



January 30, 2019

SHARON M. SUZUKI
President

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PUBLIC UTILITIES
COMMISSION

The Honorable Chairman and Members of the
Hawai'i Public Utilities Commission
465 South King Street
Kekuanaoa Building, 1st Floor
Honolulu, Hawai'i 96813

Dear Commissioners:

Subject: Adequacy of Supply
Maui Electric Company, Limited

The following information is respectfully submitted in accordance with paragraph 5.3a 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.

2019 Adequacy of Supply Report Summary

- The generation capacity of Maui Electric Company, Limited ("Maui Electric" or the "Company") for the islands of Lana'i and Moloka'i for the next three years (2019, 2020, and 2021) is sufficiently large to meet all reasonably expected demands for service and provide reasonable reserves for emergencies.
- For the island of Maui, with the peak reduction benefits of demand response ("DR") and the equivalent firm capacity value of wind generation, Maui Electric expects to have a reserve capacity shortfall in 2019 and 2020. Maui Electric is evaluating several measures to mitigate the anticipated reserve capacity shortfall.
- Maui Electric anticipates urgently needing a significant amount of additional capacity on the Maui system in the 2022 timeframe with the planned Kahului Power Plant ("KPP") retirement.

- The peak load experienced on Maui in 2018 was 206.2 MW-net and was served by Maui Electric's total capability of 246.3 MW-net, including firm power purchases, but not including variable generation sources such as wind and solar. This represents a reserve margin of approximately 19% over the 2018 net system peak.
- The peak load experienced on Lana'i in 2018 was 5.39 MW-gross, and was served by Lana'i's total capability of 9.40 MW-gross. This represents a reserve margin of approximately 74% over the 2018 system peak.
- The peak load experienced on Moloka'i in 2018 was 6.00 MW-gross, and was served by Moloka'i's total capability of 12.01 MW-gross. This represents a reserve margin of approximately 100% over the 2018 system peak.

1.0 Peak Demand and System Capability in 2018

Maui's 2018 system peak occurred on Tuesday, September 25, 2018, at approximately 7:02 p.m. and was 206.2 MW (net) or 210.7 MW (gross). During the peak, wind resources provided approximately 1.0 MW and there was no solar output. The Maui County Department of Water reduced an estimated 1.6 MW of load during the peak in response to a call for conservation from Maui Electric.

The total system capability of Maui was 246.3 MW-net, not including variable generation sources such as wind and solar. At the time of the system peak, the reserve margin was approximately 19% over the 2018 system peak.¹

1.1 Rider M

At the time of system peak, Maui had in place nine load management contracts totaling approximately 4.1 MW under Rider M, which reduced the evening peak by approximately 1.8 MW-net.

2.0 Estimated Reserve Margins

Attachment 1 shows the expected reserve margin over the next six years, 2019-2024, based on Maui Electric's May 2018 Forecast, which includes the estimated peak reduction benefits of energy efficiency.

3.0 Criteria to Evaluate Maui Electric's Adequacy of Supply

Maui Electric's capacity planning criteria are applied to determine the adequacy of supply and whether or not there is enough generating capacity on the system. Maui

¹ The total capability value used in the calculation of this reserve margin does not account for reduction of available capacity due to maintenance outages, forced outages, or derates in unit capacities.

Electric's capacity planning criteria take into account that Maui Electric must provide for its own backup generation since, as an island utility, it cannot import emergency power from a neighboring utility. Maui Electric's capacity planning criteria are described in Section 3.1.

The results of the annual analysis of the adequacy of supply on the Maui Electric system are a function of a number of forecasts, such as:

- peak demand, including the forecasted peak reduction benefits of (a) energy efficiency programs, (b) customer-sited photovoltaic ("PV") with battery installations and (c) an upward standby adjustment to account for the potential need to serve a few large customer loads that will be served by their own internal generation; [see §4.2]
- peak reduction benefits of DR programs; [see §4.3]
- planned maintenance schedules for the generating units on the system; [see §4.4], and
- increases or reductions of firm generating capacity. [see §4.5]

Each of the current assumptions for these factors is discussed in Section 4. As with all forecasts, these elements are subject to uncertainties. Therefore, a range of scenarios was considered in the analysis.

