrical System Resource Adequacy Analysis Report" dated October 31, 2024 ("FY2025 Resource Adequacy Report") spanning the period from July 1, 2024 to June 30, 2025. *Motion to Submit LUMA's Fiscal Year 2025 Resource Adequacy Study* filed on October 31, 2024 ("October 31st Motion"), and its Exhibit 1.

2. Given recent events affecting the Puerto Rico electricity system generation resources, LUMA has taken the initiative of preparing an update to the FY2025 Resource Adequacy Report to reflect these new variables and provide a more current landscape of the generation sufficiency needs for Summer 2025. LUMA herein submits this updated study titled "Puerto Rico Electricity System Resource Adequacy Interim Update for Summer 2025" dated March 21, 2025 ("Updated FY2025 Resource Adequacy Report"). *See Exhibit 1*. In addition, to facilitate the review of this report, LUMA is also submitting a presentation with the hallmarks of the updated findings in this report in both English and Spanish. *See Exhibit 2*.

3. The Updated FY2025 Resource Adequacy Report is one of a series of studies that LUMA conducts periodically to assess the resource adequacy of the Puerto Rico electricity

may enter into a Partnership Contract (as defined in Act 29-2009[, as amended])." *See id*. at Section 1.1, page 17. "Generation Supply Contracts" are contracts between PREPA and an independent power producer "relating to the sale and purchase of Power and Electricity including power purchase agreements". *See id*. "System Power Supply" refers to "electric capacity, energy and ancillary services from any power supply sources authorized under Applicable Law to operate in the Commonwealth". *See id*. at page 30. "Legacy Generation Assets" are "any power plants and any facilities, equipment and other assets related to the generation of Power and Electricity existing as of the date [of the T&D OMA] and in which [PREPA] or GenCo has an ownership or leasehold interest". *See id*. at page 19. "GenCo" means "the entity, which may be directly or indirectly owned by [PREPA or an affiliate of PREPA], that acquires or obtains ownership of the Legacy Generation Assets after the reorganization of PREPA". *Id*. at page 16. "Power and Electricity" means "the electrical energy, capacity and ancillary services available from the System Power Supply." *Id*. at page 25.

system.[2] These studies are intended to provide Puerto Rico stakeholders an informed perspective on the degree to which the island has sufficient electric generating capacity – and if not, the extent to which load shedding may be invoked by the system operator wherein service to selected customers will be interrupted in order to prevent the entire system from suffering an island-wide blackout.

4. The FY2025 Resource Adequacy Report submitted last October identified systemic generation insufficiency issues and the need to achieve adequate generation supply to deliver reasonable system stability and reliability and provided perspective on potential changes to the Puerto Rico electric system to achieve resource adequacy at U.S. electric utility industry standards. October 31st Motion, Exhibit 1, pp. 9, 10, 11, 19, 20, 46 and 68. In this Updated FY2025 Resource Adequacy Report, LUMA explains that resource adequacy has further declined in recent months, and it is becoming apparent that the expected load shedding activity this coming summer could be greater than anticipated when the FY 2025 Resource Adequate Study. *See Exhibit 1*, p. 4. LUMA recommends that Puerto Rico stakeholders unite to purse accelerating new resource additions, particular energy storage assets or modern thermal generating assets, that can contribute during peak electricity demands after sunset. *See id*. LUMA also notes that, until substantial quantities of new resources that can help meet peak demands are added to the system, load shedding activity will remain far too commonplace. *See id*.

5. LUMA would like the opportunity to discuss the Updated FY2025 Resource Adequacy Report with this Energy Bureau and answer any questions it may have about this study, to further the understanding of this honorable Energy Bureau on the electric generation sufficiency

[2] LUMA has been submitting these reports yearly since 2022. *See Motion to Submit LUMA's Resource Adequacy Study* filed on August 30, 2022, and *Motion to Submit LUMA's 2024 Resource Adequacy Study* filed on November 14, 2023.

needs of the Puerto Rico electric power system and the resource adequacy situation for Summer 2025. LUMA respectfully requests this honorable Energy Bureau to schedule a technical conference for such purposes or take such other action it deems appropriate to proceed with this interactive discussion.

6. LUMA remains committed to working with the Energy Bureau, generators, and other stakeholders to address the systemic generation issues identified in the Updated FY2025 Resource Adequacy Report to provide the people of Puerto Rico with safe, reliable, and clean energy.

WHEREFORE, LUMA respectfully requests that the Energy Bureau to take notice of the foregoing, accept the Updated FY2025 Resource Adequacy Report included as *Exhibit 1* and accompanying presentation in *Exhibit 2*, and schedule a technical conference to discuss with, and answer questions from, the Energy Bureau or take such other action it deems appropriate to proceed with an interactive discussion of this study.

RESPECTFULLY SUBMITTED.

In San Juan, Puerto Rico, this 24th day of March 2025.

I hereby certify that I filed this Motion using the electronic filing system of this Energy Bureau and that I will send an electronic copy of this motion to lionel.santa@prepa.pr.gov.

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/s/ Laura T. Rozas
Laura T. Rozas

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Exhibit 1

Updated FY2025 Resource Adequacy Report

Puerto Rico Electricity System Resource Adequacy

Interim Update for Summer 2025

March 24, 2025

Contents

Tables & Figures

1.0 Executive Summary

LUMA is issuing this interim update as part of its regular assessments conducted to assess the “resource adequacy” of the Puerto Rico electricity system. These resource adequacy assessments are intended to provide Puerto Rico stakeholders an informed perspective on the degree to which the island has sufficient electric generating capacity – and if not, the extent to which “manual load shedding” (MLS) may be invoked by the system operator wherein service to selected customers will be interrupted in order to prevent the entire system from suffering an island-wide blackout.

To be clear, LUMA does not own, manage or operate any generation facilities. As the system operator for Puerto Rico, LUMA carefully monitors and dispatches available generation resources – thermal powerplants operated by Genera PR, EcoEléctrica and AES, along with renewable power projects (i.e., solar, wind and landfill gas) operated by independent power producers – to meet customer demand and ensure the reliability of the overall electricity system on the island.

Resource Adequacy Summer 2025 Update: Key Findings

LUMA undertook this interim summer update because it is apparent that Puerto Rico resource adequacy has worsened in recent months, especially in the wake of the February 2025 fire at the Aguirre 1 power generation unit that has disabled it for at least a year. LUMA believes it is important for Puerto Rico regulators and stakeholders to set expectations properly regarding the amount of MLS activity likely to occur during the upcoming summer months when customer demand, and therefore stress on the island's electricity system, is at its highest level.

Key findings of this resource adequacy update include:

- MLS activity this summer due to the island’s generation inadequacy will increase significantly relative to recent summers, primarily due to reduced generation availability.

- To illustrate, during the six months covering the summer of 2024 between May 1 and October 31, Puerto Rico experienced 34 days in which MLS occurred. This degree of load shedding is far more frequent than what should occur at a utility that meets North American electricity reliability standards. Even so, the degree of load shedding in Puerto Rico is expected to increase significantly: **LUMA’s most likely forecast (i.e., the Expected Case) for the same months in 2025 indicates 93 expected days of MLS**, representing a tripling of expected MLS activity due to resource inadequacy. Moreover, other sets of plausible circumstances analyzed by LUMA and presented herein in sensitivity cases indicate that MLS activity this summer could be even greater than suggested by the results of the Expected Case.

- **The high volume of expected MLS activity is primarily attributable to the old and unreliable thermal electric generation fleet owned by PREPA and now operated by Genera**. Performance at these plants continues to degrade, and the recent catastrophic failure at Aguirre 1 and the resulting indefinite outage has clearly exacerbated the situation facing the Puerto Rico electricity system.

- MLS is most likely to occur during peak demand hours, which occur during the evening. Under Expected Case assumptions, Puerto Rico is likely to be most vulnerable to MLS during evenings in July. In July, the expected number of MLS events under the Expected Case is 21 days (roughly two days out of every three).

- The degradation in resource adequacy is cumulative, worsening as adverse developments accumulate not only will more MLS events occur, but the average and total length of load shed events will increase. To illustrate, the loss of Aguirre 1 is estimated to have caused an increase in expected summer 2025 load shed event duration from 319 to 572 hours (a 79% increase), whereas the loss of yet another baseload unit (as evaluated in a sensitivity case) would cause a further 92% increase on load shed duration to 1102 hours.

Efforts to Increase Generation Capacity

In response to the recent loss of the Aguirre 1 power generation unit, Genera submitted a proposal to the Energy Bureau in which it seeks approval to pursue the acquisition of 800 MW of new generation capacity on an emergency basis. Analysis herein indicates such an addition of resources would not only restore electricity service reliability in Puerto Rico to levels observed in recent summers but would make a meaningful contribution toward bringing the Puerto Rico electricity system much closer to North American electric utility reliability benchmarks.

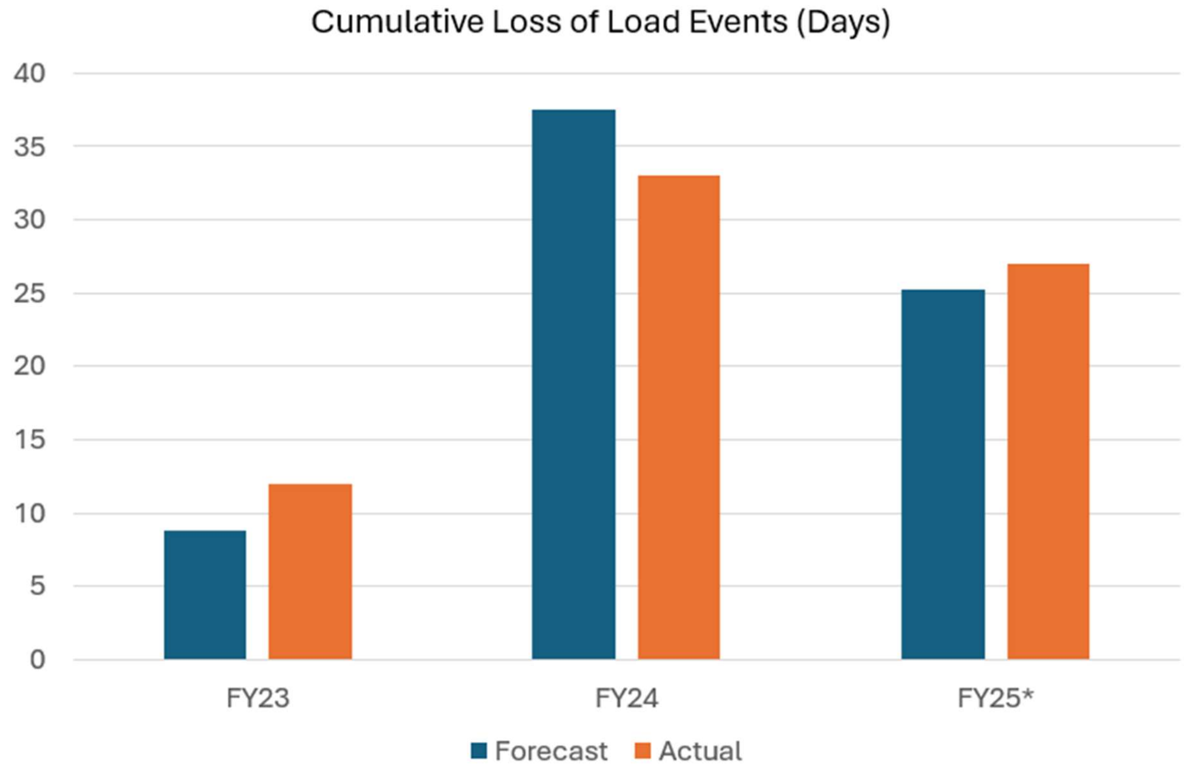
Accordingly, LUMA implores Puerto Rico stakeholders to unite in pursuit of accelerating new resource additions, particularly energy storage assets or modern thermal generating assets, and demand-side measures undertaken by electricity customers that can help the system serve peak electricity demands after sunset. Until substantial quantities of new resources that can help meet peak demands are added to the system, load shedding activity will remain far too commonplace, even after Aguirre 1 is expected to return to service in the second half of 2026.

2.0 Introduction and Context

This paper summarizes the results from a set of updated analyses performed by LUMA in February 2025 to assess the resource adequacy of the Puerto Rico electricity grid for the summer of 2025.

This interim update is the most recent assessment performed by LUMA to evaluate the resource adequacy of the Puerto Rico electricity system. Using modeling methodologies similar to those adopted by most electric utilities, LUMA has been able to accurately forecast MLS activity in Puerto Rico in its prior resource adequacy studies for fiscal years 2023, 2024 and (the current) 2025, as shown in Figure 1.

Figure 1: Prior Resource Adequacy Forecasts Have Accurately Predicted Load Shedding



* Through Jan. 31

Based on the findings from these prior resource adequacy studies, LUMA has consistently emphasized that electricity resources in Puerto Rico are substantially inadequate.

Resource inadequacy is a serious matter to an electric utility. When supplies of electricity resources are insufficient to meet the levels of electricity volumes demanded by the customers connected to an electricity grid, the electricity grid operator is confronted with the need to initiate a "load shed event" – in which electricity service to some customers is interrupted in order to preserve the ability of the grid to continue providing electricity to most customers. No system operator ever wants to interrupt electricity service to customers, but absent load shedding under such circumstances, operating conditions on the grid would rapidly deteriorate and quickly lead to a systemwide blackout requiring lengthy power restoration efforts.

Due to inadequacy of resources, the magnitude of MLS activity that has occurred in Puerto Rico in recent years is notably higher than what is experienced elsewhere in North America. Using one measure of resource adequacy commonly used in the electric utility industry, Puerto Rico experienced 36 days of MLS during calendar year 2024. This significantly contrasts with the planning standard utilized by many North American utilities, which aims for only one expected generation shortfall event every 10 years – or approximately 0.1 days involving loss of load per year, representing the minimally acceptable resource adequacy. In other words, **Puerto Rico's electricity resource adequacy in 2024 was about 360 times worse than benchmark levels set by the North American electric utility industry.**

Developments since LUMA's last resource adequacy study (FY25 Resource Adequacy Report, issued October 31, 2024) suggest that Puerto Rico electricity resource adequacy has worsened even further, and by a considerable degree. In response, during January and February of 2025, LUMA revised key assumptions and undertook a new set of analyses to develop a revised perspective on Puerto Rico's resource adequacy for the summer of 2025.

This interim report presents the findings from this set of updated resource adequacy analyses, focusing on the possible magnitude of load shedding activity that may be required during the upcoming summer. Findings are presented for the six months planning period between May 1 and October 31, which represents hurricane season, in contrast to prior resource adequacy studies wherein findings were presented over the 12-month LUMA fiscal year (July 1 to June 30).

3.0 Drivers of Resource Adequacy

As with any assessment of electricity resource adequacy, the findings described herein are highly dependent upon assumptions about two fundamental sets of factors about the electricity system: (1) the level of systemwide electricity demand to be served by the grid, and (2) the availability of generation resources to supply demand. Both sets of factors have changed in ways that increase the strains on the already-challenged Puerto Rico electricity system, and each of these sets of factors is discussed below.

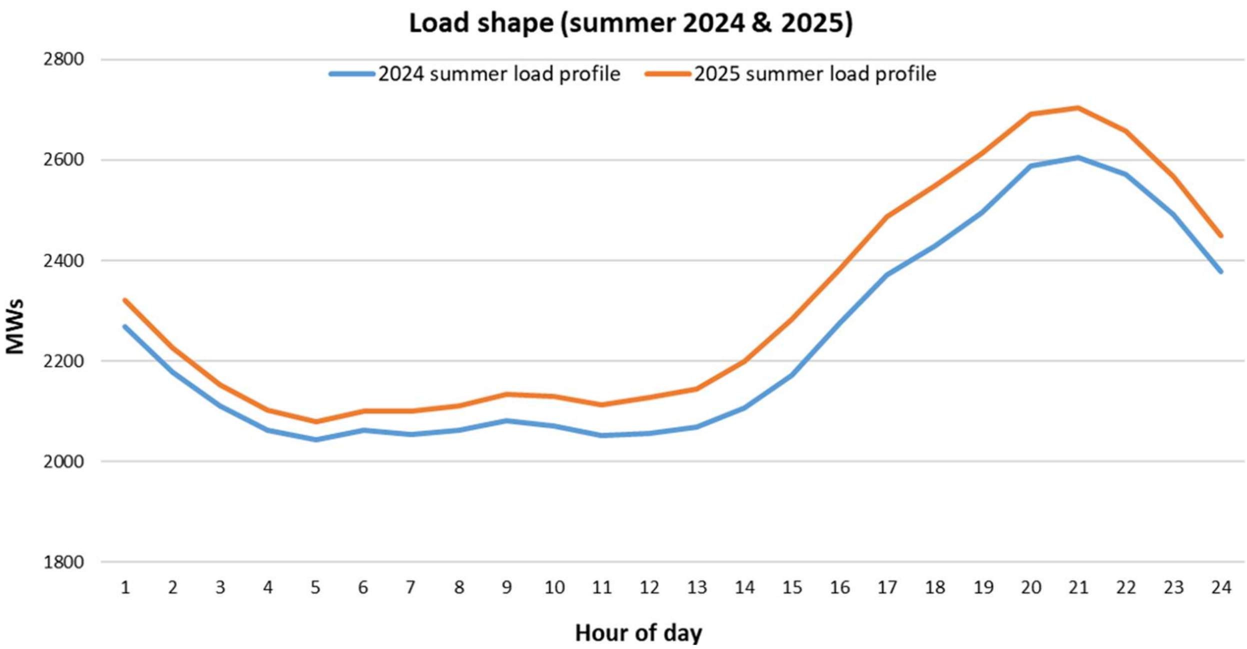
3.1 Growing Peak Electricity Demand

From a demand perspective, the daily pattern of electricity consumption in Puerto Rico is changing. Although the changes may not appear dramatic, even subtle shifts can have important implications on resource adequacy when the overall status of the electricity system is already under stress, as is the case for Puerto Rico.

One of the most notable sources of change in electricity demand in Puerto Rico is that households are increasingly installing rooftop solar photovoltaics (PV) systems – some coupled with battery energy storage systems – with the goal of reducing their monthly electricity bills and increasing personal reliability and resiliency of electricity supplies. To LUMA, the net effect of the installation of a growing number of customer-sited PV systems is to reduce volumes of electricity delivered from the grid during daylight hours. Notwithstanding reduced delivery volumes due to PV during daylight hours, peak demands on the electricity system during evening hours can continue to increase with greater adoption of PV, and this appears to be occurring in Puerto Rico. This is the case even though a growing number of residential PV systems in Puerto Rico are being deployed with battery energy storage systems, suggesting that households are not (at least yet) using energy storage to reduce electricity purchases from the grid during evening hours.

Even though rooftop PV systems do reduce aggregate electricity volumes delivered by the grid over the course of the year, the addition of PV systems does not materially improve Puerto Rico electricity resource adequacy. This is because resource inadequacies manifest themselves most critically during peak demand hours and the daily peak of electricity demand in Puerto Rico occurs after the sun has set, when PV cannot supply electricity to help other capacity resources to meet peak demand needs on the system. Figure 2 illustrates the hour-by-hour profile of systemwide electricity demand in Puerto Rico for the average day during the six-month period between May 1 and October 31 for both 2024 (i.e., one year prior to the forecasting horizon of this assessment) and estimated for 2025. As is evident, the daily peak of electricity demand occurs in hours 20 (hour ending 2000 or 8 pm) and 21 (hour ending 2100 or 9 pm), well after sunset when PV systems do not produce electricity.

