



January 30, 2023

The Honorable Chairman and Members of the
Hawai'i Public Utilities Commission
465 South King Street
Kekuaaoa Building, First Floor
Honolulu, Hawai'i 96813

Dear Commissioners:

Subject: Adequacy of Supply Report
Hawai'i Electric Light Company, Inc.

The following information is respectfully submitted in accordance with paragraph 5.3.a. of General Order No. 7, which states:

The generation capacity of the utility's plant, supplemented by electric power regularly available from other sources, must be sufficiently large to meet all reasonably expectable demands for service and provide a reasonable reserve for emergencies. A Statement shall be filed annually with the Commission within 30 days after the close of the year indicating the adequacy of such capacity and the method used to determine the required reserve capacity which forms the basis for future requirements in generation, transmission, and distribution plant expansion programs required under Rule 2.3h.1.

2023 Adequacy of Supply Report Summary

- Hawai'i Electric Light Company, Inc.'s ("Hawai'i Electric Light" or the "Company") 2023 Adequacy of Supply employs the Energy Reserve Margin criteria, developed to review adequacy of supply in all hours of the year vs. during the peak hour of the day or year, and incorporates the reliability contribution of variable and energy-limited resources, such as energy storage, and duration limited grid services, such as demand response resources. To the extent necessary, the Company respectfully requests Commission approval to use the Energy Reserve Margin criteria for purposes of the Adequacy of Supply Report pursuant to Order No. 38482 in Docket No. 2018-0165.¹
- Hawai'i Electric Light's Energy Reserve Margin is anticipated to be short of the 30% target in 2023 but is satisfied for 2024-2027. With Puna Steam already not expected

¹ See Order No. 38482 issued June 30, 2022, in Docket No. 2018-0165, at 27, which states: "If Hawaiian Electric wishes to employ this methodology outside of IGP, it must seek Commission approval to do so."

to return to service until mid-2023, shortfalls in 2023 primarily occurs during PGV's annual maintenance, as well as during Kanoelehua CT1, and Puna CT3 maintenance. Prior to the outages, the Company's System Operations will assess the system state and anticipated available capacity from firm and variable resources and may implement operational measures to mitigate risk, such as onsite generation maintenance support.

- The peak load experienced on Hawai'i Island in 2022 was 187.7 MW net, when Hawai'i Electric Light's total firm generating capability was 243.6 MW net, including firm power purchases.

1.0 Peak Demand and System Capability in 2022

Hawai'i Electric Light's 2022 system peak occurred on October 18,² at approximately 6:31 pm and was 187.7 MW-net.

Hawai'i Electric Light's 2022 total firm generating capability of 243.6 MW-net includes 58 MW from Hamakua Energy LLC ("HEP") and 24.0 MW from Puna Geothermal Venture ("PGV").³

Hawai'i Electric Light also receives variable renewable energy from several wind, hydro and PV resources on Hawai'i Island, such as Hawi Renewable Development, Tawhiri wind, and Wailuku River Hydro.

2.0 Criteria to Evaluate Hawai'i Electric Light's Adequacy of Supply

Hawai'i Electric Light's capacity planning criteria are applied to determine the adequacy of supply – whether or not there is enough generating capacity on the system. Hawai'i Electric Light's capacity planning criteria take into account that the Company must provide for its own backup generation since, as an island utility, it cannot import emergency power from a neighboring utility.

The function of a planning criteria is to establish guidelines to manage the risk of insufficient generation capability from a diverse mix of generating resources available to the system in long-range generation expansion studies. Resource plan development is evaluated based on an evolving guideline or criteria to provide adequate generation to meet customer demand, with reasonable reserves to account for routine maintenance or overhauls of units, unexpected outages of generating units, growth in customer demand

² Hawai'i Electric Light's system peak in 2022 occurred in the month of October. For this report, it is assumed that Hawai'i Electric Light's future annual system peaks will occur in December.