3.1 Maui Electric's Capacity Planning Criteria

The following capacity planning criteria are used to determine the timing of an additional generating unit for the Maui Division:

New generation will be added to prevent the violation of the rule listed below where "units" mean all units and firm capacity suppliers physically connected to the system, and "available unit" means an operable unit not on scheduled maintenance.

Rule 1:

The total capability of the system must at all times be equal to or greater than the summation of the following:

- a. the capacity needed to serve the estimated system peak load less the total amount of interruptible load;*
- b. the capacity of the unit scheduled for maintenance; and*

- c. *the capacity that would be lost by the forced outage of the largest available unit in service.*

Reserve Margin:

Consideration will be given to maintaining a reserve margin of approximately 20 percent based on Reserve Ratings.

In the Hawaiian Electric Companies'² *PSIP Update Report: December 2016*,³ a possible reserve margin planning guideline of 30% was used for capacity planning analysis starting in the year 2022.

3.2 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 become imminent, it is essential that Maui Electric broaden its consideration 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. the preferred mix of generation resources to meet varying daily and seasonal demand patterns at the lowest reasonable capital and operating costs;
3. required power purchase obligations and contract terminations;
4. the uncertainties surrounding Non-Utility Generation resources;
5. transmission system considerations;
6. meeting environmental compliance standards; and
7. system stability considerations for Maui Electric's isolated system.

In the application of Maui Electric's capacity planning criteria that are used to determine its adequacy of supply, the inputs drive the results. The key inputs in the application of the capacity planning criteria are (1) projected peak demand (including the anticipated peak reduction benefits of energy efficiency programs and

² "Hawaiian Electric Companies" or "Companies" refers collectively to Maui Electric, Hawaiian Electric Company, Inc., and Hawai'i Electric Light Company, Inc.

³ See Power Supply Improvement Plan ("PSIP") Update Report, filed December 23, 2016, in Docket No. 2014-0183.

DR programs) and (2) the total firm capacity on the system. These key inputs are described in the following sections.

4.0 Key Inputs to the 2019 Adequacy of Supply Analysis

4.1 Period Under Review

This adequacy of supply review covers the period 2019 to 2024. As indicated in the *PSIP Update Report: December 2016*, KPP is anticipated to be decommissioned in the 2022 timeframe. Given that it may take five to seven years to install replacement firm capacity, generating system reliability was examined up to 2024 to determine the impact of the loss of KPP.

4.2 May 2018 Peak Forecast

Maui Electric developed and adopted⁴ its peak forecast in May 2018. This forecast was used for the purposes of this analysis. In addition, a high weather peak scenario forecast was used in the analysis to show asymmetric risks associated with unusual events that could occur in future years. Maui Electric has recently experienced significantly higher peak loads than forecasted primarily due to unusually high temperature and humidity conditions. To evaluate the potential risk associated with higher peaks due to unusual conditions such as high temperature and humidity, a high weather peak scenario forecast was created.

Figure 1 and Table 1 below illustrate Maui's historical system peaks and compares them to the forecasts used in 2018 and 2019 analyses. The analyses contained in the 2018 adequacy of supply filing were based on the March 2017 peak forecast. A comparison between recorded and forecasted peaks shows the volatility of recorded system peaks from year to year.

The May 2018 forecast includes peaks that are slightly lower than the March 2017 forecast driven primarily by an updated outlook on sales.

Maui Electric's May 2018 forecast assumes that annual system peaks occur in October. The actual annual peak month can vary from year to year and occurred in September in 2018.

⁴ The May 2018 peak forecast was adopted for planning purposes by Maui Electric for years 2018 through 2024.

For both the recorded and forecast data, Table 1 includes the peak reduction benefits of energy efficiency programs and naturally occurring conservation.