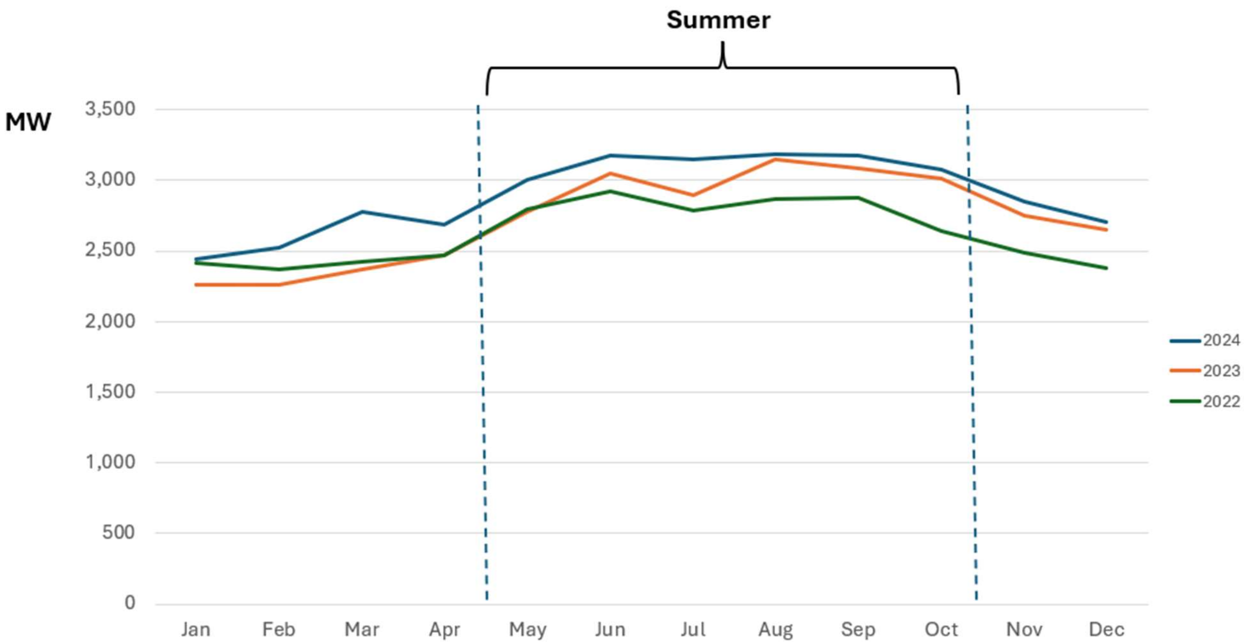
Figure 2: Hour-by-Hour Systemwide Electricity Demand on Average Summer Day



As is the case with most electric utilities in the U.S., peak electricity demands are heavily driven by customer use of air conditioning to cool their buildings. Moreover, air conditioning demands are not confined to afternoon hours when temperature peaks. Indeed, in many places (including Puerto Rico), aggregate customer electricity demands for air conditioning use reach their maximums in the evening as workers return home, begin preparing meals, and seek to cool their homes for more comfortable leisure and sleeping.

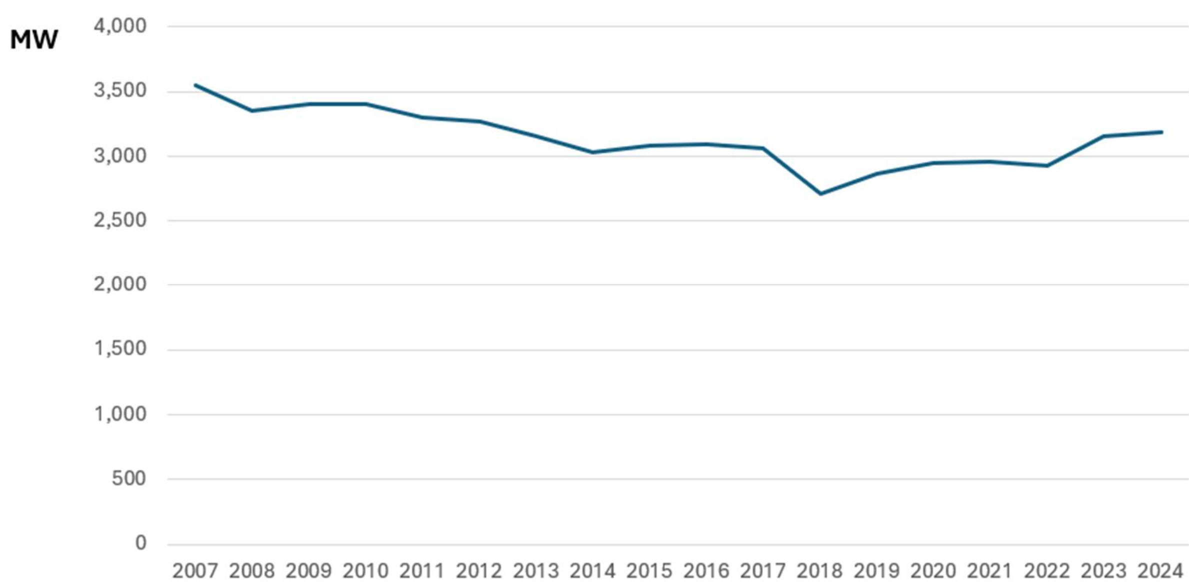
In turn, this means that the highest electricity demands of the year in Puerto Rico occur during the summer, corresponding to days that are especially hot and humid. Figure 3 presents the peak demand levels in each month of the last three calendar years, showing that the highest peak demands during months May through October are substantially higher than the peak demands that occur in each of the other months of the year.

Figure 3: Monthly Peak Demand Levels on Puerto Rico Electricity Grid



Importantly, annual peak electricity demand in Puerto Rico appears to be growing again after many years of decline. Seemingly hitting bottom in 2018 at 2,705 MW due to the after-effects of Hurricane Maria, annual peak electricity demand in Puerto Rico is once again consistently exceeding 3,000 MW, as shown in Figure 4.

Figure 4: Annual Peak Demand Levels on Puerto Rico Electricity Grid



Puerto Rico Electrical System Resource Adequacy Analysis Report – Summer Update

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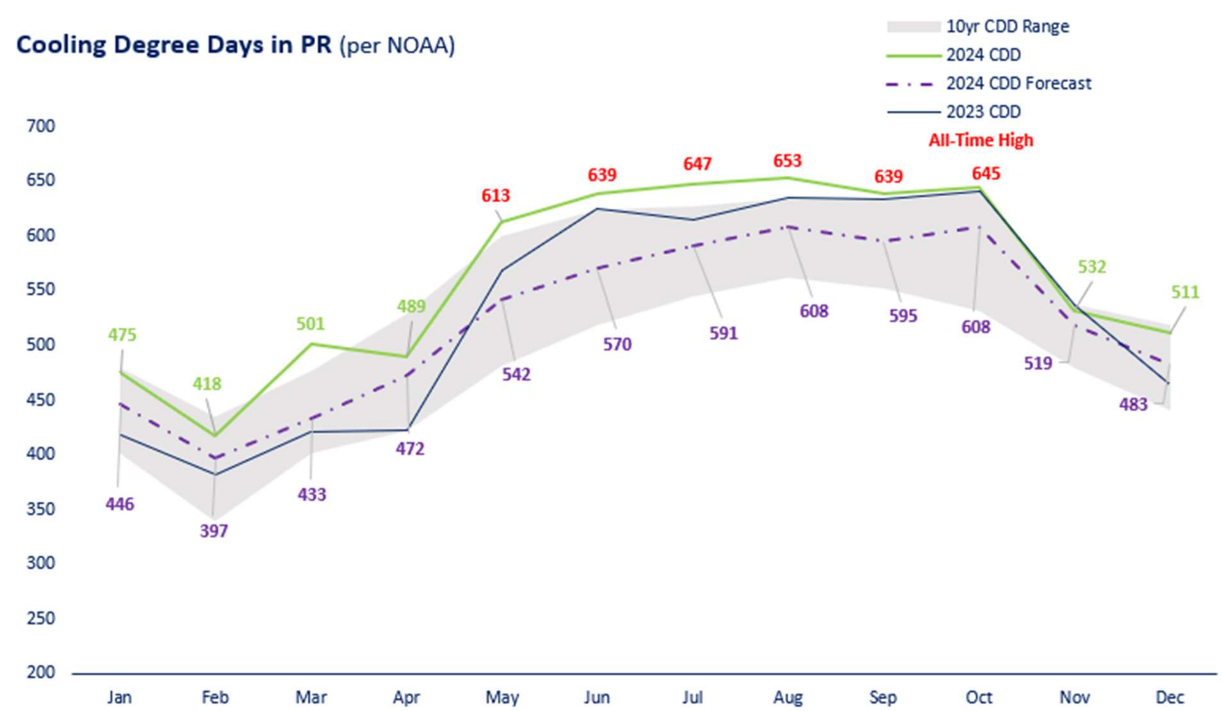
Although the underlying causes of the resumed growth in peak demand in recent years are not yet fully understood, LUMA believes that one driver of growth is increasing air conditioning penetration and use among Puerto Rican households. In turn, greater adoption and use of air conditioning in the Puerto Rico residential sector may have stemmed from the shift to work-at-home, which remains in effect for many workers, and economic incentives initiated during COVID to purchase air conditioners.

Compounding matters, Figure 5 shows that the last two summers in Puerto Rico – as measured in cooling degree days (CDD) – were notably hotter than historical norms, resulting in electricity demands above expected levels.

Figure 5: Monthly Cooling Degree Days in Puerto Rico During Recent Summers



Although it would be premature to state any conclusions definitively based on just a few summers of evidence, it is possible that climate change has begun to shift upwards the probability distribution of higher temperatures occurring during summer months in Puerto Rico. If this is the case, hotter summers will only serve to amplify the positive impact of increased air conditioning penetration on Puerto Rico peak electricity demand.

Given that forecasting of electricity demand is a vital function to be performed by every grid operator, LUMA continues to refine its demand forecasting approaches and capabilities on an ongoing basis and consequently updates its forecasts with regularity to better reflect the patterns of electricity consumption currently being observed in Puerto Rico. In LUMA's most recent forecast revision, peak demand during summer 2025 is projected to reach 3,184 MW, the same as actual summer 2024 peak demand, but a 7.8% increase relative to the maximum peak demand of 2,954 MW assumed in the FY25 Resource Adequacy Report. The 230 MW increase from what was anticipated as summer peak demand in the

FY25 Resource Adequacy Report is quite significant, as supplies on the Puerto Rico electricity system were deemed inadequate in that study, and each increment of peak demand further exacerbates the inadequacy. Moreover, the sensitivity to increases in peak demand is made even more acute by the fact that the supply resource situation in Puerto Rico has significantly deteriorated, as discussed further below.

3.2 Deteriorating Generation Availability

In any electricity system, demand is supplied by a fleet of power generation facilities. Each facility has a "nameplate" rated capacity in MW, which was established when the facility was initially commissioned, based on the then-new equipment that was installed.

The aggregate nameplate capacity of all the installed power generation facilities supplying to LUMA, including both fossil and renewable facilities – is 5,749 MW. Based on this value, relative to the peak demand of 3,184 MW (both actual 2024 levels and projected summer 2025 levels), one might be led to believe ample supplies of electricity generation in Puerto Rico are (or at least should be) readily available. However, the sum of nameplate capacity values from any set of generation facilities significantly overstates the aggregate capacity actually ever available to deliver electricity from that set of facilities to the electricity grid. In the case of Puerto Rico, the difference between aggregate nameplate capacity and actual available capacity is dramatic.

Two sets of considerations must be accounted for when assessing the true available capacity of an electricity system: (1) "dependable" capacity of each unit in the generation fleet and (2) outages when facilities are simply unavailable to operate.

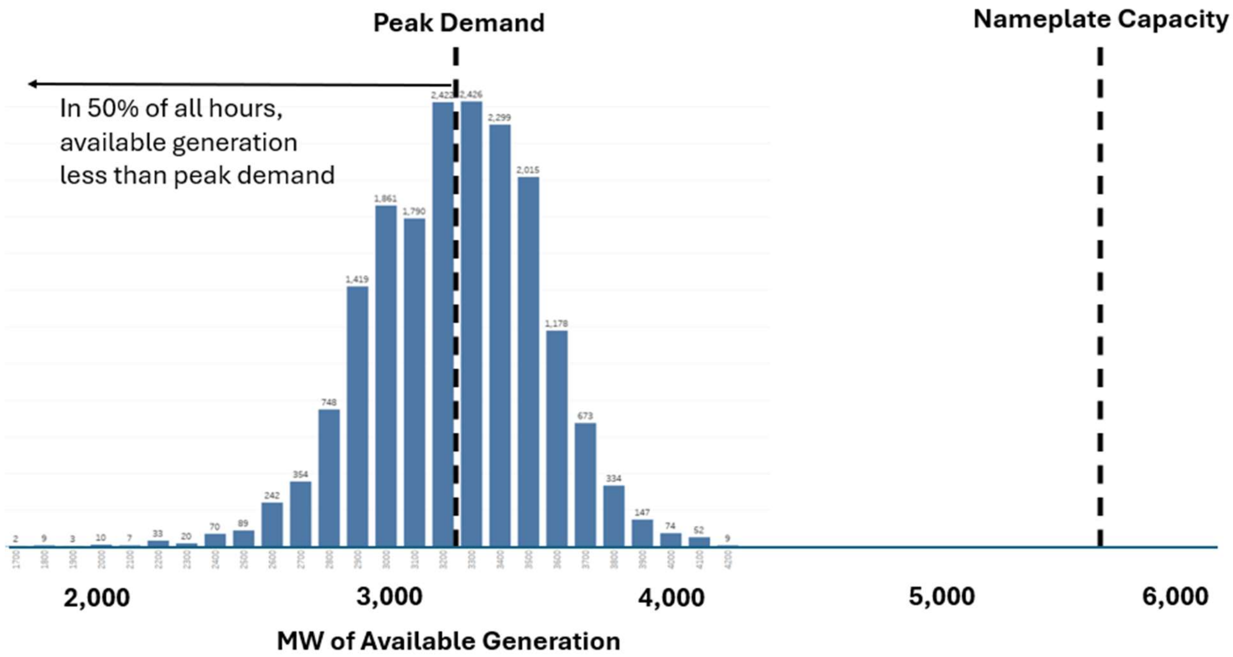
- **Dependable capacity: The** nameplate capacity rating of a powerplant is based on the theoretical performance of brand-new equipment as measured in the factory. Over time, after years of wear-and-tear, the level of dependable capacity will tend to deteriorate further, such that power generation owners often "derate" the capacity that the facility is stated to be able to produce. For renewable energy facilities, the concept of dependable capacity must be expanded to also consider the expected availability of wind or sunshine in the hour of peak demand. To illustrate, as discussed above, because PV cannot be relied upon to deliver any capacity after sunset, it does not contribute to available capacity during the evening hours, which in Puerto Rico is when peak demand occurs. All told, the dependable capacity of a power generation facility is less – and sometimes far less – than nameplate capacity.

- **Outages: As** is the case with any machine, any power generation facility will be operational less than 100% of the time. Routine preventative maintenance must periodically be performed and worn, or damaged components must occasionally be replaced. Ideally, maintenance and minor repairs can be undertaken during "planned outages", when the facility is shut down in an orderly fashion at a time when the electricity system can best accommodate its absence until restorative work is complete. In more extreme or severe cases, the facility unexpectedly suffers a major failure and is required to immediately shut down in a "forced outage", whose duration will depend upon the nature of the failure and the ability to obtain necessary resources (labor and equipment, often very specialized) to restore operational capability. By definition, the timing of forced outages is unpredictable, which means that resource adequacy must be evaluated using probabilities and statistical methods – including accounting for possibilities that multiple power generating facilities can become unavailable at the same time due to independent forced outages.

When these two sets of considerations are applied to the old and fragile power generation fleet in Puerto Rico, any impression that nameplate ratings may provide about overall capacity abundance is significantly diminished.

For this interim resource adequacy assessment, LUMA undertook a thorough reassessment of the fossil powerplant fleet, which represents over 90% of the net dependable power generation capacity directly supplying LUMA. For each unit in the Puerto Rico fossil powerplant fleet, hourly actual operating data from 2023 and 2024 was reviewed to update assumptions on dependable capacity and forced outage rates. Assumptions about dependable capacity were revised upwards for some units and downwards for others, with the net change across all units being minimal. More substantively, assumptions about forced outage rates – the probability in any given hour that the unit will experience a failure requiring immediate shutdown – were adjusted for virtually all units to reflect actual trends. Actual operating data from the island's powerplant fleet – including both fossil and renewable generating facilities – provides a clear illustration of true capacity availability in Puerto Rico compared to nameplate capacity ratings. Figure 6 presents the distribution of over 18,000 hours of systemwide electric generation capacity availability since the beginning of 2023.

Figure 6: Average Hourly Capacity Availability in Puerto Rico Since January 2023



Note: Data from January 1, 2023, through January 31, 2025, N=18,286 hours)

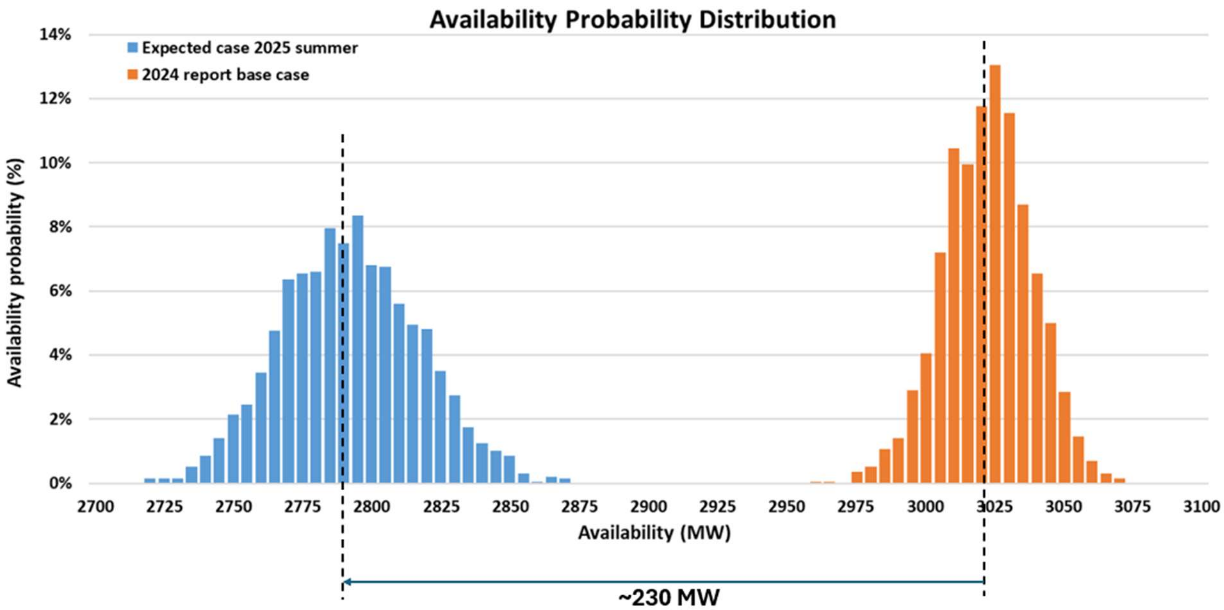
The data above reveals that the total amount of available capacity to supply electricity to the Puerto Rico electricity grid -- including both fossil and renewable facilities -- never exceeded 4,200 MW during 2023 and 2024. Put another way, the maximum (and rarely achieved) capacity available in Puerto Rico was more than 1,500 MW less than the rated nameplate capacity of the generation fleet. Indeed, in 50% of all hours, available capacity was less than the amount necessary to meet actual peak demand of 2024 and the expected peak demand for 2025.

Thus, a simplistic view of Puerto Rico generation availability based solely on nameplate capacity far exceeding peak demand does not accurately reflect the true ability of supplies to meet demand. This contrast stems from the fact that most of the island's electric generating facilities are not only old but also in poor mechanical condition, having suffered from years of underinvestment. Many of these facilities are subject to frequent forced (unplanned) outages, some of which can be lengthy. Even when operational, many of these facilities can dependably operate only at capacity levels substantially below their nameplate ratings.