³ PGV began returning from an outage due to prior volcanic activity on November 5, 2020, and at the end of 2022, had a rated capacity of 24.0 MW.

over time, and possibilities of higher than forecasted instantaneous peak demand.

With the increasing quantities of variable renewable wind and solar resources, and future energy storage additions to the system, an Energy Reserve Margin criteria was developed considering the dynamic nature of variable resources and limited duration storage.⁴ For the purposes of this adequacy of supply report, Hawai'i Electric Light used this planning criteria.

2.1 Energy Reserve Margin

The Energy Reserve Margin is the percentage by which the system capacity must exceed the system load in each hour, for planning purposes. With increasing quantities of variable renewable wind and solar resources, this capacity planning criteria is intended to account for current and future variable generation resources considering the dynamic nature of energy provided by wind, PV and the implications of limited duration storage. The hourly evaluation of available energy allows for statistical representation of the impact of variable and finite resources at all hours of the day in the assessment of energy margins. The Energy Reserve Margin target for Hawai'i Electric Light is 30% to provide reasonable reliability reserves to address some level of contingencies, forecast errors, and uncertainties inherent in the assumptions and methodology.

2.2 Other Considerations in Determining the Timing of Unit Additions

The need for new generation is not based solely on the application of the criteria previously mentioned. As capacity needs emerge, it is essential that Hawai'i Electric Light consider additional factors to ensure timely installation of generation capacity necessary to meet its customers' energy needs.

Other near-term considerations may include:

1. The current condition and rated capacity of existing units;
2. Required power purchase obligations and contract terminations;
3. The uncertainties surrounding non-utility generation resources;
4. The uncertainties surrounding new energy and generation resources;
5. Transmission system considerations;
6. Meeting environmental compliance standards; and

⁴ Refer to Appendix C (page 102) of Hawaiian Electric's Integrated Grid Planning Grid Needs Assessment & Solution Evaluation Methodology filed November 5, 2021:
https://www.hawaiianelectric.com/documents/clean_energy_hawaii/integrated_grid_planning/20211105_grid_needs_assessment_methodology_review_point_book_1.pdf

7. System reliability considerations for Hawai'i Electric Light's isolated electrical system.

While meeting the planning criteria implies a reasonable adequacy of supply, it is not equivalent to a guaranteed supply. As firm capacity resources are displaced to accommodate variable renewable energy, resource planning may need to include resource characteristics to mitigate adequacy of supply risks by having large amounts of offline reserves. This may include consideration of minimum fast-start capability and/or means to curtail demand on short notice.

3.0 Key Inputs to the 2023 Adequacy of Supply Analysis

In the application of Hawai'i Electric Light's capacity planning criteria, the inputs drive the results. Key inputs are described in the following sections.

3.1 Period Under Review

This adequacy of supply review covers the period 2023 to 2027.

3.2 June 2022 Sales and Peak Forecast

In June 2022, a sales and peak forecast ("June 2022 S&P Forecast") was developed which was subsequently approved by the Company for future planning purposes and used for this analysis.

The June 2022 S&P Forecast began with the development of the energy forecast (i.e., sales forecast) by rate class (residential, small, medium and large commercial and street lighting) and by layer (underlying load forecast and adjusting layers – energy efficiency, distributed energy resources, and electrification of transportation). The underlying load forecast is driven primarily by the economy, weather, electricity price, and known adjustments to large customer loads and is informed by historical data, structural changes, and historical and future disruptions. The impacts of energy efficiency ("EE"), distributed energy resources ("DER"), primarily photovoltaic systems with and without storage (i.e., batteries), and electrification of transportation (light duty electric vehicles ("EV") and electric buses ("eBus"), collectively "EoT") were layered onto the underlying sales outlook to develop the sales forecast at the customer level.

The sales and peak forecasts used for the analysis herein is the result of the methodology described above.