Figure 1: Recorded Peaks and Future Year Projections

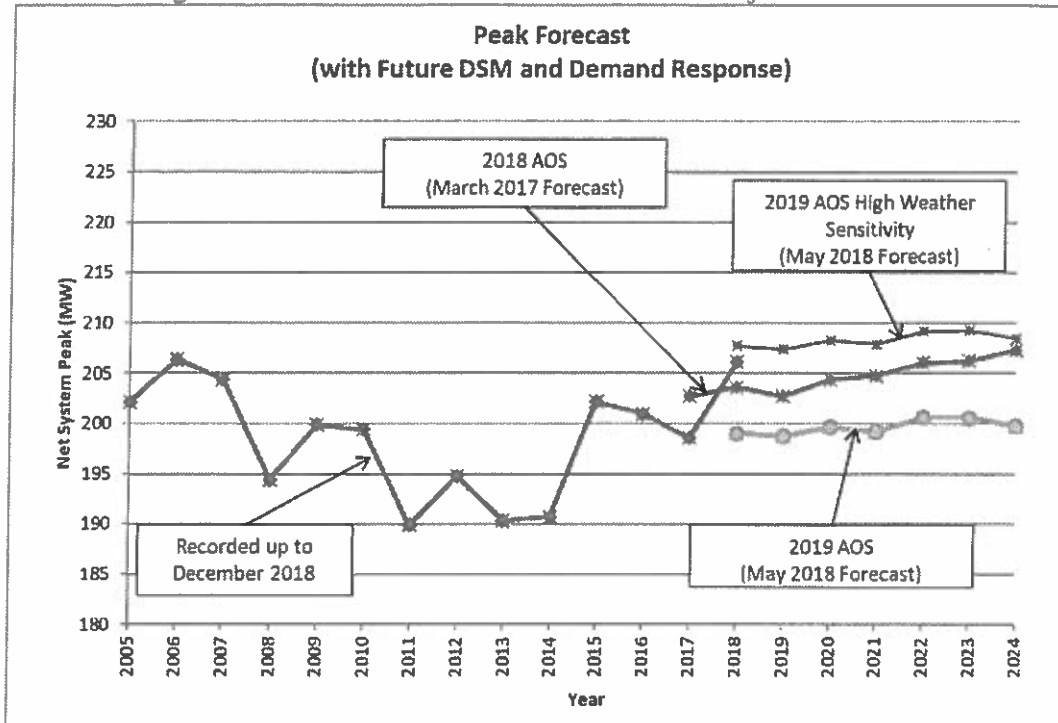


Table 1: Recorded Peaks and Future Year Projections
 Net System Peak⁵ (MW) without DR

Year	Actual Net-to-System	2018 AOS March 2017 Peak Forecast	Difference 2019 - 2018 AOS	2019 AOS May 2018 Peak Forecast	2019 AOS High Weather Sensitivity May Peak Forecast
2008	194.4				
2009	199.9				
2010	199.4				
2011	189.9				
2012	194.8				
2013	190.3				
2014	190.7				
2015	202.2				
2016	201.0				
2017	198.5	202.7			
2018	206.2	203.6	-4.6	199.1	207.8
2019		202.7	-4.0	198.7	207.4
2020		204.4	-4.7	199.7	208.3
2021		204.8	-5.6	199.2	207.9
2022		206.1	-5.4	200.6	209.2
2023		206.3	-5.7	200.6	209.3
2024		207.3	-7.5	199.8	208.5

4.3 Projected Peak Reduction Benefits of DR Programs

Maui Electric is committed to pursuing DR programs designed to provide cost-effective resource options as identified in the Hawaiian Electric Companies' Integrated Demand Response Portfolio Plan.⁶

In 2015, the Hawaiian Electric Companies submitted to the Commission for approval, a DR Portfolio Application in Docket 2015-0412. In 2016, Maui Electric filed an application seeking to expand its Fast DR Program from 0.2 MW to 5.0 MW ("Fast DR Expansion Application").⁷ A Revised DR Portfolio filing

⁵ The May 2018 peak forecast includes - 2 MW of standby load.

⁶ Refer to Docket No. 2007-0341.

⁷ See Application filed in Docket No. 2016-0232.

was filed on February 10, 2017, which provided modified approval requests and DR program design and targets following 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.

For the purposes of this analysis, DR peak reduction impacts from the *PSIP Update Report: December 2016* were used for scenario analysis. Due to the starting time of DR implementation, the first year was shifted two years. For example, 2017 targets are now 2019 targets. The DR impacts in Table 2 lists the peak reductions in the month with the highest peaks, which is October.

Table 2 – DR Peak Reduction

Year	October DR Peak Reduction Impacts (MW-Net)
2019	5.6
2020	9.1
2021	10.3
2022	12.3
2023	12.4
2024	12.8

4.4 Planned Maintenance Schedules for the Generating Units on the System

Planned outages and maintenance outages reduce generating unit availabilities. The schedules for planned overhaul and maintenance outages (“Planned Maintenance Schedule”) change frequently due to unforeseeable findings during outage inspections or to changes in priorities due to unforeseeable problems or circumstances. When major revisions to planned and/or maintenance outages occur, the Planned Maintenance Schedule is revised.