As LUMA was finalizing assumptions in February 2025 while preparing to conduct the analyses for this updated resource adequacy assessment, Genera's Aguirre 1 unit (450 MW nameplate rated capacity) suffered a fire that catastrophically damaged its generator, such that the unit will be unavailable for at least a year. Reflecting this critical development, this interim resource adequacy assessment assumes that Aguirre 1 will not be available to supply electricity to the Puerto Rico electricity grid during summer 2025. As will be discussed further below, the loss of Aguirre 1 has a significant negative impact on resource adequacy, thereby greatly increasing the frequency and duration of load shed events that are likely to occur during summer 2025.

Between the loss of Aguirre 1 and the increase in historic forced outage rates of the fossil powerplant units, the amount of available generation capacity in this resource adequacy study is much lower than was the case for the FY25 Resource Adequacy Report. As shown in Figure 7, on average for all hours across all simulations, the total generation capacity available to serve Puerto Rico electricity demands net of outages has fallen since the FY25 Resource Adequacy Report by about 230 MW – a very significant reduction in capability for an electricity system with a peak demand of approximately 3,200 MW that was already resource deficient.

Figure 7: Reduction in Hourly Generation Capacity Availability in Puerto Rico



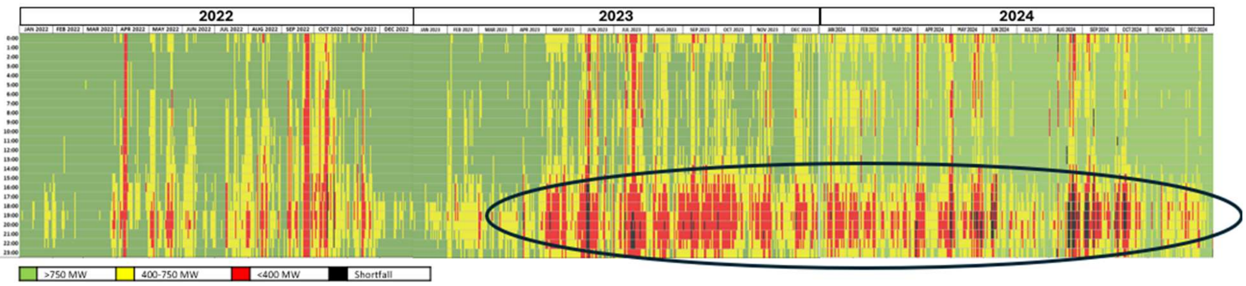
Not only has average generation capacity availability decreased by about 230 MW, but it is also evident that the probability distribution of capacity availability has widened, meaning that downside possibilities in capacity availability have become more extreme.

4.0 Summer 2025 Resource Adequacy

As is evident from the discussion above, changing circumstances have worsened Puerto Rico's electricity resource adequacy relative to LUMA's previous assessments. Deterioration in the availability of generation facilities, in combination with growth in peak electricity demand, can only mean that there will be more occasions when electricity supplies will be inadequate to serve the needs of Puerto Rico customers. In turn, this implies a higher incidence of MLS activity during which customers will be without electricity service.

The trend toward increasing generation shortfall load shedding is revealed by reviewing the steady deterioration of generating capacity reserves. As discussed in the FY25 Resource Adequacy Report, capacity reserves are defined as the amount of generation capacity online in excess of instantaneous demand, and policies set by LUMA's System Operations Principles state that there should be at least 650 MW of capacity reserves available in short notice to cope with the possibility that a generator currently supplying electricity to the Puerto Rico grid may fail. With an increasing number of hours in which capacity reserves are inadequate – such as the increasing prevalence of red areas in Figure 8 denoting "emergency operating conditions" in which capacity reserves have fallen below 400 MW during the last two years – it is apparent that capacity reserves on the Puerto Rico electricity system have been steadily falling, with shortfalls becoming commonplace curing evening hours.

Figure 8: Declining Capacity Reserves on Puerto Rico Electricity Grid Since 2022



It should be noted here that LUMA does not always invoke load shedding when capacity reserves fall below any fixed threshold such as the 650 MW stipulated in LUMA's System Operations policies. As capacity reserves fall below key thresholds, most North American electric utilities are required by North American Electric Reliability Corporation (NERC) standards to declare an emergency and interrupt service to some customers (i.e., shed load) if needed to resolve the emergency condition. LUMA chooses to not invoke this many load shed events, instead making real-time operating decisions by paying close attention to key system health indicators (e.g., frequency) and operating at higher risk levels than Prudent Utility Practices followed by North American utilities would otherwise allow. In other words, if LUMA were to invoke load shedding each time that capacity reserves fell below a designated threshold, load shedding incidence would have been significantly higher than actually occurred in prior years and would be much higher this summer than the findings below would suggest.

Given that peak electricity demands in Puerto Rico occur during the summer months to power air conditioning systems, generation shortfall load shedding activities will be most evident during the summer. Accordingly, this resource adequacy update focuses on how much load shedding activity can be anticipated to occur in Puerto Rico during the upcoming summer of 2025.

The two metrics for load shedding activity most commonly presented in this report are (1) loss of load events (LOLE) and (2) loss of load hours (LOLH). LOLE indicates the number of days in which manual load shedding occurs due to generation shortfalls, and LOLH indicates the cumulative number of hours that these load shed events will last. Forecasts of summer 2025 generation shortfall load shedding activity – both LOLE and LOLH – represent statistical expectations of resource deficiencies that would be severe enough to lead LUMA to invoke Manual Load Shedding (MLS) according to LUMA's System Operations Principles.

The LOLE and LOLH metrics, which reflect MLS events – the load shed events that correspond to these metrics – do not capture the full extent of generation-driven load shed events experienced by Puerto Rico electricity customers. In addition to MLS events, Underfrequency Load Shed (UFLS) events also occur, and have been averaging about three per month – although these events are strictly due not to resource inadequacy but to inadequate flexibility among the Puerto Rico generation fleet to always be able to instantaneously balance supply and demand on the grid. Outside the context of resource adequacy analysis, when discussing reliability of electricity service to customers, LUMA sometimes refers to all generation-related load shed events, which include both MLS and UFLS. However, for the purposes of this report specifically addressing resource adequacy, all historical data and all future projections of load shedding activity presented herein pertain only to MLS events (and the corresponding LOLE and LOLH values), as they are driven specifically by generation shortfalls.

Note further that all values of LOLE and LOLH presented in this report for summer 2025 are for the six-month period from May 1, 2025, to October 31, 2025. In contrast, all prior LUMA resource adequacy assessments covered a 12-month (not six-month) period corresponding to the PREPA fiscal year (July 1 to June 30). Therefore, it is not appropriate to directly compare the LOLE and LOLH values presented in this report covering six months to LOLE and LOLH values from prior resource adequacy reports spanning 12 months, as the values shown herein would need to be increased to account for the six winter months that were not assessed. It would also not be appropriate to simply double the values presented herein as an adjustment, because LOLE and LOLH levels will be lower in the uninvestigated winter months than in the summer months investigated in this report.

By definition, the future cannot be known with certainty. Resource adequacy is the result of many factors, and each factor is itself subject to considerable uncertainty. Because of this, it would be misleading to present any single value of any single measure of resource adequacy and claim it as "the forecast". Instead, a proper assessment of resource adequacy must be probabilistic in nature.

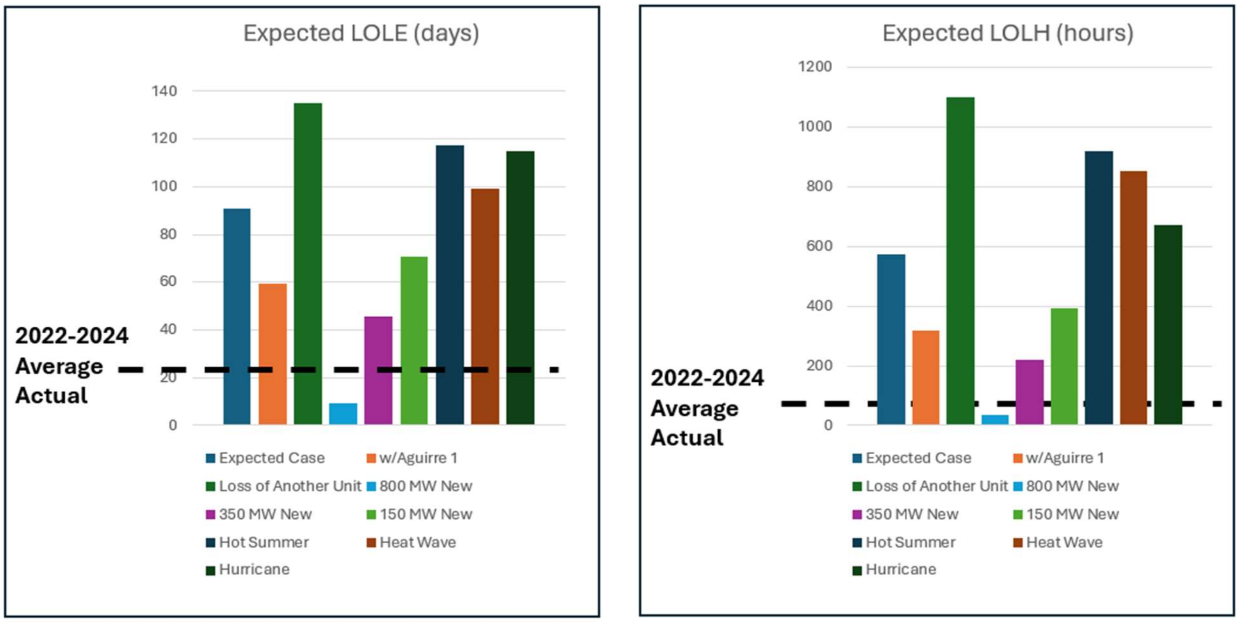
Using modeling techniques and approaches employed by leading electric utilities to conduct a probabilistic analysis of resource adequacy, LUMA's resource adequacy analyses address uncertainty in two ways:

- First, LUMA develops an "Expected Case" along with several sensitivity cases to illuminate how resource adequacy – as measured by estimated load shedding activity (for which LOLE and LOLH are good proxies) stemming from insufficient supply resources – would be affected if certain forces beyond LUMA's control were to arise.

- Second, for each "case", LUMA runs 2,000 simulations of the future in which estimates of LOLE and LOLH are calculated, from which averages and probability distributions of LOLE and LOLH can be presented to illustrate the range of potential load shedding activity that might happen if reality ends up mirroring the conditions associated with the case.

When looking across all cases run by LUMA for this resource adequacy assessment and evaluating the probability distributions for LOLE and LOLH that emerge from each case, it becomes clear that Puerto Rico will experience a significant increase in load shedding activity when this summer is compared to prior summers. As shown in Figure 9, estimated average LOLE and LOLH in all cases during summer 2025 (except one sensitivity case involving the addition of 800 MW of new capacity that almost certainly is infeasible to accomplish before May 1) will greatly exceed LOLE and LOLH values associated with actual load shedding activity that occurred in the three most recent summers.

Figure 9: Projected Increases in LOLE and LOLH for Summer 2025 Across All Cases



The following section presents the key findings and conclusions from all cases analyzed for this resource assessment, beginning with the Expected Case, followed by a comparison among the sensitivity cases that were investigated.

4.1 Expected Case

As of the writing of this report, the Expected Case presented herein should be considered as the baseline assessment of expected Puerto Rico resource adequacy during the summer of 2025. The Expected Case reflects LUMA's best modeling representation of the current state of the island's electricity generation fleet, along with the further assumption that (1) systemwide electricity demand materializes at forecasted levels and (2) no other major abnormal events occur. As a result, the Expected Case presents the best current estimate of the probability distribution and average values for LOLE and LOLH for Puerto Rico in the summer of 2025. As such, the findings from the Expected Case warrant detailed discussion here.

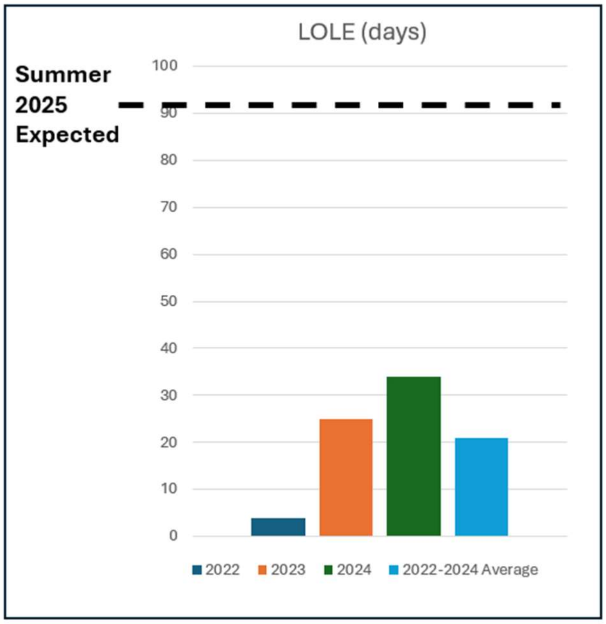
As is the case with all resource adequacy analyses, results are critically dependent upon assumptions. Major assumptions associated with the Expected Case are discussed in detail in Section 7.

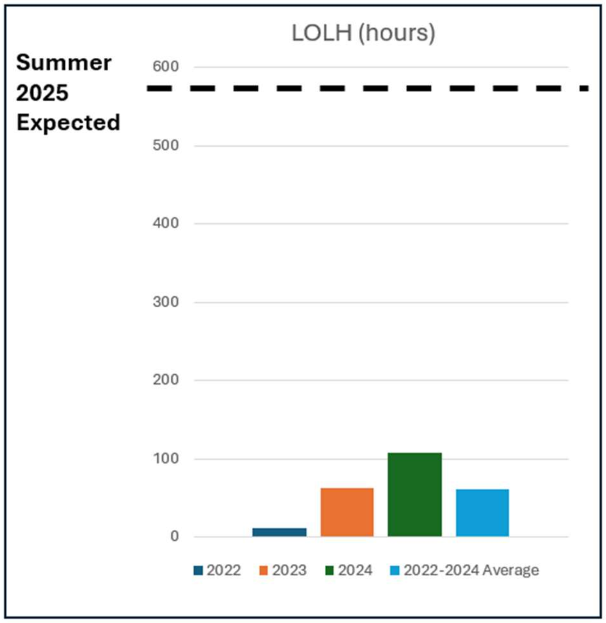
Probably the most important assumptions for assessing Puerto Rico's electricity resource adequacy are those relating to the likely performance of the island's legacy thermal electric generating fleet owned by PREPA.

Based on LUMA's experience as system operator for the Puerto Rico electricity grid since June 2021, it is almost always the case that at least one of the legacy PREPA baseload units is out of commission at any moment in time. Thus, even before the recent loss of Aguirre 1, LUMA was preparing to run the Expected Case under the assumption that one of the island's large baseload units would be unavailable for the duration of the summer. In the wake of the loss of Aguirre 1, LUMA's Expected Case now assumes that Aguirre 1 plus a large baseload unit are not available for the summer of 2025.

Amplified by the loss of Aguirre 1, Puerto Rico resource adequacy has deteriorated since the FY25 Resource Adequacy Report. The analyses presented herein make it increasingly evident that load shedding activity is projected to significantly increase for the summer of 2025 relative to previous summers. Figure 10 compares the expected levels of LOLE and LOLH yielded from the Expected Case to actual LOLE and LOLH achieved in recent summers.

Figure 10: LOLE and LOLH in Summer 2025 Expected Case Relative to Prior Summers

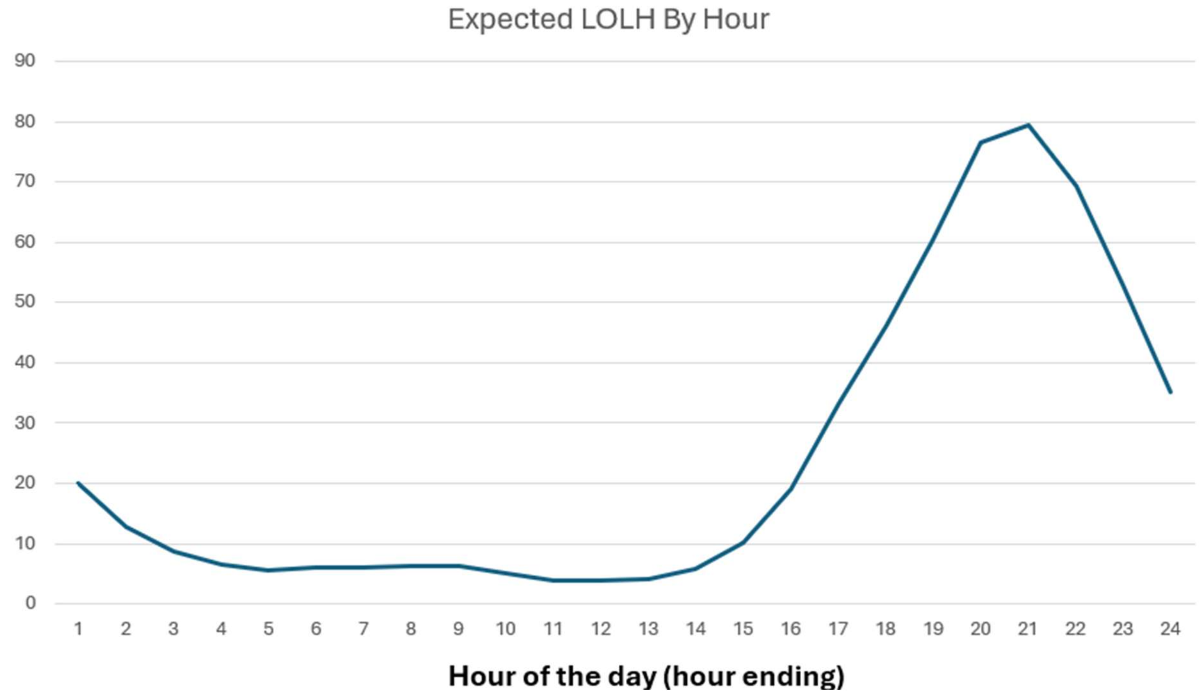




Between May 1 and October 31 during the last three summers (2022, 2023 and 2024), there were an average of 21 days in which MLS events occurred, whereas that number is expected to almost triple (to 93 days, or approximately every other day) during the same period in 2025. During the last three summers, MLS events totaled 61 hours but are expected to increase by almost an order of magnitude (to 572 hours) this summer.

Consistent with findings from prior resource adequacy analyses, MLS activity is far more likely to occur during the evening hours – coinciding with the highest demand levels of the day – than other hours of the day. Figure 11 shows expected LOLH for the Expected Case by hour of the day, peaking in hour 21 (hour ending 2100 or 9 pm). In summary, there will likely be many load shed events due to resource inadequacy this summer, and most of them will likely occur between 6 pm and midnight.

Figure 11: LOLH in Summer 2025 Expected Case by Hour of the Day



On a month-by-month basis over the course of the coming summer, under conditions reflected by the assumptions of the Expected Case, Puerto Rico is likely to be most vulnerable to MLS activity during July. In the single month of July, expected LOLE for the Expected Case is 21 days (roughly two days out of every three) and expected LOLH is 156 hours (about 21% of all hours in the month, or 6.5 days of cumulative duration).

The difficulties likely to be encountered in July are especially apparent in Figure 12, which shows that average capacity reserves during the evening hours on an average day in July in the Expected Case are expected to be negative, implying that load shedding activity due to resource inadequacy during July evening hours will be highly likely.

It is important to note that the values presented in Figure 12 reflect the average capacity reserves in each hour when averaged across all days of a given month, whereas the resource adequacy analyses presented herein involve modeling reserves on an hour-by-hour basis to more accurately represent the risks of generation shortfalls relative to demand in any hour. Thus, there will be days in any month when available capacity reserves in a given hour will be lower than presented in Figure 12.