The June 2022 S&P Forecast used in the 2023 Adequacy of Supply is based on the latest information at the time the forecast was developed. Hawai'i Island's peak demand forecast for 2023-2027 has increasing impacts from Energy Efficiency and DER which reduce the forecasted peaks compared to historical. The forecast reflects the Company's most current outlook for customer energy demand for the next five years. Figure 1 below illustrates Hawai'i Electric Light's historical system peaks and compares them to the forecasts used in the 2022 and 2023 Adequacy of Supply analyses.

Figure 1: Recorded Peaks and Future Year Projections

(with Future Energy Efficiency and Customer PV Battery, but without DR & Rider M)

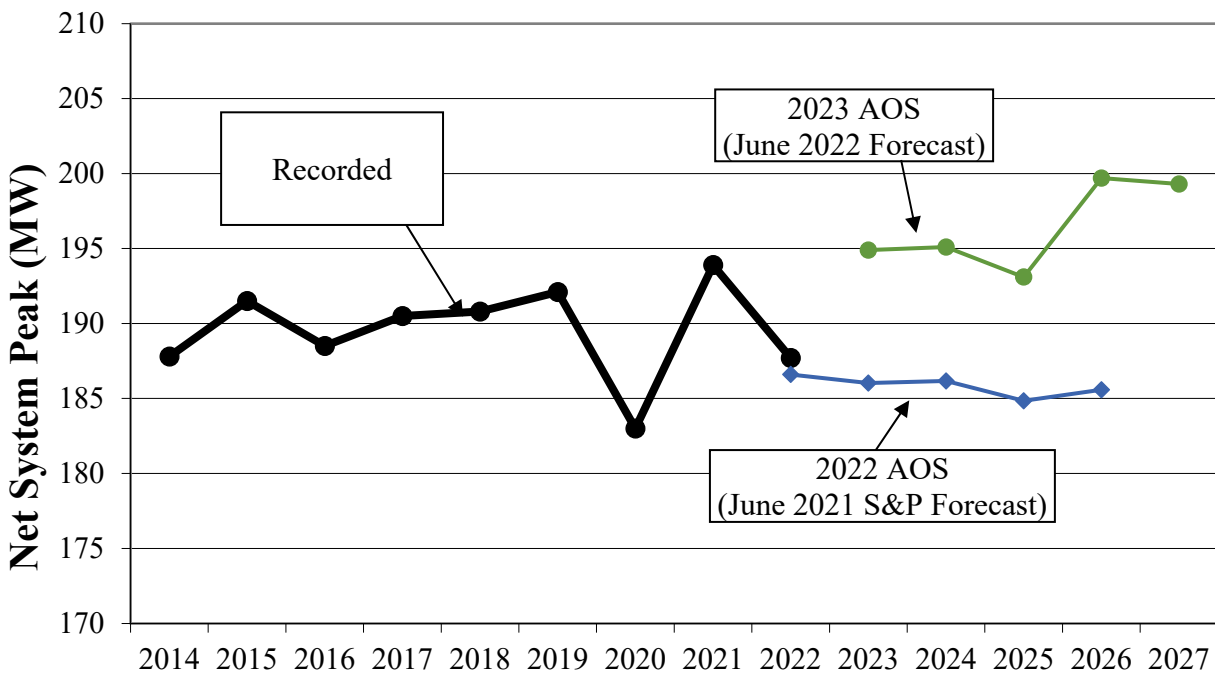


Table 1 below provides the recorded peaks since 2014 and the forecasts used in Hawai‘i Electric Light’s 2022 and 2023 Adequacy of Supply analyses.