Maui Electric schedules three days of maintenance for combustion turbine engine replacements; Maui Electric intends to undertake these three-day outages at times that present a low degree of risk, such as during the weekend, when loads are expected to be relatively low. As a result, potential shortfalls that occur during these three days of combustion turbine replacement, in isolation, do not warrant any longer-term mitigation measures to be implemented. In order to identify the additional risk to the system this short-term maintenance can present,

however, the analysis provides results with and without the three-day combustion turbine maintenance.

4.5 Reductions of Firm Generating Capacity

4.5.1 Kahului Power Plant Retirement

Maui Electric will retire KPP by 2024 to comply with mandatory National Pollution Discharge Elimination System requirements. In the adequacy of supply analysis, KPP is assumed to retire at the end of 2022. There is an urgent need for replacement generation on Maui in order to meet the KPP retirement deadline.

4.6 Other Inputs

For the purposes of the analysis, DG-PV additions and DR impacts were included. Estimated peak reductions from customer batteries in the Customer Self-Supply and Smart Export program forecasts were included. No future firm or variable resource additions were included so that capacity needs could be examined without the addition of future resources.

4.7 Non-Firm Additions

Variable renewable generation projects are pending review by the Commission. These are AES Kuihelani Solar (Docket No. 2018-0436) and Paeahu Solar (Docket No. 2018-0433). These variable renewable projects were not assumed in the calculation of reserve margin.

5.0 Scenario Analysis

5.1 Description of Scenarios

Scenario analyses are performed to examine the effects of different input assumptions. Evaluation of results under different planning criteria could also provide insight into future capacity addition requirements. This section explains the effects of assigning variable generation resources (e.g., wind) with an equivalent capacity value. Next, the effects of DR and customer-sited battery systems were added. Reserve capacity shortfalls under Rule 1 and reserve margin were calculated under these different scenarios.

The reference case used below only includes the capabilities of the Maui generating units when calculating the reserve capacity shortfalls and reserve margin.

Examination of variable wind generation contribution to total firm capacity was performed in a scenario as a consideration due to the large amount of total wind capacity on the Maui system. Currently, the Maui system includes 72 MW of variable wind generation, which is a significant amount with respect to the system load. A 90% probability level was used to determine a capacity value of 2.6 MW for the existing wind generation. This probability level means the wind output is expected to be 2.6 MW or higher during 90% of the daily peaks. Conversely, the risk is that wind power output is expected to be less than 2.6 MW during 10% of the daily peaks as occurred in 2018 when only 1.0 MW of wind power output was available during the annual peak.

The contributions of DR programs and exclusion of three day-maintenance in additional scenarios were evaluated in the sensitivity analysis discussed below.

Additionally, a high weather peak forecast sensitivity was investigated using Rule 1 and reserve margin criteria for the scenarios listed above. In 2015 Maui experienced a peak that was more than 11 MW higher than the previous year. In 2018 Maui experienced a peak that was 8 MW higher than the previous year and higher than the previous eleven years. These peaks were due to abnormal weather. Because Maui's generating capability is on the brink of reserve capacity shortfalls, an unexpectedly high peak poses an asymmetrical risk of not meeting the load.

5.2 Results of Analysis

Table 3 shows the reserve capacity shortfall, in MW, in the amount needed to satisfy Rule 1 of the capacity planning criteria. The analysis shows that Rule 1 is violated in the reference case beginning in 2019 under a set of assumptions including, but not limited to: (1) continued implementation of third-party energy efficiency; and (2) planned retirement of KPP in December 2022. DR program impacts have not been included in the reference analysis. Also included in Table 3 is the result for Rule 1 of the scenario that includes 2.6 MW toward total system firm capacity from the existing wind facilities and a scenario that includes the impacts of combined wind capacity, DR, and customer-sited batteries with and without three-day combustion turbine engine replacement maintenance.

The Rule 1 analysis is based on annual peaks occurring in October of each year. Because the reserve margin analysis looks at the annual peak and is indifferent to which month the peak occurs, the results of the reserve margin analysis can account for the annual peaks occurring in different months.