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Figure 12: Average Capacity Reserves (MW) by Hour and Month in Expected Case

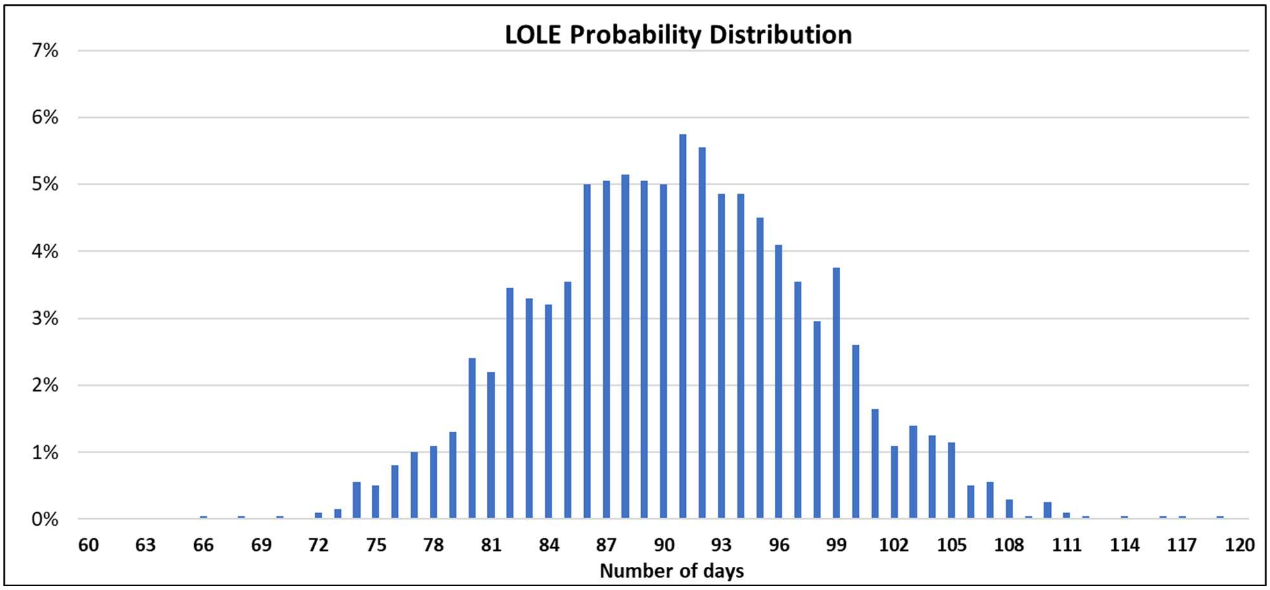
Expected Case							
	May-25	Jun-25	Jul-25	Aug-25	Sep-25	Oct-25	Avg by hour of day
1	473	403	220	466	594	483	**440**
2	568	476	315	577	680	583	**533**
3	643	519	400	674	736	648	**603**
4	682	559	456	735	780	700	**652**
5	707	583	485	758	794	716	**674**
6	684	576	479	732	773	684	**655**
7	683	581	497	745	771	663	**657**
8	671	570	484	755	796	695	**662**
9	679	571	494	759	814	716	**672**
10	704	594	539	807	856	751	**709**
11	747	627	591	859	888	776	**748**
12	756	633	602	876	884	761	**752**
13	742	614	607	872	867	740	**740**
14	668	565	565	823	800	659	**680**
15	560	498	469	708	691	547	**579**
16	445	414	344	560	559	397	**453**
17	319	326	218	375	445	256	**323**
18	248	251	127	235	364	176	**234**
19	191	169	39	129	275	92	**149**
20	97	86	**-90**	17	213	66	**65**
21	90	53	**-134**	**-6**	216	81	**50**
22	127	122	**-94**	55	264	141	**102**
23	207	206	**-17**	151	364	251	**194**
24	331	298	84	290	482	372	**310**
Monthly avg	**501**	**429**	**320**	**540**	**621**	**498**	
Average reserves at peak load	**90**	**53**	**-134**	**-6**	**213**	**66**	

July is anticipated to be the most challenging month for the Puerto Rico electricity grid this summer under the Expected Case not because peak demand occurs then – it is actually forecasted for August, although July demand levels are very nearly as high – but because the current planned outage schedule for the generation fleet used in the Expected Case anticipates a large amount of capacity (AES 1, Palo Seco 4, San Juan 7, and San Juan 9) that was planned to be offline during July, with several of those units returning to service during August. LUMA's experience is that month-by-month forecasting of resource adequacy is subject to variability because outage schedules are subject to adjustment based on then-prevailing conditions.

To illustrate, the AES 1 outage that had been planned to begin in July is currently being rescheduled due in large part to the findings of this resource adequacy analysis. Thus, the resource adequacy levels presented above for July under the Expected Case may actually occur in August instead of July, and vice versa. More important than monthly forecasts of resource adequacy and corresponding load shedding activity are the cumulative values of expected LOLE and expected LOLH over the entire summer, and as shown previously, LUMA's experience has been that its cumulative forecasts of resource adequacy over a multi-month period have generally been fairly accurate, as month-to-month variability tends to cancel itself out.

Though informative, the above values for expected LOLE and LOLH under the Expected Case are insufficient to fully understand the resource adequacy situation in Puerto Rico. As was discussed above, it is somewhat oversimplistic to gauge resource adequacy by looking only at the singular values of expected LOLE and expected LOLH. Rather, a more holistic view of resource adequacy is gained by reviewing the probability distribution of LOLE for the Expected Case, as shown in Figure 13.

Figure 13: Probability Distribution for LOLE in Summer 2025 Expected Case



As can be seen from the above figure, there is about a 95% probability that, under Expected Case conditions, the number of days with MLS events during the summer of 2025 will end up between 74 and 108 days. This is in contrast to 34 actual days of MLS events during the summer of 2024, and 21 days of MLS events on average across the past three summers.

4.2 Sensitivity Cases Compared to Expected Case

Complementing the Expected Case, sensitivity cases have been developed to assess the implications on resource adequacy if (1) the availability of generating capacity units was substantially worse than expected, (2) new generation capacity resources were added, (3) electricity demand ends up differing substantially from forecasted levels, and (4) a Category 3 hurricane (or other similarly disruptive natural disaster) occurs.

Eight sensitivity cases were developed and analyzed:

- Sensitivity cases with different assumptions about powerplant availability
  - With Aguirre 1 available
  - With the loss of another baseload powerplant unit for the entire summer beyond the outages assumed in the Expected Case
- Sensitivity cases assuming the addition of new generation on an emergency basis (consistent with Genera's recent emergency request to obtain 800 MW of new capacity as quickly as possible)
  - 800 MW of new capacity (almost certainly unobtainable by summer 2025)
  - 350 MW of new capacity
  - 150 MW of new capacity
- Sensitivity cases with different assumptions about electricity demand
  - Hot summer: all hours with electricity demand 5% above forecast
  - Extreme heat wave: all hours of one month (August) with electricity demand 10% above forecast
- Category 3 hurricane scenario: A hurricane impacting Puerto Rico (assumed to occur on September 1), causing extensive damage across the powerplant fleet

Detailed statistical results from each of these sensitivity cases, along with the Expected Case, are provided in Section 6.06.

Note that each sensitivity case was defined to examine in isolation the impact on resource adequacy if only one set of assumptions was varied from the assumptions used in the Expected Case. Of course, it is possible that – as the summer of 2025 actually plays out – Puerto Rico could witness a combination of circumstances in which multiple factors will have deviated from the sets of assumptions made in the Expected Case. For instance, if actual powerplant availability turns out to be lower than assumed in the Expected Case and if actual electricity demand turns out to be higher than assumed in the Expected Case, the negative implications on resource adequacy will be more severe than those suggested by the two sensitivity cases that independently investigate the effects of lower powerplant availability and higher electricity demand.

Table 1 below summarizes estimated LOLE and LOLH for each of the eight sensitivity cases described above, as well as for the Expected Case.

Table 1: Summary of Results for All Summer 2025 Cases

Summer 2025 Sensitivity Cases	Loss of Load Events (# of days)	Loss of Load Hours (# of hours)
Summer 2025 Expected Case	92.9	572.1
Sensitivity w/Aguirre 1	59.3	318.6
Sensitivity w/Loss of Another Baseload Unit	134.9	1,101.6
Sensitivity w/800 MW of New Capacity	9.4	34.1
Sensitivity w/350 MW of New Capacity	45.4	220.4
Sensitivity w/150 MW of New Capacity	70.6	391.4
Hot Summer Sensitivity	117.4	918.3
Extreme Heat Wave Sensitivity	99.0	850.8
Category 3 Hurricane Scenario	115.1	672.7

As can be seen from Table 1, the only sensitivity cases in which expected LOLE and LOLH decline from the Expected Case are the cases in which the generation supply perspective is more optimistic than truly anticipated:

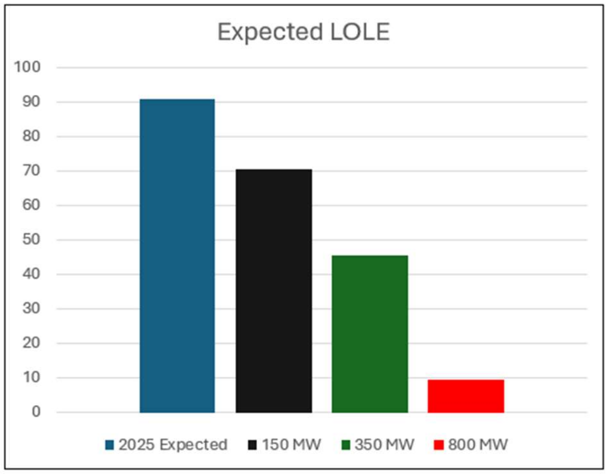
- The sensitivity case that assumes Aguirre 1 is available, and
- The three sensitivity cases involving the installation of new emergency generation capacity.

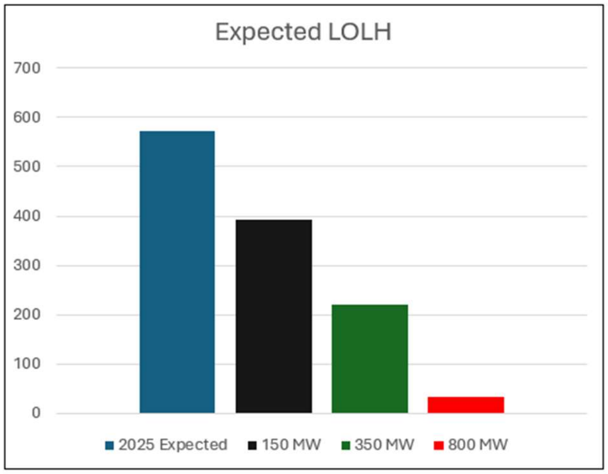
The sensitivity case involving the availability of Aguirre 1 is plainly impossible due to the prolonged repairs that are universally acknowledged to be necessary, and the case was only investigated to estimate the incremental impact on Puerto Rico resource adequacy due to the loss of Aguirre 1. Analysis of this sensitivity case found that the effect of the loss of Aguirre 1 on expected grid reliability in Puerto Rico for the upcoming summer is significant, by increasing expected LOLE by 54% (from 59 days in the sensitivity case to 93 days in the Expected Case) and expected LOLH by 79% (from 319 hours in the sensitivity case to 572 hours in the Expected Case). Note that the loss of Aguirre 1 thus accounts for about half of the degradation in resource adequacy that emerges from the Expected Case relative to actual generation shortfall load events during the summer of 2024 (34 days totaling 108 hours).

Meanwhile, the three sensitivity cases involving the emergency addition of new generation capacity (150 MW, 350 MW and 800 MW) were developed and analyzed in response to the recent request to the Energy Bureau by Genera to obtain and install 800 MW of new capacity as quickly as possible. In a separate submission to the Energy Bureau, LUMA has identified the numerous challenges that accompany the addition of 800 MW of new capacity within just a few months. Nevertheless, LUMA saw the merit in analyzing the beneficial impact on resource adequacy that any addition would make and hence included such analysis herein. Because smaller amounts of new capacity are at least conceivable to be installed before the summer, LUMA also analyzed two cases involving lesser quantities of new capacity (350 MW and 150 MW) to provide insight into the incremental improvements in resource adequacy that would result from any emergency generation additions that could be accomplished.

As Figure 14 shows, 800 MW of new capacity addition would significantly reduce LOLE and LOLH relative to the Expected Case, enabling expected load shedding activity this summer to decline to 9 LOLE days and 34 LOLH hours, levels that are better than what was observed last summer (albeit still below levels commensurate with reliability standards employed by the U.S. electric utility industry). While smaller capacity additions offer less resource adequacy improvement, any capacity additions would help reduce what will be a very high number of MLS events this coming summer.

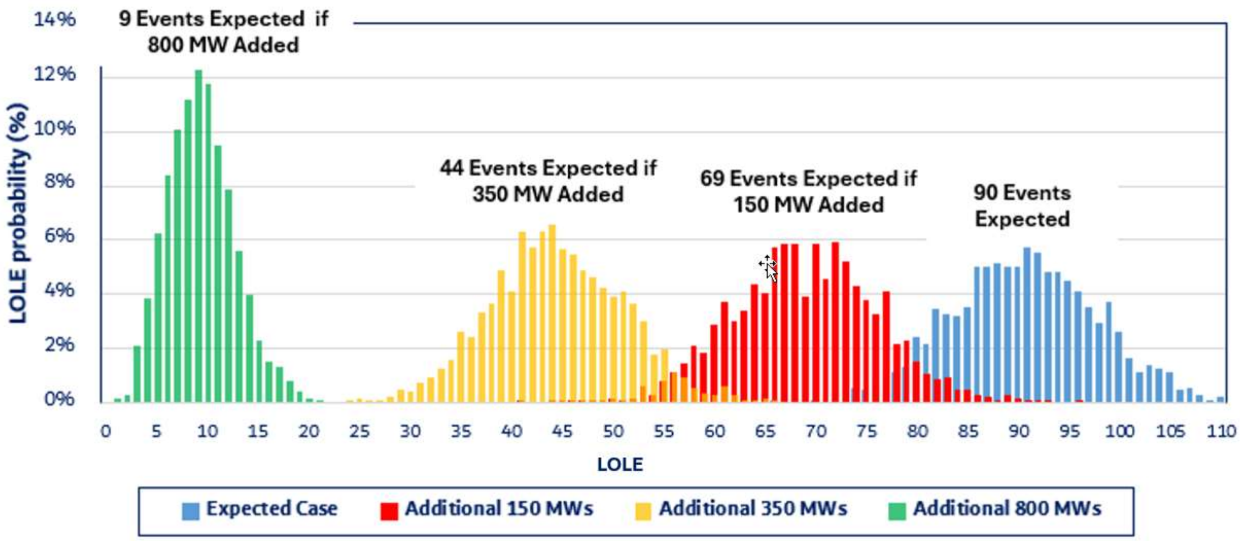
Figure 14: Impact of New Capacity Additions on Expected LOLE and LOLH in Summer 2025





Not only will new generation capacity reduce expected levels of MLS activity, but it will also reduce the variability in outcomes. As indicated in Figure 15, the addition of 800 MW new capacity not only would reduce expected LOLE from 90 days to 9 days in the summer of 2025, but it would also significantly narrow the potential variability in actual load shedding activity that might occur.

Figure 15: Reduced Expected LOLE and LOLE Variability with Capacity Additions



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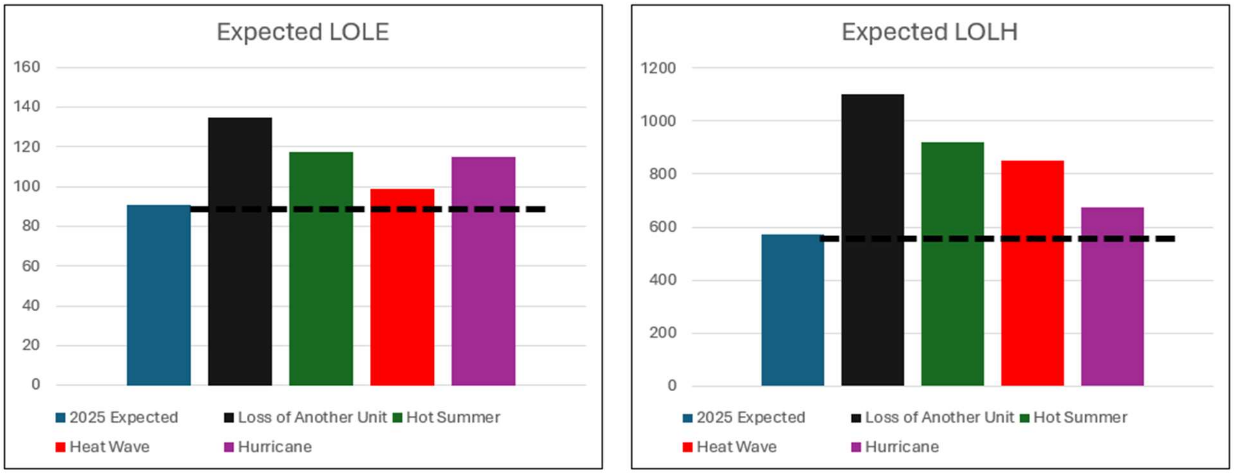
Meanwhile, the remaining sensitivity analyses – which were developed to investigate adverse scenarios for the Puerto Rico electricity grid – show (as expected) further worsening of resource adequacy relative to the findings from the Expected Case. Estimates of LOLE and LOLH for this summer from this set of adverse sensitivity cases are presented in Figure 16.

Figure 16: Impact of Adverse Sensitivity Cases on Expected LOLE and LOLH in Summer 2025



Note that the differences in expected LOLE and expected LOLH between the Expected Case and the Heat Wave sensitivity case all occur during the one summer month in which the heat wave is assumed to occur (August). Associated with this extreme heat wave, stemming from the assumption of a 10% increase in electricity demand for every hour in the month, peak demand is assumed to also be 10% higher than the Expected Case, reaching 3,502 MW. Thus, it is reasonable to infer that any extremely hot month this summer, holding all other assumptions constant, will produce roughly 8 additional LOLE days in that month – and more notably, that the duration of the corresponding load shed events in that month will increase by about 275 hours (equivalent to 11 full days). In other words, an extreme heat wave may only modestly increase the number of days with MLS events but will tend to make the average load shed event during the heat wave substantially longer in duration.

Note further the differences in expected LOLE and expected LOLH between the Expected Case and the Hurricane sensitivity case. Examining these differences further, a Category 3 hurricane (and its modeled impact on generation availability) is expected to cumulatively increase LOLE by about 24 days and LOLH by almost 346 hours compared to the Expected Case, and these effects are confined (by assuming the hurricane impacts Puerto Rico on September 1) to just the last two months of the forecast horizon. In other words, if a Category 3 hurricane were to hit Puerto Rico, it is reasonable to anticipate that MLS activity would worsen in the first month after the storm by perhaps 12 additional days and by perhaps 200 more cumulative hours relative to the Expected Case.

Of all the adverse sensitivity cases that were examined, the most dire would be the loss of yet another baseload unit for the entire summer beyond the two assumed (Aguirre 1 plus one other baseload unit) in the Expected Case. Having three major powerplant units out of service for the entire summer – well within the realm of possibility, given that Aguirre 1 is certainly out – is estimated to cause expected LOLE to reach 135 days (three days out of every four during the six-month period investigated) and expected

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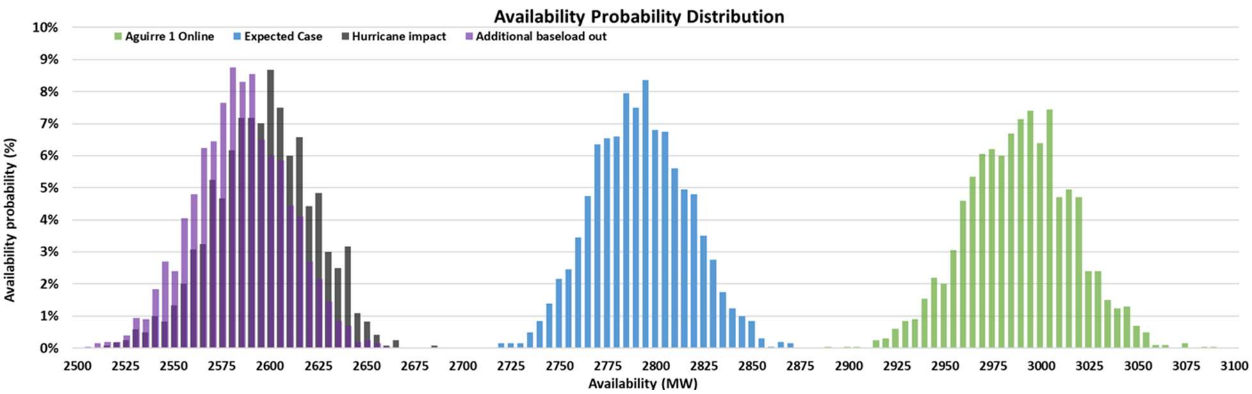
LOLH to reach 1,102 hours (equivalent to 46 days of cumulative load shed event duration during the 184 day period between May 1 and October 31).