Table 1: Recorded Peaks and Future Year Projections

Net System Peak (MW) (with Future Energy Efficiency and Customer PV Battery, but without DR)			
Year	Actual	June 2021 S&P	June 2022 S&P
2014	187.8		
2015	191.5		
2016	188.5		
2017	190.5		
2018	190.8		
2019	192.1		
2020	183.0		
2021	193.9		
2022	187.7	186.6	
2023		186.0	194.9
2024		186.2	195.1
2025		184.9	193.1
2026		185.6	199.7
2027			199.3

Figure 1 also includes estimated peak reduction benefits of energy efficiency programs and naturally occurring conservation. With the advent of storage technology (i.e., battery energy storage systems (“BESS”)) for the consumer market, impacts of customer-sited PV paired with batteries were included in the peak forecast. As solar capacity continues to grow year over year, daytime loads are projected to be reduced and, all else being equal, the average daily load profile is expected to have a more pronounced difference between daytime and evening peak. With an operating assumption of BESS charging during the daytime hours, coincident with PV generation, and discharging the stored energy during the system priority peak period, the system peak has been reduced for this type of energy storage operation.

3.3 Projected Peak Reduction Benefits of Demand Response Programs

Hawai‘i Electric Light is committed to pursuing demand response (“DR”) programs and grid services procurements designed to provide cost-effective resource options.

In 2015, the Hawaiian Electric Companies submitted to the Commission an application for approval of a DR Portfolio in Docket No. 2015-0412. A Revised DR Portfolio was filed on February 10, 2017, which provided modified approval requests and DR program design and targets consistent with the DR Portfolio used in the *PSIP Update Report: December 2016*. On January 25, 2018, the Commission issued Decision and Order No. 35238, approving the Companies’ Revised DR Portfolio tariff structure framework.

The Commission supported the approach of working with aggregators to implement the DR portfolio. In 2020, the utilities signed a multi-year Grid Services Purchase Agreement (“GSPA”) with a third-party aggregator. Currently, the Companies are implementing three GSPA contracts that were approved by the Commission on December 31, 2020. Customer enrollment under these GSPA contracts have been delayed by the COVID-19 pandemic, but the Companies are diligently working with the aggregators to catch up. For the purposes of this analysis, Hawai‘i Electric Light’s adequacy of supply was calculated using the estimated DR impacts from the GSPA for Hawai‘i Island, as shown below. The DR impacts in Table 2 lists the peak reductions from 5:00 PM to 9:00 PM forecasted for 2023. Peak reductions for 2024 to 2027 are assumed to be the same for 2023 as a conservative estimate.

Table 2: DR Impacts for Capacity Planning Purposes (MW)

Year	DR Total at Year End
2023	0.2
2024	0.2
2025	0.2
2026	0.2
2027	0.2

3.4 Planned Maintenance Schedules for the Generating Units on the System

Planned overhauls and maintenance outages reduce generating unit availabilities. The schedules for planned overhaul and maintenance outages change frequently due to unforeseeable findings during outage inspections, or to changes in priorities due to unforeseeable problems. When major revisions to planned and/or

maintenance outages occur, or unplanned outages impact the available margins, the Planned Maintenance Schedule is revised with outages deferred (or reduced) to the extent possible, to meet the operational planning criteria of having sufficient available capacity, including offline capacity available within two hours or less, to serve anticipated demand, after loss of the largest operating unit. For this analysis, the five-year planned maintenance schedule was developed in 2022 for company planning purposes, with more recent updates made in January 2023.

3.5 Resource Removals

There are no resource removals thru 2027.

3.6 Resource Additions

3.6.1 Firm Capacity Additions

On July 9, September 9, and October 1, 2020 in Decision and Order Nos. 37205, 37306, and 37335 respectively, the Commission denied Hawai'i Electric Light's request for a waiver from the Competitive Bidding Framework in Docket No. 2017-0122 for Approval of an Amended and Restated Power Purchase Agreement ("A&R PPA") with Hu Honua, denied the Company's motion for reconsideration, and closed the docket. Hu Honua appealed both Order Nos. 37205 and 37306 to the Hawai'i Supreme Court, which on May 24, 2021, found that its prior 2019 decision "did not disturb, modify or vacate the 2017 waiver." The Court remanded the matter back to the Commission. An evidentiary hearing was held March 1-8, 2022, and on May 23, 2022, in Decision and Order 38395, the Commission denied the A&R PPA and closed the docket. On June 2, 2022, Hu Honua and the Company filed motions for reconsideration, and Hu Honua also requested a hearing on said motion, but in Order No. 38443 on June 24, 2022, the Commission denied all 3 requests. Hu Honua appealed D&O 38395 to the Hawai'i Supreme Court and oral arguments are scheduled for January 31, 2023 at 5 pm (SCOT-22-0000418). The capacity from Hu Honua was not included in the analysis.