Table 3 Maui Division Rule 1 Analysis

Year	Reference Case (MW)	Wind Capacity Scenario (MW)	Wind Capacity and DR Scenario (MW)	Wind Capacity and DR Scenario Excluding Three Day Maintenance (MW)
2019	-23.2	-20.6	-15.5	-3.3
2020	-13.6	-11.0	-2.6	4.0
2021	-6.8	-4.2	5.3	5.3
2022	-8.1	-5.5	6.9	6.9
2023	-47.0	-44.4	-32.0	-23.5
2024	-41.4	-38.8	-26.0	-21.2

Table 4 shows the reserve margin of the reference case and the two scenario analyses.

Table 4: Maui Division Reserve Margin Analysis

Year	Reference Case (%)	Wind Capacity Scenario (%)	Wind Capacity and DR Scenario (%)
2019	24.9	26.3	30.0
2020	23.3	24.6	30.6
2021	23.6	24.9	31.7
2022	22.8	24.0	32.2
2023	4.9	6.2	13.1
2024	5.3	6.6	13.9

Maui Electric's Rule 1 criteria analysis resulted in shortfalls in every year of the reference case. Wind capacity value can partially reduce shortfalls each year. With DR and wind capacity value included, and excluding three-day maintenance in the Rule 1 analysis, small shortfalls remain in 2019 and large shortfalls occur after KPP retires at the end of 2022. Excluding the three-day maintenance from the analysis results in a lower shortfall of 3.3 MW in 2019,

compared to 15.5 MW in the scenario when wind capacity value and DR are included.

Under the 20% reserve margin consideration described in Section 3.1, the Maui system meets the 20% reserve margin threshold for the reference case until 2022. The reserve margin is 4.9% in 2023 and 5.3% 2024, which means that there is minimal reserve capacity in these years.

If the reserve margin guideline were assessed at a 30% level following the retirement of KPP, then the Maui system would fall below the reserve margin in 2023 by 16.9% or 31.7 MW in the scenario when wind capacity value and DR are included.

Table 5 shows the Rule 1 analysis and Table 6 shows the Reserve Margin for the high weather peaks sensitivities.

Table 5: Maui Division Rule 1 Analysis – High Weather Peaks Sensitivity Forecast

Year	Reference Case (MW)	Wind Capacity Scenario (MW)	Wind Capacity and DR Scenario (MW)	Wind Capacity and DR Scenario Excluding Three Day Maintenance (MW)
2019	-34.8	-32.2	-27.1	-13.2
2020	-23.3	-20.7	-12.3	-7.6
2021	-18.4	-15.8	-6.3	-6.3
2022	-19.7	-17.1	-4.8	-4.8
2023	-55.7	-53.1	-40.8	-31.4
2024	-54.5	-51.9	-39.1	-28.5

Table 6: Maui Division Reserve Margin Analysis – High Weather Peaks Sensitivity Forecast

Year	Reference Case (%)	Wind Capacity Scenario (%)	Wind Capacity and DR Scenario (%)
2019	19.3	20.6	23.6
2020	18.2	19.5	24.6
2021	18.5	19.7	25.4
2022	17.7	19.0	26.4
2023	0.5	1.7	8.1
2024	0.9	2.1	8.8

The high weather peaks sensitivity resulted in shortfalls in all years under the Rule 1 criteria analysis of the reference case the wind capacity scenario, and the DR and wind capacity value scenario.

For the high weather peaks sensitivity under the 20% reserve margin consideration, the Maui system is below the 20% reserve margin threshold in all years under the reference case. Counting the capacity value of wind, the Maui system is below the 20% reserve margin threshold in years 2020 to 2024. Counting the capacity value of wind, implementing DR programs, and customer batteries could eliminate the shortfalls in the years 2019 to 2022 and reduce the shortfalls in the other years.

If the reserve margin guideline were assessed at a 30% level following the retirement of KPP, then the Maui system would fall below the reserve margin in 2023 by 21.9% or 43.1 MW in the scenario when wind capacity value and DR are included.

6.0 Mitigation Measures

To avoid near-term reserve capacity shortfalls, Maui Electric has taken a portfolio approach because individually, none of the following measures will be able to fully mitigate the near-term reserve capacity shortfalls.

6.1 Fast DR Expansion

In 2018, the expanded Fast DR program ("Fast DR") contracted approximately 5 MW in customer load. By the end of 2018, 2.7 MW was enabled with the remaining 2.3 MW – or the majority thereof – expected to be enabled in Q1 of 2019. A detailed status report will be provided in Maui Electric's Fast Demand Response Program and Reserve Capacity Mitigation Measures Quarterly Program Status Report to be filed January 30, 2019. Maui Electric continues to treat these efforts with great urgency as the first and best option to boost Maui's reserve capacity.