The major deterioration in resource adequacy that would result from the loss of another baseload generation unit is evident from Figure 17, which shows how the probability distribution of available capacity is reduced (i.e., shifted to the left) by over 200 MW from Expected Case levels – which as noted above, had already been reduced by about 230 MW from levels assessed in the FY25 Resource Adequacy Report.

Figure 17: Probability Distributions of Available Capacity Under Alternative Cases



The implication is that reserve capacity deficiencies – and consequently the vulnerability to the need to initiate load shedding – should be anticipated every day of the summer if another large baseload unit is lost for the entire summer, as is revealed by the prevalence of black cells indicating electricity demand exceeding available supply, as shown in Figure 18.

Figure 18: Average Capacity Reserves (MW) With Loss of Another Baseload Unit

Hour	May-25	Jun-25	Jul-25	Aug-25	Sep-25	Oct-25	Avg by hour of day
1	333	192	6	225	369	262	231
2	427	266	102	336	455	362	325
3	503	308	186	433	511	427	395
4	543	348	244	493	555	478	443
5	567	371	274	517	569	494	465
6	544	364	268	491	548	462	446
7	543	369	286	504	547	441	448
8	532	358	273	515	572	472	454
9	538	360	282	519	590	493	464
10	564	383	327	567	632	527	500
11	607	416	379	619	663	553	540
12	616	422	390	636	660	538	544
13	603	404	393	633	641	517	532
14	529	355	353	583	575	437	472
15	420	289	256	469	465	325	371
16	305	205	131	322	333	176	245
17	180	117	4	136	219	35	115
18	108	41	-86	-3	139	-45	26
19	51	-40	-175	-110	50	-129	-59
20	-44	-124	-303	-221	-12	-155	-143
21	-51	-156	-348	-245	-9	-140	-158
22	-14	-89	-309	-185	38	-80	-106
23	67	-5	-232	-89	138	29	-15
24	190	87	-131	49	257	151	101
Monthly avg	**361**	**218**	**107**	**300**	**396**	**276**	
Avg reserves at peak load	**-51**	**-156**	**-348**	**-245**	**-12**	**-155**	

5.0 Discussion and Conclusions

The findings of this resource adequacy assessment make clear that tougher times are almost certainly ahead this summer for the Puerto Rico electricity system – and by extension, for Puerto Rico.

While peak demand growth in contributing to the reduction of resource adequacy, the primary root cause of resource inadequacy in Puerto Rico remains that the island's fleet of large legacy baseload units – the critical lynchpins of the system's electricity supply – are unreliable due to years of being operated aggressively despite underinvestment in maintenance, repairs and capital upgrades. Many units are well beyond retirement age and should be replaced as soon as practicable. It is difficult to see many of these units being repaired to achieve even fair levels of reliability. Even if they were robustly repaired, they employ mid-20th Century steam boiler technology that burns fuel inefficiently, produces high levels of air emissions, and cannot rapidly start up and modulate output to help the system operator instantaneously balance supply and demand.

The unreliability of these generating units is a phenomenon that compounds upon itself: when one unit goes down, all other units must work harder to compensate, and the additional stress imposed by hard duty further degrades capability. Over decades, the forced outage rates of these units have risen to levels far higher than typically observed in power plants elsewhere in the world. If powerplants with the same capacity profile were in operating condition comparable to powerplants on the U.S. mainland, forced outage rates would be much lower, and average generation availability to serve systemwide electricity demand would be much higher, thereby dramatically reducing the need to undertake load shedding activities. However, it is unrealistic to expect Puerto Rico's existing fleet of aged powerplants to be improved to reliability levels anywhere near North American electric utility industry standards. Indeed, historical operating data strongly suggests that the forced outage rates of Puerto Rico electric generating facilities are generally worsening – both becoming more frequent and longer in duration.

When preparing for this update to the resource adequacy assessment of Puerto Rico's electricity grid, LUMA's review of outage rates across the thermal generation fleet over the past two years confirmed the overall declining performance of the generation sector, as measured by forced outages. The forced outage rates used in the analyses presented herein were increased for many units in the Puerto Rico thermal powerplant fleet to reflect recent trends, with the increases netting out on average increase in forced outage rates of 3% across PREPA-legacy baseload units and 11% across the fleet of peaker units. The incorporation of higher forced outage rates across the power generation fleet translates to fewer MW of capacity available to supply demand in most hours of the year.

Additionally, note that an electricity system that is in a state as fragile as Puerto Rico's does not further deteriorate linearly. That is, losing 200 MW of resources in a system as stressed as Puerto Rico's is more than twice as harmful to system reliability as a loss of 100 MW. The Puerto Rico electricity system has already been operating at the outer bounds of statistically what can be expected to yield electricity service that is usually available, if not at standards of the North American electric utility industry. If the performance of Puerto Rico's electric generating fleet continues to worsen, the overall system's reliability will deteriorate at an accelerating pace.

One manifestation of this phenomenon can be observed by comparing the findings from the various sensitivity cases: as expected LOLE increases, expected LOLH proportionally increases more. In other words, as generation shortfall load shed events become more common, the average load shed event duration (represented by the ratio LOLH/LOLE) lengthens. An increasing LOLE indicates an electricity system that is more prone to generation shortfalls, which in turn logically means it will be more difficult to escape load shed conditions (i.e., to return enough generation resources to available status) and thereby restore adequate electricity supply to serve demand from all customers.

To illustrate, the average duration of the 34 MLS events caused by generation shortfalls in summer 2024 was a little over three hours, whereas Expected Case results for summer 2025 indicate that the average duration over 93 expected load shed event days is anticipated to double to more than six hours. Thus, a greater number of outages translates to each outage being longer in duration.

The degradation in resource adequacy is cumulative, worsening as more adverse developments accumulate not only will more load shed events occur, but the average and total length of load shed events will increase. Note that the loss of Aguirre 1 is estimated to have caused an increase in expected summer 2025 load shed event duration from 319 to 572 hours (a 79% increase), whereas the loss of yet another baseload unit (as evaluated in one of the sensitivity cases) would cause a further 92% increase on load shed duration to 1102 hours.

Another perspective to bear in mind: if losing another generation unit produces an increase in expected LOLE of 44 days relative to the Expected Case, and if a hot summer produces an increase in expected LOLE of 26 days relative to the Expected Case, it would not be appropriate to infer that the combination of another generator loss and a hot summer would increase expected LOLE by 70 (= 44 + 26) days. Instead, with this combination of adverse events, expected LOLE projections from resource adequacy modeling would certainly increase by considerably more than 70 days.

Unless upcoming repairs to Puerto Rico's generation facilities dramatically improve forced outage rates – and there is little evidence of this happening, based on recent historical experience – the worsening of resource adequacy is a vicious cycle that can only be broken by the addition of new "firm" resources that can be depended upon to contribute MW during peak hours. Ideally, the outcome of these additions would be a resource mix comprised of a larger number of assets in smaller increments of capacity, each of which offering greater operational flexibility. In turn, the addition of new resources requires sizable sums of capital and prolonged planning, procurement, delivery and installation phases of deployment. Improvements will therefore not come easily, cheaply or quickly.

Along with other forms of renewable energy, LUMA supports the deployment of additional PV resources to increase the supply of renewable energy to the island's electricity grid and thereby help Puerto Rico achieve its environmental objectives. This includes the addition of both large-scale PV systems selling electricity generation directly to LUMA and distributed PV systems located at customer premises. LUMA is working with the Energy Bureau and independent power producers to complete the commissioning of Tranche 1 PV projects and plan further projects in subsequent tranches. By streamlining interconnection processes, LUMA has facilitated a substantial growth in the adoption of distributed PV systems. Electricity generation from PV systems in Puerto Rico, both large-scale and distributed, is fully incorporated into the resource adequacy modeling presented herein.

While PV resources currently installed on Puerto Rico's electricity system make only a small positive contribution to resource adequacy, that can change if energy storage systems are adopted alongside PV, thereby enabling PV-generated electricity to be "time-shifted" from mid-afternoon hours to early evening hours when peak electricity demand occurs. Launched in late 2023, LUMA's Customer Battery Energy Sharing program (CBES) is designed to pilot how distributed PV-based electricity generation can begin to make a meaningful contribution to the island's resource adequacy when generation does not meet demand.

LUMA stands ready to work with Genera, the Energy Bureau and other stakeholders to identify and rapidly pursue pathways that will reduce the resource inadequacy challenge facing Puerto Rico. As one example, implementation of LUMA's Accelerated Storage Addition Program (ASAP) should bring 300-400 MW of new resources to Puerto Rico before the summer 2026 season. Although such additions will not get the Puerto Rico electricity grid to North American standards of reliability, they should restore service quality levels approaching those experienced in recent years. Beyond 2026, many plans for additional resources that can contribute to providing additional on-peak capacity are in play, and presumably some of these will be realized.

However, it is vital for all stakeholders in Puerto Rico to work together effectively and in good faith so that at least a significant fraction of future planned resource additions come to fruition in a timely manner – something that has not occurred in recent years. Failure to make progress in bringing significant volumes of new firm resources – generation additions, storage additions, and demand-side measures – to the Puerto Rico electricity grid that can reliably serve demands during peak hours will imply a high likelihood that load shedding activity levels far above North American standards will persist on the island for the foreseeable future.

6.0 Statistical Results from Each Case

For the Expected Case and for each of the sensitivity cases that were analyzed in this interim resource adequacy assessment, the following sections present key statistical results. Table formats are the same across the cases, facilitating the ability of the reader to select compare findings across cases to evaluate topics of particular interest.

6.1 Expected Case

Key statistical results from the Expected Case are presented in Table 2 below.

Table 2: Key Statistical Results from Expected Case

	May-25	Jun-25	Jul-25	Aug-25	Sep-25	Oct-25	Total or Average
LOLE (days)	13.65	14.93	21.87	17.25	9.60	15.58	**92.89**
LOLH (hours)	68.14	93.46	156.07	104.79	51.68	97.86	**572.00**
Avg. load shed duration (hours)	4.99	6.26	7.14	6.07	5.38	6.28	**6.16**
Peak demand (MW)	2871	2994	2982	3184	3038	3003	**3012**
Avg. capacity reserves at peak hour (MW)	89.73	53.30	-134.15	-5.97	213.30	66.35	**47.09**

6.2 Sensitivity Cases with Different Powerplant Availabilities

Relative to the Expected Case, two sensitivity cases were examined to investigate the impact of different assumptions about the availability of legacy PREPA baseload generating units: (1) a hypothetical scenario in which Aguirre 1 was not lost for the indefinite future, and (2) the loss of yet another baseload unit for the entire summer 2025 period.

6.2.1 With Aguirre 1 Available

Key statistical results from the sensitivity case in which Aguirre 1 is assumed to be available are presented in Table 3 below.

Table 3: Key Statistical Results from Sensitivity Case with Aguirre 1 Available

	May-25	Jun-25	Jul-25	Aug-25	Sep-25	Oct-25	Total or Average
LOLE (days)	13.46	8.50	14.19	11.01	4.95	9.27	**61.37**
LOLH (hours)	66.62	43.85	81.07	55.96	22.70	48.44	**318.63**
Avg. load shed duration (hours)	4.95	5.16	5.71	5.08	4.59	5.22	**5.19**
Peak demand (MW)	2871	2994	2982	3184	3038	3003	**3012**
Avg. capacity reserves at peak hour (MW)	94.99	271.69	83.31	207.83	429.81	284.71	**228.72**

6.2.2 With Another Baseload Unit Unavailable

Key statistical results from the sensitivity case in which another baseload unit is assumed to be unavailable for the entire summer – beyond the two units (Aguirre 1 and another baseload unit) already assumed in the Expected Case to be unavailable for the entire summer – are presented in Table 4 below.

Table 4: Key Statistical Results from Sensitivity Case with Another Baseload Unit Unavailable

	May-25	Jun-25	Jul-25	Aug-25	Sep-25	Oct-25	Total or Average
LOLE (days)	19.24	22.39	28.25	24.78	17.15	23.08	**134.89**
LOLH (hours)	142.97	192.45	277.17	189.02	114.19	185.78	**1101.57**

Avg. load shed duration (hours)	7.43	8.59	9.81	7.63	6.66	8.05	**8.17**
Peak demand (MW)	2871	2994	2982	3184	3038	3003	**3012**
Avg. capacity reserves at peak hour (MW)	-51.44	-156.32	-348.16	-245.25	-12.19	-155.12	**-161.41**

6.3 Sensitivity Cases with New Capacity Additions

In the wake of the loss of Aguirre 1, Genera submitted a request to the Energy Bureau to approve the pursuit of 800 MW of new generation capacity additions to be installed on an emergency basis as quickly as possible. To investigate the implications of new capacity additions on the resource adequacy findings of the Expected Case, LUMA conducted three sensitivity cases: (1) addition of 800 MW per Genera's proposal (although almost certainly unobtainable by summer 2025), (2) addition of 350 MW, and (3) addition of 150 MW.

Note that these analyses were focused solely on the implications of new capacity additions before May 1, 2025, on the expected resource adequacy of the Puerto Rico electricity grid for the summer 2025 season. No attempt was made to estimate the potential costs or feasibility of adding such capacity increments so that they would be ready to supply electricity to the Puerto Rico electricity grid by May 1, 2025.

6.3.1 800 MW of New Capacity

Key statistical results from the sensitivity case in which 800 MW of new capacity is installed before summer 2025 (as proposed by Genera) are presented in Table 5 below.

Table 5: Key Statistical Results from Sensitivity Case With 800 MW New Capacity

	May-25	Jun-25	Jul-25	Aug-25	Sep-25	Oct-25	Total or Average
LOLE (days)	1.00	1.29	2.93	2.14	0.56	1.53	**9.44**
LOLH (hours)	3.60	4.73	11.17	7.17	1.81	5.65	**34.13**
Avg. capacity reserves at peak hour (MW)	3.59	3.67	3.81	3.36	3.23	3.70	**3.61**
Peak demand (MW)	2871	2994	2982	3184	3038	3003	**3012**
Avg. capacity reserves at peak hour (MW)	750.62	713.64	527.88	655.79	874.76	731.13	**708.97**

6.3.2 350 MW of New Capacity

Key statistical results from the sensitivity case in which 350 MW of new capacity is installed before summer 2025 are presented in Table 6 below.

Table 6: Key Statistical Results from Sensitivity Case With 350 MW New Capacity

	May-25	Jun-25	Jul-25	Aug-25	Sep-25	Oct-25	Total or Average
LOLE (days)	5.82	6.97	12.09	9.05	3.82	7.64	**45.39**
LOLH (hours)	27.74	34.36	64.22	40.43	16.19	37.48	**220.42**
Avg. capacity reserves at peak hour (MW)	4.77	4.93	5.31	4.47	4.23	4.90	**4.86**
Peak demand (MW)	2871	2994	2982	3184	3038	3003	**3012**
Avg. capacity reserves at peak hour (MW)	363.01	320.72	138.72	265.77	483.77	336.34	**318.05**

6.3.3 150 MW of New Capacity

Key statistical results from the sensitivity case in which 150 MW of new capacity is installed before summer 2025 are presented in Table 7 below.

Table 7: Key Statistical Results from Sensitivity Case With 150 MW New Capacity

	May-25	Jun-25	Jul-25	Aug-25	Sep-25	Oct-25	Total or Average
LOLE (days)	9.74	11.09	17.45	13.65	6.81	11.86	**70.60**
LOLH (hours)	51.98	62.91	107.76	69.83	32.78	66.12	**391.38**
Avg. capacity reserves at peak hour (MW)	5.34	5.67	6.18	5.12	4.81	5.58	**5.54**
Peak demand (MW)	2871	2994	2982	3184	3038	3003	**3012**

Avg. capacity reserves at peak hour (MW)	205.71	167.75	-13.97	108.66	326.67	183.58	**163.07**

6.4 Sensitivity Cases with Different Demand Assumptions

Because peak electricity demand has such a significant impact on resource adequacy, LUMA investigated two sensitivity cases in which electricity demand assumptions were varied: (1) a "hot summer" sensitivity in which electricity demand in each hour of the summer was 5% above Expected Case levels, and (2) an "extreme heat wave" sensitivity in which electricity demand in each hour of one month (assumed to be August) was 10% above Expected Case levels.

6.4.1 Hot Summer

Key statistical results from the Hot Summer sensitivity case, in which electricity demand levels are assumed to be 5% above levels assumed in the Expected Case for each hour of summer 2025, are presented in Table 8 below.

Table 8: Key Statistical Results from Hot Summer Sensitivity Case

	May-25	Jun-25	Jul-25	Aug-25	Sep-25	Oct-25	Total or Average
LOLE (days)	18.68	19.86	25.99	21.58	14.16	20.14	**120.42**
LOLH (hours)	105.76	144.54	218.72	151.32	86.29	144.16	**850.79**
Avg. capacity reserves at peak hour (MW)	5.66	7.28	8.41	7.01	6.10	7.16	**7.07**
Peak demand (MW)	3015	3144	3131	3343	3190	3153	**3163**
Avg. capacity reserves at peak hour (MW)	-38.34	-82.34	-270.49	-147.38	74.34	-67.81	**-88.67**

6.4.2 Extreme Heat Wave

In contrast to the prior sensitivity case in which that the entire summer was assumed to be hotter than normal, this case investigates the effect of an intense albeit relatively brief heat wave. For the purposes of modeling, the extreme heat wave was assumed to occur in the month of August. Because this case differs from the Expected Case only in the month of August, all results presented below differ from the Expected Case only in the month of August. As such, the differences in results between this case and the Expected Case in the month of August are a good representation of the incremental impact on resource adequacy and load shedding activity of an extreme heat wave in any summer month. Note that peak demand during the extreme heat wave is assumed to exceed 3,500 MW, about 320 MW greater than peak demand assumed for the Expected Case.

Key statistical results from this Extreme Heat Wave sensitivity case are presented in Table 9 below.

Table 9: Key Statistical Results from Extreme Heat Wave Sensitivity Case

	May-25	Jun-25	Jul-25	Aug-25	Sep-25	Oct-25	Total or Average
LOLE (days)	13.78	15.08	21.86	25.10	9.59	15.61	**101.03**
LOLH (hours)	68.68	94.33	154.35	206.28	51.51	97.57	**672.71**
Avg. capacity reserves at peak hour (MW)	4.98	6.25	7.06	8.22	5.37	6.25	**6.66**
Peak demand (MW)	2871	2994	2982	3502	3038	3003	**3065**
Avg. capacity reserves at peak hour (MW)	88.09	49.65	132.02	-291.86	213.40	67.24	**-0.92**

6.5 Hurricane Scenario

Lastly, LUMA conducted a sensitivity case that aimed to model the impacts on the Puerto Rico generation fleet as if a Category 3 hurricane hit Puerto Rico on September 1, 2025. The assumptions and methodology of this sensitivity analysis mirrored the "Force Majeure Scenario" presented in the FY25 Resource Adequacy Report. Because this case differs from the Expected Case only in the months of September and October, all results presented below differ from the Expected Case only in the months of September and October.

Key statistical results from this Hurricane Scenario case are presented in Table 10 below.