On December 31, 2019, Hawai'i Electric Light filed an application for approval of an Amended and Restated Power Purchase Agreement ("A&R PPA") for Firm Capacity Renewable Dispatchable Generation with Puna Geothermal Venture, in Docket No. 2019-0333. On March 16, 2022, subject to several conditions including environmental review and approval and the Company's interconnection study, in Decision and Order 38276 the Commission approved the A&R PPA. However, on June 6, 2022, PGV requested an Amendment to the A&R PPA due to delays in the Commission's D&O on the A&R PPA, its requirement of an environmental impact statement, cost increases from the COVID-19 supply chain

crisis, and related effects from Russia's invasion of Ukraine, such as large increases in raw material, commodity, and services pricing due to disrupted global supply, financing, shipping, and security. The Company is currently negotiating with PGV on new pricing and terms for this Amendment to the A&R PPA.

Among other things, this application included an increase in the capacity of PGV by 8 MW. This additional capacity was not included in the analysis. During 2021, PGV returned gradually to service from the lava flow outage that started in 2018. PGV is anticipating additional capacity tests in the latter parts of 2023 to increase its production capacity to 38 MW. But for the purposes of this analysis, the PGV facility rating was assumed to be 24 MW, based on its actual capability as of December 2022. Any capacity made available above 24 MW will increase available energy margin above that represented in this filing.

3.6.2 Non-Firm Resource Additions

In January 2017, Hawai'i Electric Light filed a letter with the Commission requesting to open a docket to solicit proposals for new renewable dispatchable generation. The Commission subsequently issued Order No. 34856 and opened Docket No. 2017-0352 to receive filings, review approval requests, and resolve disputes, if necessary, related to the plan to proceed with competitive procurement of this generation. Request for Proposals ("RFP") for the above docket were separated into three stages, Stage 1,2 and Stage 3.

Two Stage 1 variable renewable generation and storage projects have been approved and are in various stages of completion. These are AES Waikoloa Solar ("Waikoloa"), and Hale Kuawehi Solar, LLC ("Hale Kuawehi"), each 30 MW/120 MWh PV/BESS project. Waikoloa has begun initial testing and is added to the analysis 4/30/2023. Hale Kuawehi is seeking an amendment to their price and Guaranteed Commercial Operating Date; for this analysis, they were not included.

On April 20, 2021, the Commission provided guidance to develop a Stage 3 RFP for Hawai'i. Pursuant to Order 38653 issued on October 17, 2022, Hawai'i Electric Light issued the Stage the Stage 3 RFP on November 21, 2022. No Stage 2 or Stage 3 projects are included in this analysis.

The Company's analysis includes a total of 9.75 MW of Community Based Renewable Energy ("CBRE") projects from Phase 1 (0.75 MW, existing) and Phase 2 RFP LMI (3 MW added June 2025 and 6 MW added November 2025).

3.7 Table of Generating Unit Capacities

Table 3: Hawai'i Electric Light Adequacy of Supply 2023 Unit Ratings

Unit	Net Rating (MW)
Hill 5	14.20
Hill 6	20.20
Puna	15.70
Kanoelehua D11	2.00
Waimea D12	2.50
Waimea D13	2.50
Waimea D14	2.50
Kanoelehua D15	2.50
Kanoelehua D16	2.50
Kanoelehua D17	2.50
Keahole D21	2.50
Keahole D22	2.50
Keahole D23	2.50
Kanoelehua CT1	10.25
Keahole CT2	13.80
Puna CT3	20.00
Keahole CT4/CT-5/ST-7	54.00
Panaewa D24	1.25
Ouli D25	1.25
Punaluu D26	1.25
Kapua D27	1.25
Hawai'i Electric Light total	177.65
PGV	24.00
HEP	58.00
IPP Total	82.00
System total	259.65

4.0 Analysis

4.1 Description of Planning Scenario

For the Energy Reserve Margin analysis, a scenario was analyzed which included the AES Waikoloa Stage 1 RFP project and did not include the Hale Kuawehi Stage 1 RFP project.