6.2 Temporary Distributed Generation

Maui Electric's application to purchase and install approximately 4.95 MW of temporary distributed generation ("Temp DG") remains suspended.⁸ However, the Company believes Temp DG is the lowest risk alternative to supplement DR capacity in the near-term. Temp DG units can be operational in six months or less, and provide a high level of dependable capacity, relative to the other options available to Maui Electric.

Should the Company decide to pursue Temp DG units as a solution, leasing the units may be the preferred option (versus buying and later selling the units as originally proposed in the Temp DG application). Leasing removes the uncertainty of the future sale price of the units and may also alleviate stakeholder concerns regarding the permanency of the units.

6.3 Battery Energy Storage System

A battery energy storage system ("BESS") has the potential to both address system security and provide an alternative means of addressing peak demand by storing energy during non-peak periods and discharging stored energy during peak demand periods. Although the project is still in the evaluation stage, a BESS could be installed as soon as 2022. Due to the timing of this project, it would not be able to offset the reserve capacity shortfalls expected during the 2019-2021 period.

6.4 Collaboration with Hawai'i Energy

Maui Electric and Hawai'i Energy are working together to maximize the impact of Hawai'i Energy's efforts on Maui relative to reducing loads during Maui's system peaks. For example, the parties have discussed focusing efforts on

⁸ See Order No. 34437 Suspending the Docket, filed on March 9, 2017 in Docket No. 2016-0234.

technologies that reduce load during the evening peak and that can be implemented quickly, during the years with the lowest amount of reserve capacity. This type of coordination will help both parties achieve their goals of providing for Maui's energy needs. However, in light of the 2018 volcanic eruption on Hawai'i Island, Hawaii Energy has shifted attention to helping the affected communities for the current program year (July 2018 – June 2019).

6.5 Refinement of Maintenance Schedule

Maui Electric's normal maintenance scheduling practices are performed by the Maui Electric Power Supply Department. Scheduling involves many different operational factors. Maintenance scheduling can be expected to be adjusted numerous times over the year due to changing operational factors. In the event of reserve capacity shortfalls, rearranging maintenance schedules, to the extent possible, may provide some level of mitigation.

6.6 Call for Conservation

Maui Electric may request voluntary customer curtailment of demand during capacity reserve shortfall conditions. This step was taken on September 25 and 26 when Maui's system peak reached 210.7 and 209.3 respectively due to unusually hot and humid conditions. However, because this is strictly voluntary, and the Company has no direct control in implement this measure, it should not be considered as dependable as other measures such as demand response. Also, the potential benefit of this option is likely to reduce over time, as increased customer participation in the Fast DR Program or other demand response programs becomes more common. In fact, some of the accounts that reduced their loads on September 25 and 26 have enrolled in the Fast DR Program.

7.0 Acquisition of Replacement Firm Generating Capacity

Any new capacity needed for Maui will be acquired in accordance with the Commission's Framework for Competitive Bidding, adopted by the Commission on December 8, 2006, in Decision and Order No. 23121 in Docket No. 03-0372, and pursuant to Hawai'i Revised Statutes §§ 269-7 and 269-15, and Hawai'i Administrative Rules § 16-601-71.

In response to requests filed by the Companies, on October 6, 2017, the Commission opened Docket No. 2017-0352 related to competitive procurement of dispatchable firm generation and new renewable energy. On October 23, 2017, the Companies filed a draft request for proposals ("RFP"), including one for 40 MW of firm renewable generation on Maui to be in service by the end of 2022. On January 12, 2018, in Order No. 35224, the Commission provided guidance on the RFP process, prioritizing finalizing the Maui variable request for proposals,

and signaling further guidance from the Commission on the Maui Firm RFP. On November 15, 2018, the Companies filed a letter providing an update regarding Maui Electric's Firm RFP stating that it has been updating its analysis for Maui Island considering changes in load forecasts and the necessary retirement of the Kahului Power Plant, as well the impact of the combined PV and storage projects selected from the variable RFPs for the island to ensure that the Companies develop an RFP that meets the system needs of the island properly and within appropriate timeframes.