Table 10: Key Statistical Results from Hurricane Scenario Sensitivity Case

	May-25	Jun-25	Jul-25	Aug-25	Sep-25	Oct-25	Total or Average
LOLE (days)	13.74	15.08	21.73	17.24	23.87	25.69	**117.35**
LOLH (hours)	68.00	94.07	154.44	104.83	240.10	256.84	**918.28**
Avg. capacity reserves at peak hour (MW)	4.95	6.24	7.11	6.08	10.06	10.00	**7.83**
Peak demand (MW)	2871	2994	2982	3184	3038	3003	**3012**
Avg. capacity reserves at peak hour (MW)	88.80	51.05	-130.01	-5.79	-174.04	-262.93	**-72.15**

7.0 Major Assumptions

To conclude this interim resource adequacy assessment, this section documents the critical assumptions that most heavily affect the results presented herein. As noted earlier in this report, there are two sets of assumptions that are vital to consider: supply-related assumptions and demand-related assumptions. Each of these will be discussed in turn below.

7.1 Thermal Generation Fleet Performance

The most important set of assumptions affecting these resource adequacy results yields the amount of capacity that can be anticipated at a moment in time to be available from Puerto Rico's thermal power generation asset base. Note that more than 90% of total capacity on the island is thermal generation, with most of the remainder being PV that can contribute only negligibly to resource adequacy because of inability to supply electricity during peak demand hours occurring after sunset.

Generating capacity actually able to serve electricity load is determined by (1) dependable capacity, which is less than nameplate rated capacity for most of the Puerto Rico fossil generation fleet (especially so for the PREPA legacy units) and (2) outages, which in turn are comprised of (a) planned outages already scheduled in order to make repairs and (b) forced outages, which – because they are random and unexpected events – cannot be accurately modeled deterministically but must instead be modeled probabilistically.

For each thermal generation facility in Puerto Rico, Table 11 presents the dependable capacity and forced outage rate assumptions for each fossil powerplant unit that were used in this resource adequacy assessment.

Table 11: Assumptions on Dependable Capacity and Forced Outage Rate for Power Plants

Generator Name	Start of Operations	Fuel	Nameplate Capacity (MW)	Dependable Capacity (MW)	Forced Outage Rate (%)
AES 1	2002	Coal	227	227	10
AES 2	2002	Coal	227	227	15
Aguirre Combined Cycle 1	1977	Diesel	296	165	50
Aguirre Combined Cycle 2	1977	Diesel	296	100	60
Aguirre Steam 1[1]	1971	Bunker	450	300	30
Aguirre Steam 2	1971	Bunker	450	340	30
Costa Sur 5	1972	Natural Gas / Bunker	410	275	20
Costa Sur 6	1973	Natural Gas / Bunker	410	360	20
EcoElectrica	1999	Natural Gas	545	545	3
Palo Seco 3	1968	Bunker	216	170	25
Palo Seco 4	1968	Bunker	216	160	35
San Juan 7	1965	Bunker	100	80	45
San Juan 9	1968	Bunker	100	90	10
San Juan Combined Cycle 5	2008	Natural Gas / Diesel	220	210	10
San Juan Combined Cycle 6	2008	Natural Gas / Diesel	220	210	20
Cambalache 2	1998	Diesel	82.5	78	15
Cambalache 3	1998	Diesel	82.5	78	15
Mayagüez 1	2009	Diesel	55	50	30
Mayagüez 2	2009	Diesel	55	50	30
Mayagüez 3	2009	Diesel	55	25	35
Mayagüez 4	2009	Diesel	55	25	35
3 Palo Seco Mobile Pack	2021	Diesel	3x27	81	50
7 Gas Turbines (Peakers)[2]	1972	Diesel	7x21	147	45
4 TM Gens (Palo Seco)	2023	Natural Gas / Diesel	2x20 + 2x25	90	15
10 TM Gens (San Juan)	2023	Natural Gas / Diesel	10x25	250	20
TOTAL			**5,336**	**4,333**	**—**

Notes:

1. The Expected Case considers Aguirre 1 to be out of service for the duration of the summer 2025 analysis period. Aguirre 1 suffered a "catastrophic" failure in February 2025 that will have the unit out for approximately 12-18 months.

2. A total of 18 gas turbines, each with a capacity of 21 MW, are installed. However, only 7 are considered operational, due to frequent outages of these units.

As can be seen above, the sum of dependable capacity (4,333 MW) of the thermal generation fleet is substantially less than the sum of nameplate capacity (5,336 MW), reflecting the degraded state of many of the facilities. Indeed, as noted previously, in over 18,000 hours since the beginning of 2021, total capacity availability in Puerto Rico (which also includes the renewable generation fleet of over 400 MW of nameplate capacity) has never exceeded 4,200 MW.

With respect to the assumptions on forced outage rates, the net effect of the unit-by-unit performance – when weighted by each unit's share of total generation capacity – is that the average forced outage rate of the average baseload unit is now 20% (up from 17% assumed in the FY25 Resource Adequacy Report), and the average forced outage rate of the average peaker is now 38% (up from 27%). By comparison, according to NERC's 2023 State of Reliability Technical Assessment, the comparable weighted-average forced outage rate for the U.S. fossil power generation fleet was 8.5% in 2022.

The assumptions contained in Table 11 were developed after a thorough review of actual output and downtime from each of the units during 2023 and 2024 and reflect LUMA's best judgment of how to most accurately model the ability of the Puerto Rico generation fleet to supply electricity at any moment in time. During this review, it was found that many assumptions – particularly in relation to forced outage rates – had likely been over-optimistic in LUMA's prior resource adequacy studies. In addition to the assumptions on forced outage rates listed in the above table, note further that LUMA assumes any forced outages to have a duration of 40 hours, after which time the unit will be returned to service. This assumption may be overoptimistic and should be the subject of further investigation in advance of future resource adequacy assessments.

Because powerplant outages can be either planned or unplanned (i.e., forced), resource adequacy modeling also relies upon assumptions about planned outages of the powerplant fleet. This interim resource adequacy assessment assumed the planned outage schedule most recently approved by LUMA System Operations, which is summarized in Table 12.

Table 12: Planned Outage Schedule Assumptions

Unit	Planned Outage Start Date	Planned Outage Finish Date
AES 1	7/5/25	8/1/25
AES 2	2/1/25	2/28/25
Aguirre CC 1		
Aguirre CC 2		
Costa Sur 5	1/12/25	5/10/25
Costa Sur 6	11/8/25	12/23/25
EcoElectrica CT 1	10/25/25	11/24/25
EcoElectrica CT 2		
EcoElectrica STM		
Palo Seco 3		
Palo Seco 4	8/8/23	8/31/25
San Juan 7	10/2/24	7/30/25
San Juan 9	4/8/25	8/7/25
San Juan CC 5	10/3/25	10/24/25
San Juan CC 6	8/20/24	4/30/25

This planned outage schedule shows that several of Puerto Rico's most important powerplant units – AES 1, Costa Sur 5, Palo Seco 4, San Juan 7, San Juan 9 and San Juan CC 5 – are expected to be out of service during some portion of the May through October 2025 time horizon analyzed in this resource adequacy assessment. Of these, Palo Seco 4 and San Juan 7 are in extended outages, and LUMA's experience has shown that delays in return to service after lengthy outages are commonplace. Furthermore, San Juan CC 6 is assumed to return to service just before the beginning of this resource adequacy assessment time window, meaning that any significant delay in its return to service would only serve to worsen the results presented herein.

7.2 Electricity Demand Forecast

The final important set of assumptions that significantly affect a resource adequacy assessment is the systemwide electricity demand forecast.

For its resource adequacy modeling, LUMA takes its most recent electricity demand forecast – which estimates future monthly peak demand and monthly electricity volumes from the Puerto Rico bulk power system – and develops an hourly electricity demand forecast wherein the sum of hourly demands equals the monthly volumetric forecast. The allocation of monthly volumes to the hourly level required for resource adequacy modeling is accomplished by developing an average daily load shape such that the ratios of hourly demands over a month to the monthly peak demand are consistent with hour-by-hour systemwide demand patterns actually observed last summer.

The monthly peak demands and electricity volumes employed for the Expected Case from LUMA's most recent forecast are presented in Table 13.

Table 13: Expected Case Monthly Peak Demands and Electricity Volumes

	May-25	Jun-25	Jul-25	Aug-25	Sep-25	Oct-25
Monthly Volumes (GWh)	1,643.2	1,697.2	1,713.6	1,739.8	1,704.2	1,700.7
Peak Demand (MW)	2,871	2,994	2,982	3,184	3,038	3,003

As can be seen from the above table, peak demand for summer 2025 in the Expected Case is projected to reach 3,184 MW. Since actual peak demand in 2024 was also 3,184 MW, LUMA is therefore forecasting zero peak demand growth for this year. However, recall that the summer of 2024 was unusually hot in Puerto Rico. Therefore, it is probably more appropriate to consider this forecast to reflect a modest amount of peak demand growth – note that each 1% of peak demand growth represents about 30 MW of increase in peak demand – relative to what peak demand would have been last summer under normal weather conditions.

Then, for the Hot Summer and Extreme Heat Wave sensitivity cases, the hourly electricity demand assumptions from the Expected Case were adjusted: a 5% increase in all hours for the Hot Summer case, and a 10% increase for all hours in one month (August) for the Extreme Heat Wave case. These adjustment factors were developed based on the approximate magnitude by which prior LUMA forecasts of summer electricity consumption have occasionally under-forecasted actual electricity consumption.

Accordingly, hourly demands in the Hot Summer sensitivity case are uniformly 5% higher than hourly demands in the Expected Case, which means that the peak demand levels in each month are 5% for the Hot Summer Case than in the Expected Case. In August, the month of forecasted peak demand over the entire summer, the 5% increase translates to an assumed peak demand of 3,343 MW.

Meanwhile, all August hours in the Extreme Heat Wave sensitivity case are uniformly 10% higher than all August hours in the Expected Case, which means that the peak demand in August (3,502 MW) for the Extreme Heat Wave case is 10% higher than the August peak demand assumed in the Expected Case.

The above discussion focuses heavily on peak demand, which clearly is the most critical demand-side determinant of overall resource adequacy. However, the importance of assumptions about the monthly volumes of electricity demand should not be underestimated, particularly given the extent of the resource deficiency of the Puerto Rico electricity system. Because forced outages are unpredictable and hence can occur at any time, they can trigger generation shortfalls and load shedding in Puerto Rico during off-peak hours as well as peak hours. The resource adequacy results show clearly that, although their values are highest during evening hours, LOLE and LOLH are nevertheless significantly greater than zero during other hours of the day – and that is directly attributable to assumptions about the levels of systemwide electricity demand during off-peak hours.

Exhibit 2

Presentation on Updated FY2025 Resource Adequacy Report

Interim Resource Adequacy Update

Summer 2025 Outlook

March 7, 2025

Executive Summary

As system operator, LUMA closely monitors generation portfolio performance trends and their impact on customers.

- Annual Resource Adequacy (RA) reports accurately predicted last 3 years' performance trends
- LUMA's focus has been on predicting cost and load shed impacts from generation sector
- LUMA initiated a "Summer Update" focused on summer risks (e.g. hurricane, heat wave, loss of another baseload generator)

Recent deterioration of Genera's fleet raises significant alarms about a bad situation getting worse

- 1,500 MW of baseload generation will be offline on June 1st
- Genera recently informed LUMA that Aguirre 1 will be out of service indefinitely
- Forced outages becoming more frequent and lasting longer

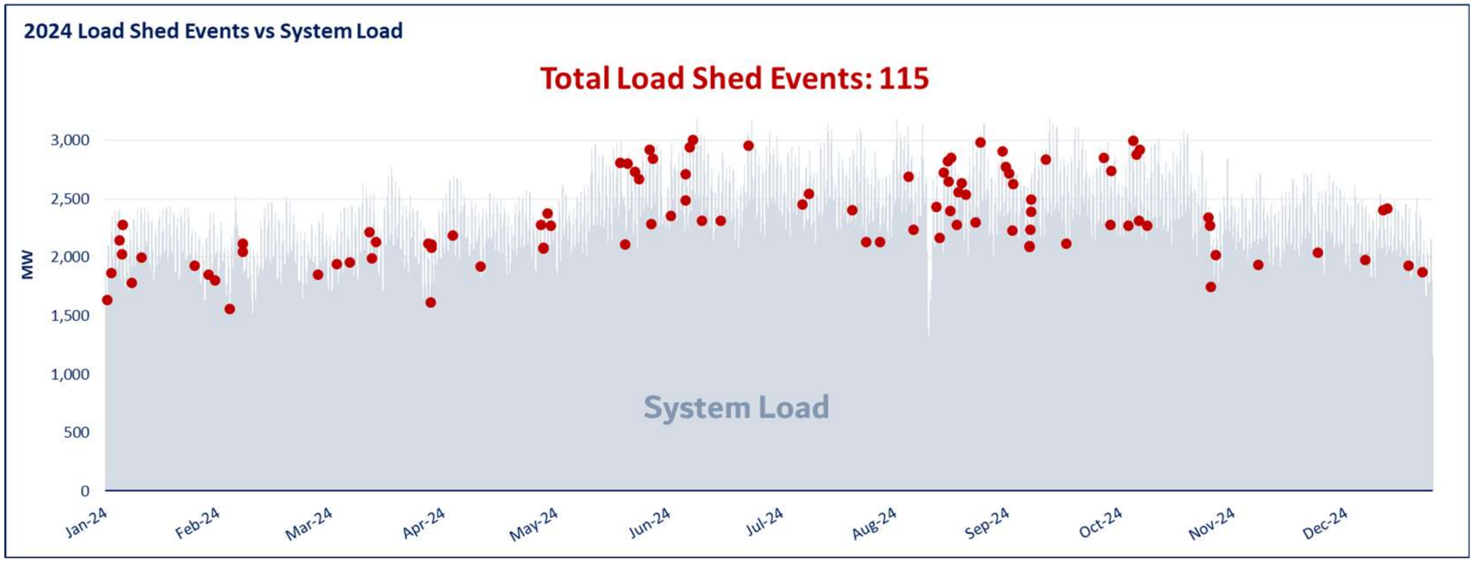
Summer Update models were updated in February to reflect Genera's deteriorating portfolio status

- Puerto Rico's "expected case" will be over five load sheds per week during summer
- Feasible risk scenarios could make load sheds a daily event under adverse cases
- While the focus is on the next six months, the crisis will continue much longer

LUMA has very few levers to reduce these risks, but an active communication strategy could ensure customers understand the underlying causes

115 load shed events occurred in 2024 due to generation events

Industry standard is one Manual Load Shed event from inadequate generation every 10 years, which approximates to 0.1 event per year



Two Categories of Load Sheds (1) Manual Load Sheds (MLS) and (2) Underfrequency Load Sheds (UFLS).
Resource Adequacy focuses on MLS because these are caused by lack of generation. "Total Load Shed Events" in graph reflect the sum of MLS plus UFLS.

Rolling 12 Months (January 1, 2024 – December 31, 2024)	**Total Events**	**Average Customers Affected**	**Average Duration (min)**	**Customer Minutes Interrupted (CMI)**
Manual Load Sheds (1)	36	98,053	188	663,622,704
Underfrequency Load Sheds (UFLS) (2)	79	91,293	21	151,455,087

(1) Manual Load Sheds are sometimes referred to as "Generation Load Sheds" or "Loss of Load Events" (LOLE)
(2) Underfrequency Load Sheds are sometimes referred to as "Unit Performance" Load Sheds

LUMA

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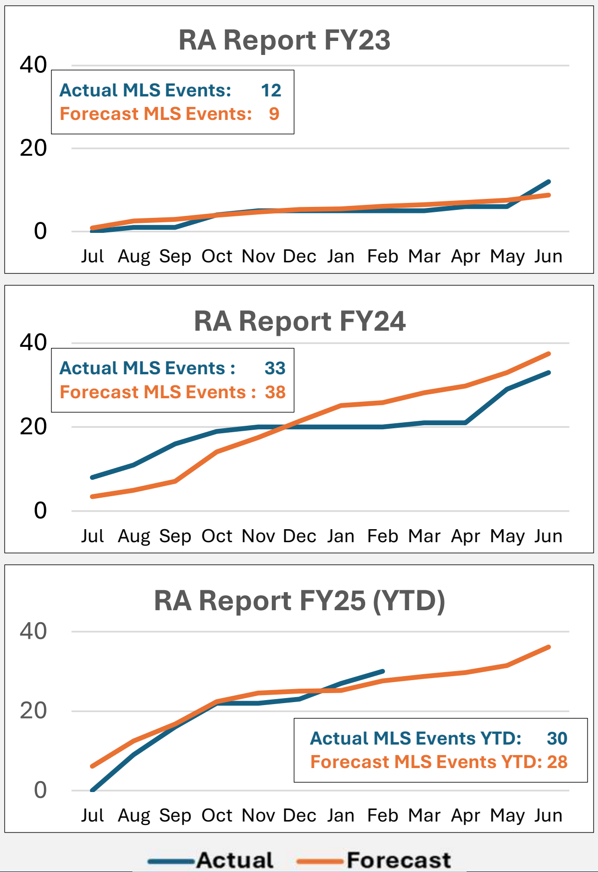
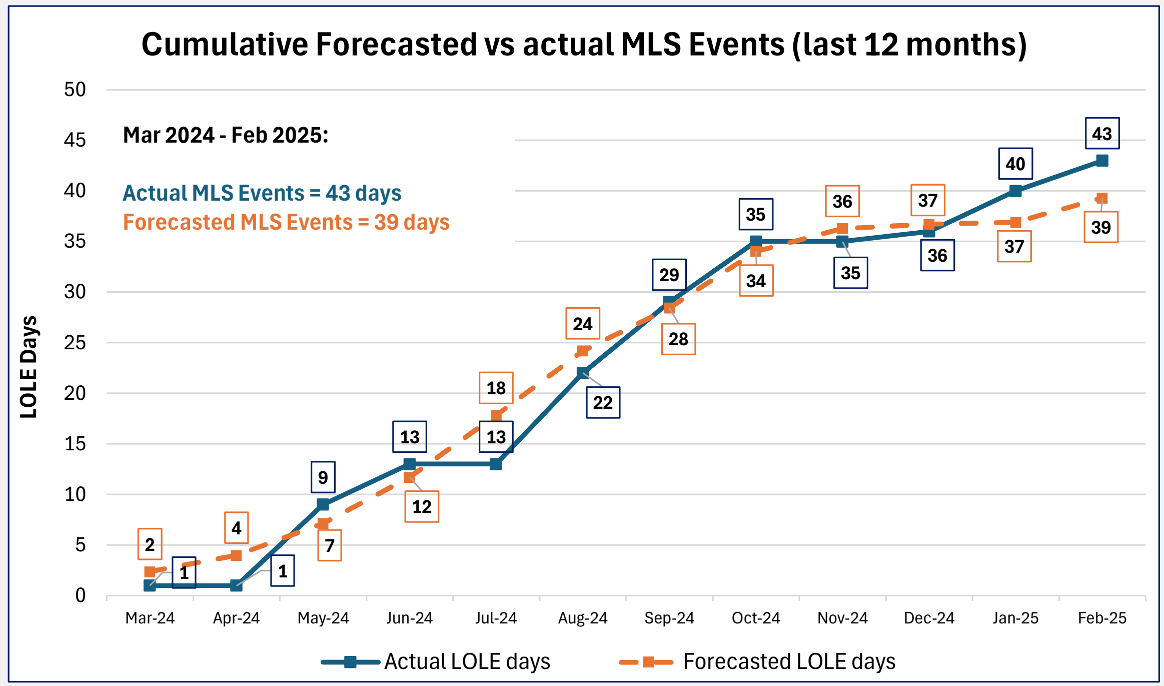
LUMA has a very good ability to predict MLS event frequency

RA reports predicted 73 MLS would occur over past 32 months versus 75 that actually occurred
Industry planning standard is one event every 10 years which approximates to 0.1 events per year