4.2 Energy Reserve Margin

The analysis indicates Hawai'i Electric Light's target Energy Reserve Margin of 30% is not met in 2023. The estimated minimum Energy Reserve Margin in 2023 is 18%, during maintenance outages of the Kanoelehua CT1, Puna CT3 and PGV between January and March of 2023. With Puna Steam not expected to return online until June of 2023, the cumulative outages of these units cause a dip below the 30% target during this period. From 2024-2027, with the return of Puna steam and the addition of Waikoloa Solar, the 30% Energy Reserve Margin criteria is exceeded.

A 2023 Energy Reserve Margin of 18% indicates the system is at higher risk of unserved energy if there are additional outages during the lower margin period. This risk will depend in some measure on the actual amount of variable energy at the time of the outages and actual net customer demand, in addition to the nature of other contingencies. For example, should Hamakua Energy and/or Keahole combined cycle ("CC") experience a forced outage during the PGV planned total outage and before Puna Steam returns to service, during peak net demand, there is a risk of unserved energy. The number of shortfall hours shown in Table 4 only refers to hours during which the 30% of Energy Reserve Margin target is not met and does not indicate periods of forecast unserved energy.

Risk mitigation measures in 2023 include prioritization of maintenance to ensure the full availability of other large units (Keahole CC, Hamakua Energy, Puna Combustion Turbine 3, Hill 5/6) during the PGV total plant outage, and operational measures such as standby personnel. Puna Steam returning sooner than anticipated or any available output from PGV above 24 MW will also increase margin. If the Company forecasts a shortfall in meeting forecast net demand without additional contingencies prior to the start of the outage, the outage will be deferred until sufficient resources are restored to service to meet forecast demand.

Table 4: Estimated Energy Reserve Margin Shortfall Hours

Number of Hours Below Energy Reserve Margin Target (Pass/Fail Criteria 30%)	
2023	21 (FAIL)
2024	0 (PASS)
2025	0 (PASS)
2026	0 (PASS)
2027	0 (PASS)

Table 5: Estimated Energy Reserve Margin Percentage

Lowest Estimated Hourly Energy Reserve Margin Percentage	
2023	18%
2024	36%
2025	38%
2026	40%
2027	38%

5.0 Conclusion

Hawai'i Electric Light's generation capacity, using the Energy Reserve Margin, will be below its 30% target at several times in early 2023. With Puna Steam not slated to return to service until mid 2023, generating Energy Reserve margins will be lower during Kanoelehua CT1, and Puna CT3 outages, as well as during PGV's annual maintenance. During these outages, the system will be at higher risk of insufficient resources to meet peak demands if generation contingencies occur and variable resource production is low. An earlier return of Puna Steam, additional output from PGV, maintenance support, and high variable output would reduce risk. Waikoloa is currently testing and is projected to be at its full output in April of 2023. Any generation provided by Waikoloa will increase ERM. Planned outages may be deferred if unplanned outages or other system conditions exist prior to the start of the outage that would forecast generation shortfall. Energy Reserve Margins are forecasted to exceed the target from 2024 through 2027.

Sincerely,

/s/ Kevin M. Katsura

Kevin M. Katsura
Director
Regulatory Non-Rate Proceedings

c: Division of Consumer Advocacy

FILED

2023 Jan 30 PM 14:44

PUBLIC UTILITIES
COMMISSION

The foregoing document was electronically filed with the State of Hawaii Public Utilities Commission's Document Management System (DMS).