8.0 Lana'i Division

8.1 Peak Demand and System Capability in 2018-2021

Lana'i's 2018 system peak of 5,390 kW (gross) occurred on October 2, 2018 (7:18 p.m.). The total system capability of Lana'i was 9,400 kW-gross at the time of the system peak resulting in a reserve margin of approximately 74% over the 2018 system peak.

At times during 2018, Lana'i received energy from Lanai Sustainability Research, LLC ("LSR"), a PV independent power producer. Since the power purchase contract with LSR is not for firm capacity, it is not reflected in Lana'i's total firm generating capability.

On April 6, 2018, Maui Electric's combined heat and power system, located at the Manele Bay Four Seasons Resort, incurred engine damage. Therefore, the total system capability for Lana'i was reduced to 9,400 kW for the majority of 2018. Maui Electric fully restored the combined heat and power system on November 28, 2018.

Maui Electric developed and adopted its peak forecast in May 2018 that was used in this analysis for Lana'i.

Table 7 shows the expected reserve margins over the next three years, based on the May 2018 Forecast.

Table 7: Lana'i Division Reserve Margin Analysis

Year	System Capability at Annual Peak Load (Gross kW) [A]	System Peak (Gross kW) [B]	Reserve Margin (%) [A - B] / [B]
2018	9,400	5,390	74%
2019	10,230	6,500	57%
2020	10,230	6,600	55%
2021	10,230	6,600	55%

8.2 Lana'i Division Capacity Planning Criteria

The following criterion is used to determine the timing of an additional generating unit for the Lana'i Division and the Moloka'i Division:

New generation will be added to prevent the violation of any one of the rules listed below where "units" mean all units and firm capacity suppliers physically connected to the system, and "available unit" means an operable unit not on scheduled maintenance.

1. *The sum of the normal top load ratings of all units must be equal to or greater than the system peak load to be supplied.*
2. *With no unit on maintenance, the sum of the reserve ratings of all units minus the reserve rating of the largest available unit must be equal to or greater than the system peak to be supplied.*
3. *With a unit on maintenance:*
 - a) *The sum of the reserve ratings of all units minus the reserve rating of the largest available unit must be equal to or greater than the daytime peak load to be supplied.*
 - b) *The sum of the reserve ratings of all units must be equal to or greater than the evening peak load to be supplied.*

9.0 Moloka'i Division

9.1 Peak Demand and System Capability in 2018 - 2021

Moloka'i's 2018 system peak of 6,000 kW (gross) occurred on September 25, 2018 (6:50 p.m.). The total system capability on Moloka'i was 12,010 kW-gross at the time of the system peak, resulting in a reserve margin of approximately 100% over the 2018 system peak.

Maui Electric developed and adopted its peak forecast in May 2018 that was used in this analysis for Moloka'i.

Table 8 shows the expected reserve margins over the next three years, based on the May 2018 Peak Forecast.

Table 8: Moloka'i Division Reserve Margin Analysis

Year	System Capability at Annual Peak Load (Gross kW) [A]	System Peak (Gross kW) [B]	Reserve Margin (%) [A - B] / [B]
2018	12,010	6,000	100%
2019	12,010	5,900	104%
2020	12,010	5,900	104%
2021	12,010	5,900	104%

9.2 Reductions in Peak Demand: Moloka'i's Rider

At the time of system peak, Moloka'i had in place one load management contract totaling approximately 367 kW under Rider M, which reduced evening peak by approximately 359 kW.

9.3 Moloka'i Division Capacity Planning Criteria

Moloka'i Division's capacity planning criteria are identical to those of the Lana'i Division. See Section 6.3 above, Lana'i Division Capacity Planning Criteria.

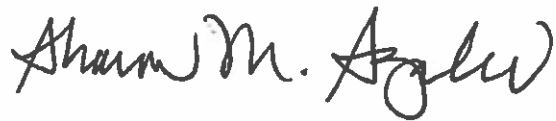
10.0 Conclusion

Maui Electric's generation capacity for the islands of Lana'i and Moloka'i for the next three years (2019, 2020, and 2021) is sufficiently large to meet all reasonably expected demands for service and provide reasonable reserves for emergencies.

Maui Electric forecasts reserve capacity shortfalls for the island of Maui to occur starting in 2019, under its May 2018 forecast. Maui Electric is implementing the expansion of Fast DR to mitigate these shortfalls. In the event that additional mitigation measures are needed, Maui Electric is prepared to implement the Temp DG and is evaluating BESS technology to provide peak shaving capability.