Past Full Year Annual Forecasts



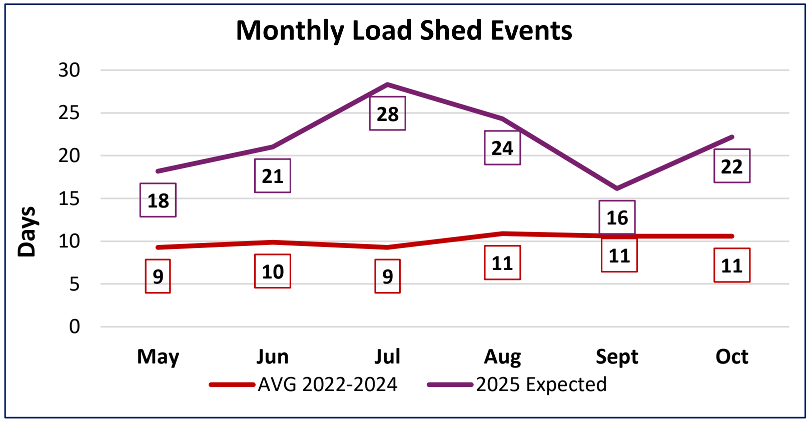
Past 12 Month Rolling Average Forecast vs. Actual Record

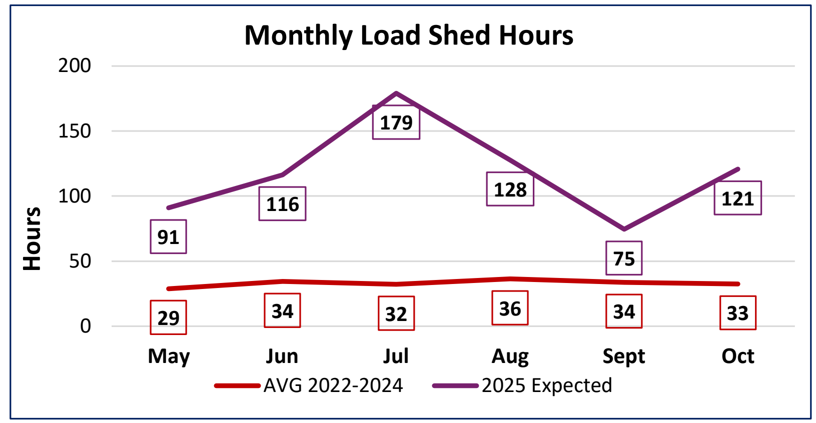


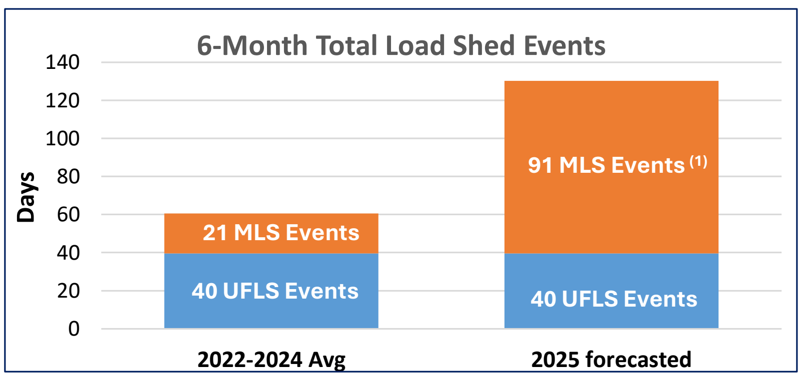
The number and duration of load shed events will more than double this summer relative to prior years

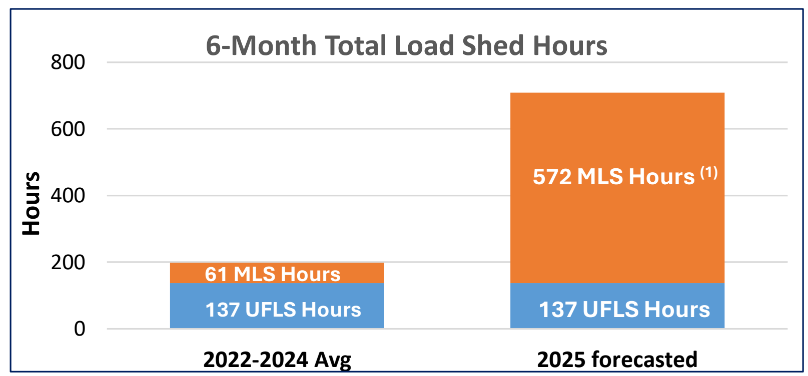
Some month-to-month shifts could result from adjusting outage schedules, expanding customer programs, etc.

Load Sheds presented here include MLS plus UFLS events









MLS = Manual load shed UFLS = Under frequency load shed

The numbers shown on these slides represent outage schedules updated since the time of the Resource Adequacy report publication.

LUMA

Generation reserves are inadequate for most hours in every single day of the year, but this will be much worse in summer 2025

Prudent Utility Practices[1] would shed load below 400 MW Reserves (red cells) and disconnect at least some customers during most hours every day; This is not judged to be politically acceptable in Puerto Rico, but ignoring industry Policy on Reserves <u>increases system stress and risks</u> to system stability and resilience.

2025 Forecast Average Hourly Reserves by Month (MW)

Hour	May-25	Jun-25	Jul-25	Aug-25	Sep-25	Oct-25	Avg by hour
1	473	403	220	466	594	483	440
2	568	476	315	577	680	583	533
3	643	519	400	674	736	648	603
4	682	559	456	735	780	700	652
5	707	583	485	758	794	716	674
6	684	576	479	732	773	684	655
7	683	581	497	745	771	663	657
8	671	570	484	755	796	695	662
9	679	571	494	759	814	716	672
10	704	594	539	807	856	751	709
11	747	627	591	859	888	776	748
12	756	633	602	876	884	761	752
13	742	614	607	872	867	740	740
14	668	565	565	823	800	659	680
15	560	498	469	708	691	547	579
16	445	414	344	560	559	397	453
17	319	326	218	375	445	256	323
18	248	251	127	235	364	176	234
19	191	169	39	129	275	92	149
20	97	86	-90	17	213	66	65
21	90	53	-134	-6	216	81	50
22	127	122	-94	55	264	141	103
23	207	206	-17	151	364	251	194
24	331	298	84	290	482	372	310
Monthly Avg	501	429	320	540	621	498	

July 2025 Forecast Average Hourly Reserves by Day (MW)

July 2025 reserves forecast

Day

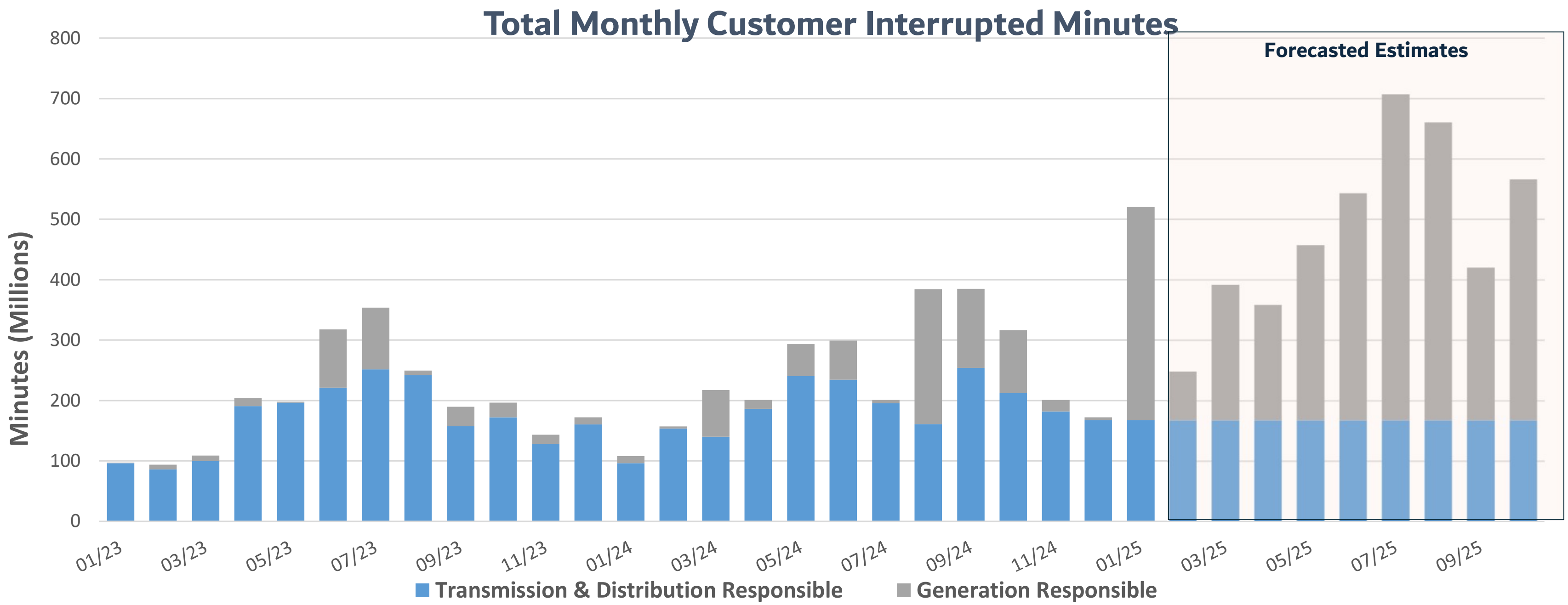
Hour	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
1	256	332	209	445	279	168	129	104	146	284	158	34	179	181	191	122	-28	-30	286	161	155	394	381	279	48	9	106	333	377	310	528
2	348	383	340	554	386	260	223	198	281	393	269	156	263	242	231	206	39	71	403	232	243	507	493	372	133	23	189	416	453	421	644
3	402	447	418	616	463	374	332	264	315	480	357	217	345	310	359	314	143	166	467	305	352	553	568	462	203	188	292	499	513	488	699
4	443	519	503	660	459	448	387	313	347	502	379	339	427	349	469	353	203	212	538	368	419	594	599	517	270	281	404	550	595	542	725
5	435	544	507	660	517	515	415	332	419	558	390	382	475	375	482	390	231	239	543	414	440	635	623	532	294	332	448	550	591	596	844
6	387	525	532	672	540	526	430	314	391	548	415	424	532	377	519	372	201	248	573	456	411	602	605	537	288	398	489	520	521	508	676
7	486	518	613	716	591	575	439	342	399	539	397	422	592	396	459	328	208	243	606	494	434	598	621	544	322	448	562	484	541	528	638
8	455	484	611	711	592	611	385	326	363	512	290	495	659	352	424	302	156	254	590	577	393	561	571	533	315	531	567	475	507	456	578
9	402	490	660	701	636	632	384	385	344	478	322	485	624	369	388	316	185	295	588	609	377	591	595	576	316	549	603	474	514	445	589
10	371	544	704	750	715	709	408	354	380	507	382	543	647	452	439	375	224	286	653	662	450	646	666	664	380	612	717	522	526	442	623
11	434	613	769	783	783	781	462	510	379	490	437	569	687	522	476	464	272	378	677	735	448	657	746	682	431	658	754	573	646	557	723
12	488	647	786	766	780	802	548	468	408	432	445	663	692	554	470	465	316	427	698	725	417	679	733	668	463	664	755	514	599	531	760
13	538	667	802	684	778	798	514	442	375	470	425	669	685	554	517	457	310	467	735	725	406	698	747	627	476	681	755	502	593	505	876
14	580	608	779	692	716	761	429	397	345	457	394	603	657	513	375	425	285	332	714	707	433	680	710	627	475	683	699	499	564	402	800
15	480	523	707	623	618	655	318	221	378	321	275	501	536	360	354	317	222	321	613	692	346	548	570	532	362	564	574	327	491	335	647
16	375	392	649	545	415	503	186	63	327	153	181	341	421	211	187	150	114	298	472	562	338	360	344	351	176	396	492	262	345	309	495
17	290	206	497	480	210	298	80	27	318	29	22	268	210	9	25	-83	-78	307	275	337	254	314	285	117	18	172	396	271	207	260	435
18	230	80	381	446	67	120	-36	3	230	-13	-92	189	123	-102	-15	-188	-216	258	147	163	236	207	167	53	-138	13	316	254	153	243	357
19	131	-24	322	372	-37	-51	-110	-69	221	-69	-157	98	36	-161	-98	-304	-288	199	62	27	173	129	57	-115	-242	-78	245	170	59	155	221
20	-17	-103	188	255	-168	-161	-213	-214	25	-172	-284	-64	-98	-294	-192	-472	-428	110	-50	-88	52	-8	-28	-258	-349	-186	85	51	-85	64	77
21	-55	-129	140	231	-195	-230	-243	-272	-123	-198	-308	-110	-166	-333	-254	-502	-430	53	-97	-198	-18	-26	-79	-326	-355	-206	14	-32	-118	37	11
22	-28	-97	183	238	-151	-251	-242	-222	-115	-147	-314	-66	-137	-243	-200	-412	-395	61	-30	-191	5	27	-23	-294	-358	-187	40	7	-53	60	109
23	11	-48	225	286	-87	-189	-171	-144	-39	-65	-220	-36	-50	-141	-156	-297	-300	108	46	-109	145	100	56	-244	-239	-101	127	104	47	147	193
24	137	86	337	374	28	-4	-28	-11	50	55	-126	68	39	-44	-17	-181	-356	236	76	12	262	211	179	-110	-143	-23	195	230	168	233	278

Legend

Reserves (MW): <0 MW | 0 MW – 750 MW

(1) In this case NERC Guidelines and LUMA's System Operations Principles approved by the Energy Bureau in spring 2022.

Generation-related Customer Minutes Interruption (CMI), which averages less than 1% for industry, could be twice the transmission and distribution CMI this summer



*

Year	Generation (Mil Min)	T&D (Mil Min)	Generation Share (%)
CY23	321.6	2,002.5	13.8%
CY24	713.6	2,222.4	24.3%
Jan – Oct 2025 **	3,199.9	1,675.6	65.6%

Notes

*** January through October 2025 T&D values use the December 2024 actual value as a constant for relative comparison to Generation Customer Minutes Interrupted (CMI)*

LUMA

LUMA is beginning to identify mitigation steps, however most solutions to the problem are the responsibility of Genera

1. Adjust maintenance outage schedules
2. Consider adjusting reserve thresholds, voltage reductions
3. Monitor and Support Genera Emergency Generation Request
4. Develop proactive Communication Strategy (e.g. requesting customers to reduce consumption biweekly updates similar to Generation Stabilization Plan following Fiona)
5. Accelerate Accelerated Storage Acquisition Program (ASAP) (Q1 2026 impact)
6. Expand Customer Battery Energy Storage (CBES) program
7. Expand Backup Generator (BUG) Program
8. Government Buildings
9. Behavioral Demand Shaping
10. Increase Emergency Diesel Fuel inventory at EcoElectrica
11. Others

LUMA

Actualización Interina Sobre Suficiencia de Recursos Energéticos

Pronóstico Para el Verano de 2025

7 de Marzo de 2025

Resumen Ejecutivo

LUMA, como operadora del sistema, monitorea de cerca el desempeño de la cartera de generación y su impacto en los clientes.

- Los informes anuales de suficiencia de recursos energéticos (RA) han predicho con precisión las tendencias de los últimos tres años.
- LUMA se ha enfocado en predecir los costos y el impacto de los relevos de carga debido al sector de generación.
- LUMA inició una "Actualización de verano" enfocada en riesgos de verano (huracanes, olas de calor, pérdida de otro generador de carga base).

El reciente deterioro de la flota de Genera provoca serias preocupaciones sobre una situación que sigue empeorando.

- 1,500 MW de generación de carga base estarán fuera de servicio el 1 de junio.
- Genera le informó a LUMA que Aguirre 1 estará fuera de servicio de manera indefinida.
- Las interrupciones de servicio forzadas son más frecuentes y prolongadas.

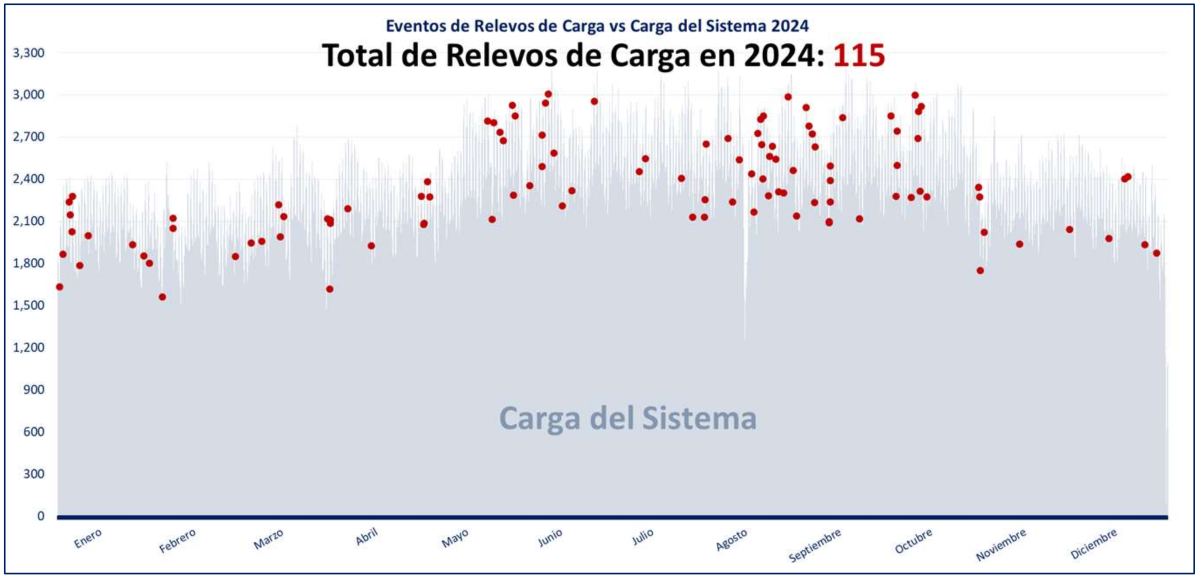
Los modelos de actualización de verano se revisaron la semana pasada para reflejar el deterioro de la flota de Genera:

- El "caso esperado" de Puerto Rico sobrepasará los cinco relevos de carga semanales durante el verano.
- Las posibles situaciones de riesgo podrían provocar relevos de carga diarios en el peor de los casos.
- Aunque el enfoque es en los próximos seis meses, la crisis se extenderá por mucho más tiempo.

LUMA tiene pocas herramientas para mitigar estos riesgos, pero una estrategia activa de comunicación podría ayudar a que los clientes entiendan las causas principales.

En el 2024, ocurrieron 115 relevos de carga debido a eventos de generación

El estándar de la industria es un evento manual de relevo de carga por insuficiencia de generación cada 10 años (aproximadamente 0.1 eventos por año).



Dos categorías de relevos de carga: relevos de carga manuales (MLS) y relevos de carga por baja frecuencia (UFLS)
La suficiencia de recursos energéticos se enfoca en los MLS, porque son provocados por la falta de generación. Los "eventos totales de relevos de carga" en la gráfica reflejan la suma de los MLS y UFLS.

12 Meses Consecutivos (1 de enero de 2024 – 31 de diciembre de 2024)	Total de Eventos	Cantidad Promedio de Clientes Afectados	Duración Promedio (min)	Minutos de Interrupciones de Clientes (CMI)
Relevos de Carga Manuales (MLS) (1)	36	98,053	188	663,622,704
Relevos de Carga por baja Frequencia (UFLS) (2)	79	91,293	21	151,455,087

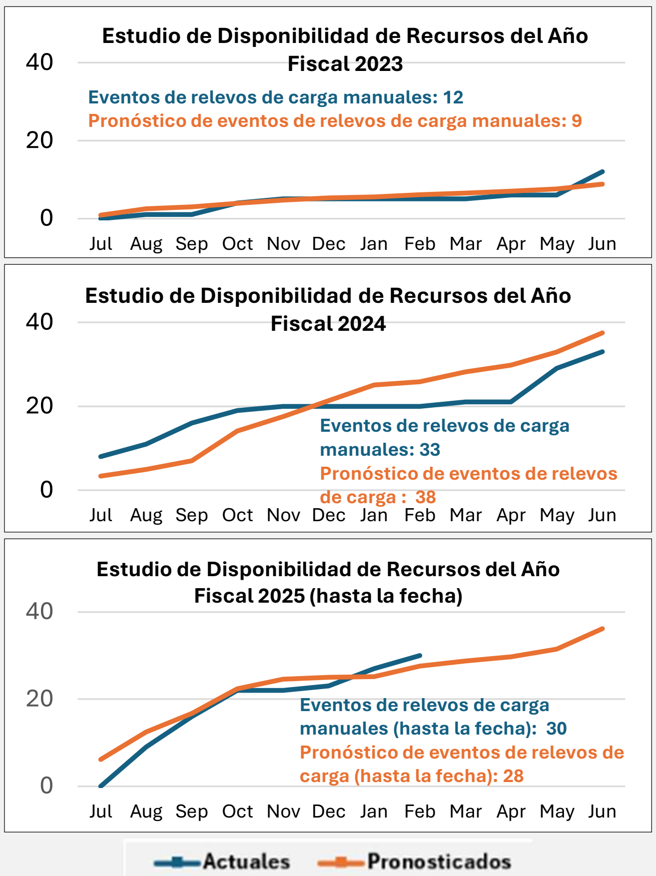
(1) Los MLS también se conocen como "relevos de carga por generación" o "pérdida de carga esperada (LOLE)".
(2) Los UFLS a veces se conocen como "relevos de carga por rendimiento de unidades".

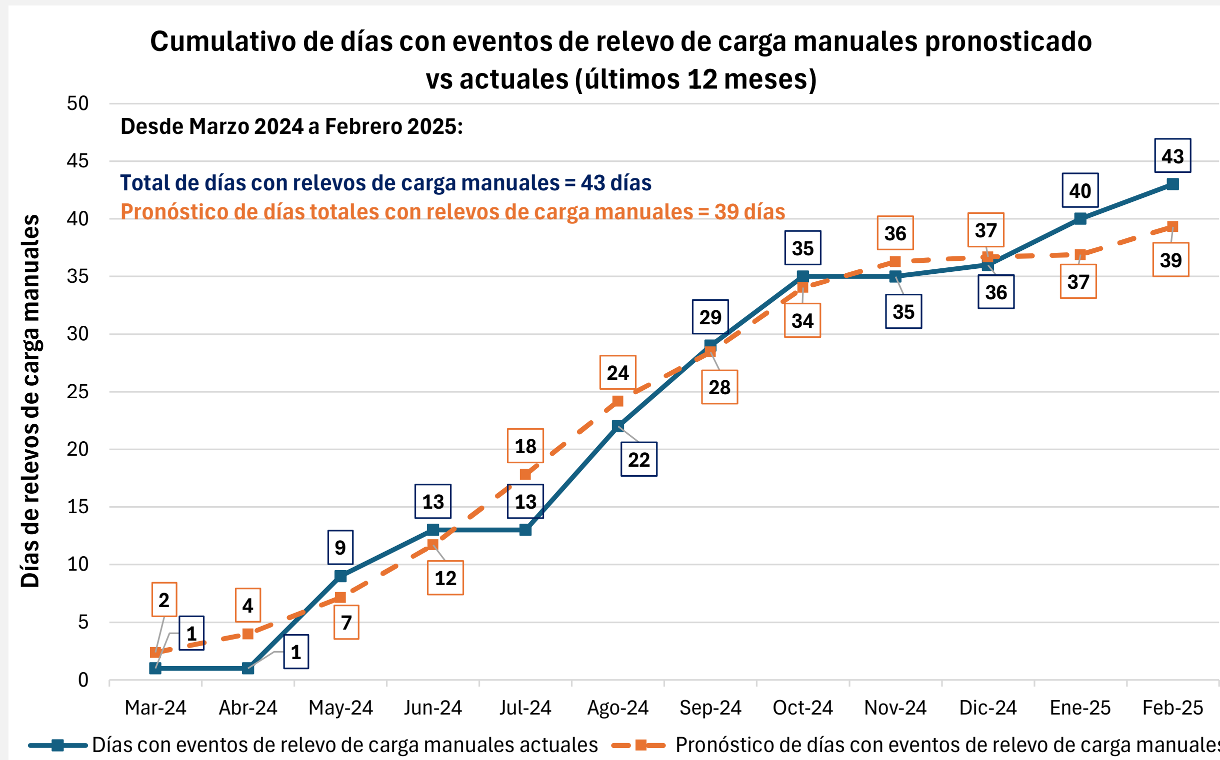
LUMA

LUMA tiene una gran capacidad para predecir eventos de MLS:

Los informes de la RA predijeron 73 eventos de MLS en los últimos 32 meses, en comparación con los 75 que realmente ocurrieron.
El estándar de planificación de la industria es un evento cada 10 años (aproximadamente 0.1 eventos por año).

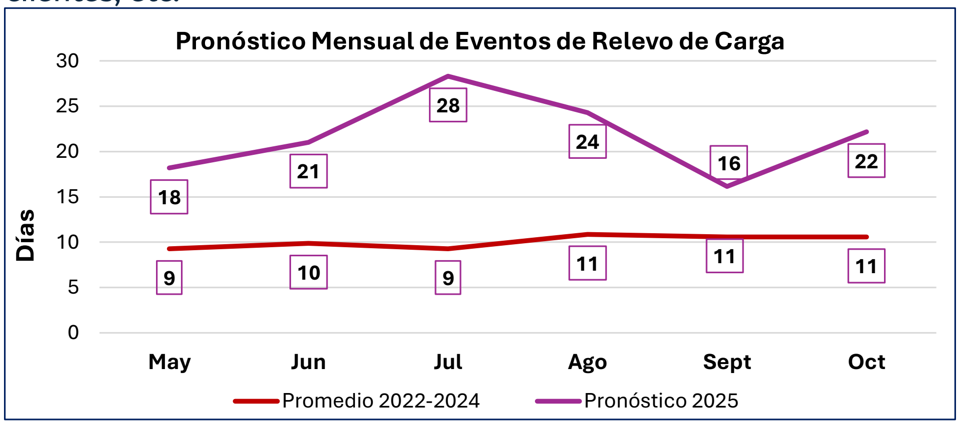
Pronósticos Anuales de los Pasados Tres Años Fiscales

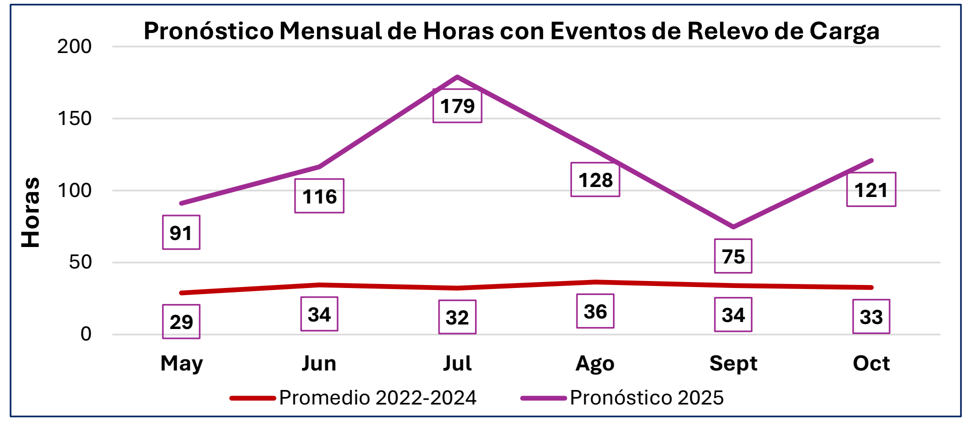


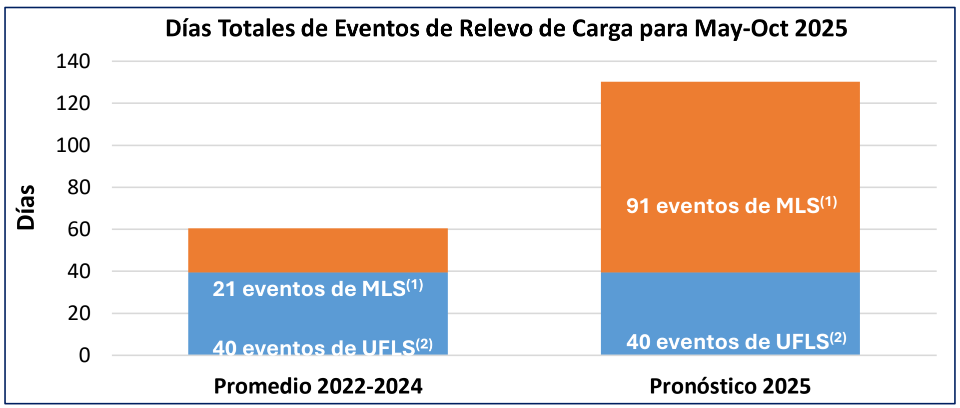


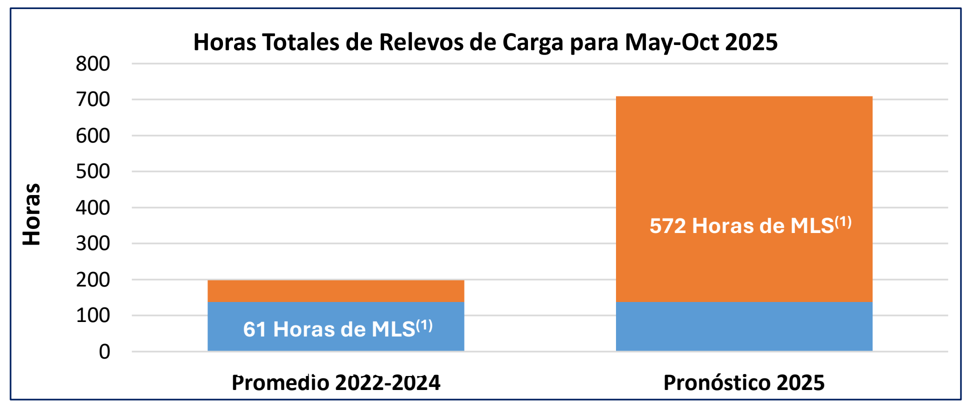
La Cantidad Y Duración De Los Eventos De Relevos De Carga Se Duplicarán Este Verano En Comparación Con Años Anteriores

Algunos cambios mensuales podrían deberse al ajuste de las interrupciones de servicio programadas, la expansión de los programas para clientes, etc.









(1)MLS = Manual load shed = Relevos de carga manual

(2)UFLS = Under frequency load shed = Relevos de carga por baja frecuencia (pérdida momentánea de una unidad)

Los valores en esta diapositiva han sido actualizados desde la fecha del reporte de RA.

LUMA

Las reservas de generación son inadecuadas en la mayoría de las horas de cada día del año y esto empeorará en el verano de 2025

Las prácticas prudentes de servicios públicos (1) requieren relevos de carga por debajo de 400 MW de reservas (celdas rojas), lo que dejaría sin servicio a algunos clientes durante la mayoría de las horas de cada día. Esto no se considera políticamente aceptable en Puerto Rico, pero ignorar la política de la industria sobre reservas aumenta el estrés y los riesgos del sistema.

Pronóstico de Promedio de Reservas Mensuales por Hora en 2025 (MW)

Hora	May-25	Jun-25	Jul-25	Ago-25	Sep-25	Oct-25	Promedio por hora del día
1	473	403	220	466	594	483	440
2	568	476	315	577	680	583	533
3	643	519	400	674	736	648	603
4	682	559	456	735	780	700	652
5	707	583	485	758	794	716	674
6	684	576	479	732	773	684	655
7	683	581	497	745	771	663	657
8	671	570	484	755	796	695	662
9	679	571	494	759	814	716	672
10	704	594	539	807	856	751	709
11	747	627	591	859	888	776	748
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16	445	414	344	560	559	397	453
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18	248	251	127	235	364	176	234
19	191	169	39	129	275	92	149
20	97	86	-90	17	213	66	65
21	90	53	-134	-6	216	81	50
22	127	122	-94	55	264	141	102
23	207	206	-17	151	364	251	194
24	331	298	84	290	482	372	310
Promedio Mensual	501	429	320	540	621	498	

Pronóstico de Promedio de Reservas por Día para Julio de 2025 (MW)

Reservas pronosticadas para Julio 2025

Hora \ Día	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
1	256	332	209	445	279	168	129	104	146	284	158	34	179	181	191	122	-28	-30	286	161	155	394	381	279	48	9	106	333	377	310	528
2	348	383	340	554	386	260	223	198	281	393	269	156	263	242	231	206	39	71	403	232	243	507	493	372	133	23	189	416	453	421	644
3	402	447	418	616	463	374	332	264	315	480	357	217	345	310	359	314	143	166	467	305	352	553	568	462	203	188	292	499	513	488	699
4	443	519	503	660	459	448	387	313	347	502	379	339	427	349	469	353	203	212	538	368	419	594	599	517	270	281	404	550	595	542	725
5	435	544	507	660	517	515	415	332	419	558	390	382	475	375	482	390	231	239	543	414	440	635	623	532	294	332	448	550	591	596	844
6	387	525	532	672	540	526	430	314	391	548	415	424	532	377	519	372	201	248	573	456	411	602	605	537	288	398	489	520	521	508	676
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11	434	613	769	783	783	781	462	510	379	490	437	569	687	522	476	464	272	378	677	735	448	657	746	682	431	658	754	573	646	557	723
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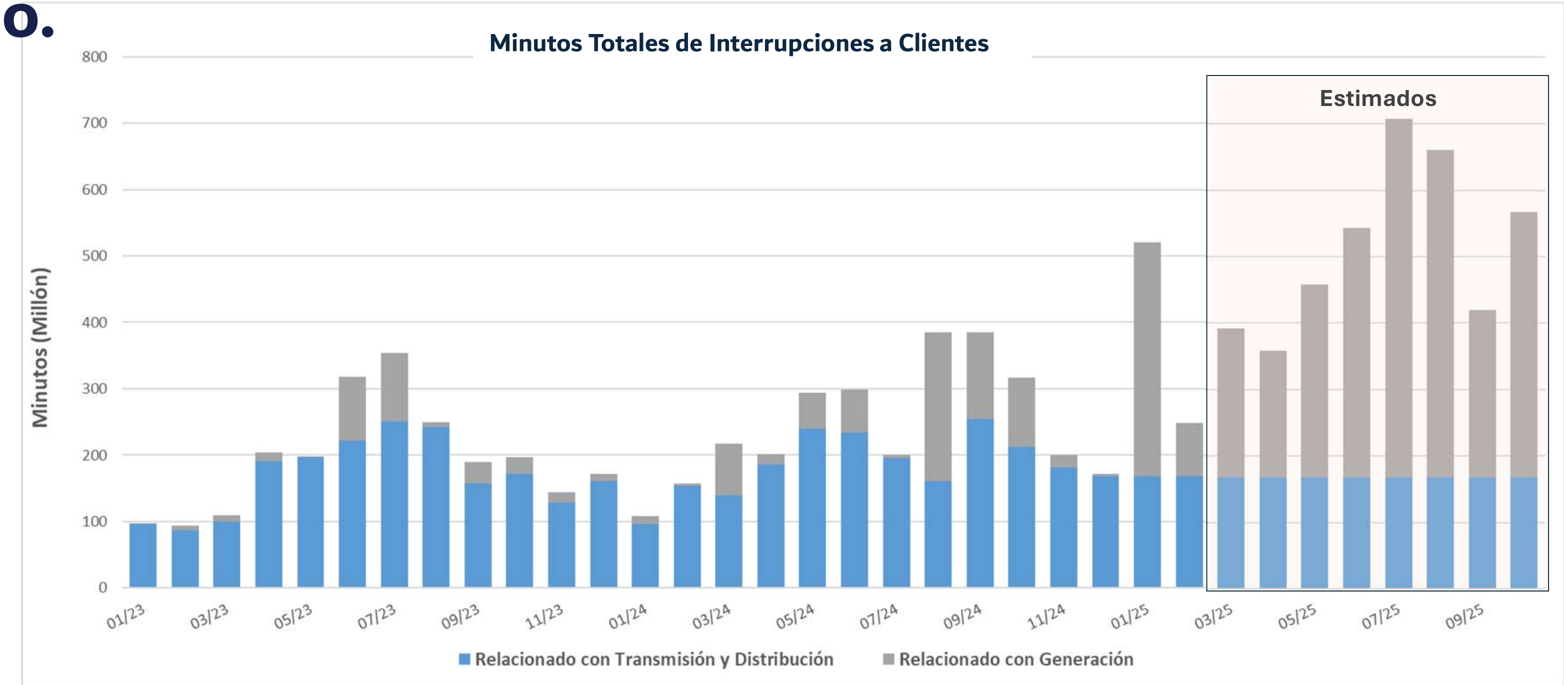
17	290	206	497	480	210	298	80	27	318	29	22	268	210	9	25	-83	-78	307	275	337	254	314	285	117	18	172	396	271	207	260	435
18	230	80	381	446	67	120	-36	3	230	-13	-92	189	123	-102	-15	-188	-216	258	147	163	236	207	167	53	-138	13	316	254	153	243	357
19	131	-24	322	372	-37	-51	-110	-69	221	-69	-157	98	36	-161	-98	-304	-288	199	62	27	173	129	57	-115	-242	-78	245	170	59	155	221
20	-17	-103	188	255	-168	-161	-213	-214	25	-172	-284	-64	-98	-294	-192	-472	-428	110	-50	-88	52	-8	-28	-258	-349	-186	85	51	-85	64	77
21	-55	-129	140	231	-195	-230	-243	-272	-123	-198	-308	-110	-166	-333	-254	-502	-430	53	-97	-198	-18	-26	-79	-326	-355	-206	14	-32	-118	37	11
22	-28	-97	183	238	-151	-251	-242	-222	-115	-147	-314	-66	-137	-243	-200	-412	-395	61	-30	-191	5	27	-23	-294	-358	-187	40	7	-53	60	109
23	11	-48	225	286	-87	-189	-171	-144	-39	-65	-220	-36	-50	-141	-156	-297	-300	108	46	-109	145	100	56	-244	-239	-101	127	104	47	147	193
24	137	86	337	374	28	-4	-28	-11	50	55	-126	68	39	-44	-17	-181	-356	236	76	12	262	211	179	-110	-143	-23	195	230	168	233	278

(1) Las guías de la NERC y los principios de las operaciones del sistema de LUMA aprobados por el Negociado de Energía en la primavera de 2022 fueron utilizados en este caso.

Leyenda

Reservas (MW): <0 MW | 0 MW – 750 MW

Las interrupciones en el servicio de los clientes, relacionadas con la generación, cuyo promedio es inferior al 1 % en la industria, podrían duplicar los CMI del sistema de transmisión y distribución este verano.



Notas
*** Los valores del sistema de transmisión y distribución de enero a octubre de 2025 utilizan el valor real de diciembre de 2024 como una constante para la comparación relativa con los Minutos Totales de Interrupciones a Clientes (CMI).*

Año	Generación (Mil Min)	T&D (Mil Min)	Porciento de Generation (%)
Ene – Dic 2023	321.6	2,002.5	13.8%
Ene – Dic 2024	713.6	2,222.4	24.3%
Ene – Oct 2025 **	3,199.9	1,675.6	65.6%

LUMA está comenzando a identificar pasos de mitigación, pero la mayoría de las soluciones son responsabilidad de Genera:

- Ajustar las interrupciones de servicio programadas por mantenimiento.
- Considerar ajustes en los umbrales de reserva y reducciones de voltaje.
  Monitorear y apoyar solicitudes de generación de emergencia de Genera.
- Desarrollar una estrategia de comunicación proactiva (ej.: solicitarles a los clientes reducir el consumo, actualizaciones bisemanales similares al Plan de Estabilización de Generación tras Fiona).
- Agilizar el Programa Acelerado de Almacenamiento Adicional (ASAP) (Impacto en el primer trimestre de 2026)
- Expandir la Iniciativa Intercambio de Energía en Baterías para los Clientes (CBES).
- Expandir el Programa de Generadores de Emergencia (BUG).
- Edificios gubernamentales
- Desarrollo de comportamientos de demanda
- Aumentar el inventario de combustible diésel de emergencia en EcoElectrica.
- Otros