Maui Electric forecasts large reserve capacity shortfalls for the island of Maui to occur in year 2023 with the planned retirement of the units at KPP in 2022.

Very truly yours,



Sharon M. Suzuki
President

Attachments

c: Division of Consumer Advocacy (with Attachments)

Table A1:
 Maui Division Projected Reserve Margins

Year	System Capability at Annual Peak Load (Net MW) [A] (I)	System Peak (Net MW) [B] (II)	Interruptible Load (net MW) [C] (III)	Reserve Margin (%) [A - (B-C)] / (B-C)
2019	246	197	0	25%
2020	246	200	0	23%
2021	246	199	0	24%
2022	246	201	0	23%
2023	210	201	0	5%
2024	210	200	0	5%

Notes:

- I. System Capability includes:
 - Maui Electric central station units at total normal capability in 2018 was 246.3 MW-net.
 - Planned retirement of the units at the Kahului Power Plant (35.9 MW-net) in 2022.
- II. System Peaks:
 - The 2019-2024 annual forecasted system peaks are based on Maui Electric's May 2018 Forecast reduced by estimated peak reduction from customer batteries.
 - The forecasted System Peaks for 2019-2024 include the estimated peak reduction benefits of third-party energy efficiency programs.
 - The Maui Electric annual forecasted system peak is expected to occur in the month of October.
- III. Interruptible Load:
 - As discussed in section 4.2, interruptible load impacts which will be part of the DR programs are assumed to be zero in this analysis.

Table A2:

Maui Unit Ratings Installed

As of December 31, 2018

Units	Gross (MW)		Net (MW)	
	Reserve	NTL ^(I)	Reserve	NTL ^(I)
M1	2.50	2.50	2.50	2.50
M2	2.50	2.50	2.50	2.50
M3	2.50	2.50	2.50	2.50
X1	2.50	2.50	2.50	2.50
X2	2.50	2.50	2.50	2.50
M4	5.60	5.60	5.51	5.51
M5	5.60	5.60	5.51	5.51
M6	5.60	5.60	5.51	5.51
M7	5.60	5.60	5.51	5.51
M8	5.60	5.60	5.48	5.48
M9	5.60	5.60	5.48	5.48
M10	12.50	12.50	12.34	12.34
M11	12.50	12.50	12.34	12.34
M12	12.50	12.50	12.34	12.34
M13	12.50	12.50	12.34	12.34
M14/15/16 ^(II)	58.00	58.00	56.78	56.78
M17/18/19 ^(II)	58.00	58.00	56.78	56.78
Maalaea GS	212.10	212.10	208.42	208.42
K1	5.90	5.00	5.62	4.71
K2	6.00	5.00	5.77	4.76
K3	12.70	11.50	12.15	10.98
K4	13.00	12.50	12.38	11.88
Kahului GS	37.60	34.00	35.92	32.33
Hana 1 ^(III)	1.00	1.00	0.97	0.97
Hana 2 ^(III)	1.00	1.00	0.97	0.97
Maui System	251.70	248.10	246.28	242.69

Notes:

(I) NTL = Normal Top Load

(II) The NTL rating for long-term capacity planning purposes for each of the two Maalaea Dual Train Combined Cycle units, Maalaea Unit 14/15/16 and Maalaea Unit 17/18/19, is 56.78 MW (net). In the first and second quarters of 2008, Maui Electric performed

capability tests on Maalaea Unit 14/15/16 and Maalaea Unit 17/18/19, respectively. Maalaea Unit 14/15/16 resulted in a net NTL rating of 56.27 MW (0.51 MW lower than the rated NTL) and M17/18/19 resulted in a net NTL of 56.20 MW (0.58 MW lower than the rated NTL). With consideration that the capabilities of these units can vary depending on ambient weather conditions, it was determined that the rated NTL of 56.78 MW (net) is acceptable.

- (III) Units located at Hana Substation No. 41. In December 2008, a communication and controls project was completed. This project provides Maui Electric with the means to operate the Hana generators in parallel to the system and as emergency units. These units also have the capability to be indirectly, remotely controlled and automatically brought on line. With the completion of the project, the Hana units have been designated as firm capacity and are included in the total reserve rating of the Maui system capability.