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President

January 30, 2017 2017 JAN 30 P 4:00

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 ("Maui Electric" or "Company")

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.*

2017 Adequacy of Supply Report Summary

- Maui Electric's generation capacity for the islands of Lana'i and Moloka'i for the next three years (2017, 2018, and 2019) is sufficiently large to meet all reasonably expected demands for service and provide reasonable reserves for emergencies.
- For the island of Maui, without the peak reduction benefits of demand response but with the equivalent firm capacity value of wind generation, Maui Electric expects to have a reserve capacity shortfall from 2017 to 2022. Maui Electric is evaluating several measures to mitigate the anticipated reserve capacity shortfall.
- Maui Electric anticipates needing a significant amount of additional firm capacity on the Maui system in the 2022 timeframe with the planned Kahului Power Plant retirement.
- Kahului Units 1 and 2 (with a combined rating of 11.4 MW-net) were reactivated in September 2016 due to the termination of the Hawaiian Commercial & Sugar Co.

("HC&S") power purchase agreement and the increased peak load growth that occurred since these units were deactivated in February 2014. The 2017 Adequacy of Supply ("AOS") total system capability includes the capacity from Kahului Units 1 and 2 through 2022.

- HC&S issued a Notice of Termination of Power Purchase Agreement to Maui Electric on January 6, 2016, terminating the PPA effective as of twelve (12) months from the date of the notice. HC&S and Maui Electric subsequently agreed to terminate the PPA effective December 23, 2016 in consideration of the end of HC&S's harvesting operations. HC&S no longer provides capacity.
- The peak load experienced on Maui in 2016 was 201.0 MW-net, and was served by Maui Electric's total capability of 250.3 MW-net, including firm power purchases, but not including variable generation sources such as wind and solar. This represents a reserve margin of approximately 22% over the 2016 net system peak.
- The peak load experienced on Lana'i in 2016 was 5.70 MW-gross, and was served by Lana'i's total capability of 9.4 MW-gross. This represents a reserve margin of approximately 65% over the 2016 system peak.
- The peak load experienced on Moloka'i in 2016 was 5.65 MW-gross, and was served by Moloka'i's total capability of 12.01 MW-gross. This represents a reserve margin of approximately 113% over the 2016 system peak.

1.0 Peak Demand and System Capability in 2016

Maui's 2016 system peak occurred on Tuesday, August 24, 2016, at approximately 7:23pm and was 201.0 MW (net) or 205.4 MW (gross). During the peak, wind resources provided approximately 11.1 MW and there was no solar output.

The total system capability of Maui was 250.3 MW-net, including 4 MW-net from HC&S and 11.4 MW-net from Kahului units 1 and 2, but not including variable generation sources such as wind and solar. At the time of the system peak, the reserve margin was approximately 22% over the 2016 system peak.[1] The actual reserve at that time was 13%.[2] This was an abnormally low reserve margin. Had the largest unit been unexpectedly lost from service at the time of the peak, there would have been a deficit of 2 MW of firm capacity and Maui Electric may not have been able to serve the peak

[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.
[2] The actual reserve was calculated using the available capacity at the time of the peak. Units that were not available during the peak were HC&S, M10 and M4. The capacity of M6 was derated to 4.5 MW of available capacity. Variable generation was not used in this calculation.

demand.[3] Larger reserve margins would enable Maui Electric to serve the peak demand even with multiple units outages of the type actually experienced.

1.1 Rider M and Demand Side Management ("DSM")

At the time of system peak, Maui had in place nine load management contracts totaling approximately 4.3 MW under Rider M, which reduced the evening peak by approximately 1.16 MW-net. In addition, Maui has had residential and commercial & industrial energy efficiency DSM programs, which reduced the system peak by an estimated 27.8 MW-net (net of free riders).[4] The estimated system peak reduction is based on Maui Electric and Hawai'i Energy, PBF Administrator, records. Without the Rider M contracts and DSM impacts, the 2016 system peak would have been approximately 230.0 MW-net.

2.0 Estimated Reserve Margins

Attachment 1 shows the expected reserve margin over the next eight years, 2017-2024, based on Maui Electric's November 2016 Peak 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 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 demand-side management programs, and (b) customer-sited photovoltaic ("PV") with battery installations; [§4.2]

[3] At the time of the peak, the wind resources were delivering approximately 11 MW of power. Thus, at the time of the peak, the peak demand could have been served even with the loss of the largest unit, provided that the wind output remained above 2 MW in this period. However, the output of wind fluctuates significantly from moment to moment and the wind resources cannot always be relied upon to deliver energy when needed.

[4] Includes impacts from Maui Electric implemented energy efficiency programs and Hawai'i Energy, Public Benefits Fee ("PBF") Administrator, for Program Years 2009-2014 as reported by Leidos Engineering in the Annual Reports to the Hawai'i Public Utilities Commission.

- peak reduction benefits of demand response programs; [§4.3]
- planned maintenance schedules for the generating units on the system; [§4.4], and
- increases or reductions of firm generating capacity. [§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 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'[5] Power Supply Improvement Plan ("PSIP") Update Report filed on December 23, 2016, a proposed Reserve Margin planning guideline of 30% was used for capacity planning analysis starting in the

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

year 2022 with the replacement capacity of Kahului Power Plant. Reserve Margin guidelines of 20 and 30% are considered in the 2017 AOS.

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; the preferred mix of generation resources to meet varying daily and seasonal demand patterns at the lowest reasonable capital and operating costs;
2. required power purchase obligations and contract terminations;
3. the uncertainties surrounding Non-Utility Generation resources;
4. transmission system considerations;
5. meeting environmental compliance standards; and
6. 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 DSM programs and demand response 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 2017 AOS Analysis

4.1 Period Under Review

This adequacy of supply review covers the period 2017 to 2024. As indicated in the PSIP Update Report, Kahului Power Plant will 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 Kahului Power Plant's firm capacity.

4.2 November 2016 Peak Forecast

Maui Electric developed and adopted its peak forecast in November 2016 ("November 2016 peak forecast"), for future planning purposes.[6] Maui Electric's November 2016 peak 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. In 2015, Maui Electric experienced significantly higher peak loads than forecasted primarily due to unusually high temperature and humidity conditions. Currently the Maui system is particularly sensitive to high peak load conditions because capacity is no longer being provided by HC&S. 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 the 2016 and 2017 AOS analyses. The analyses contained in the 2016 AOS were based on the May 2015 peak forecast. Maui Electric's planning analyses performed in the Hawaiian Electric Companies'[7] Power Supply Improvement Plan Update Report, filed on December 23, 2016, in Docket No. 2014-0183, also used the May 2015 peak forecast. A comparison between recorded and forecasted peaks shows the volatility of recorded system peaks from year-to-year. It should be noted that the 2015 and 2016 recorded Maui peaks were 11.5 MW and 10.3 MW higher than the recorded peak in 2014 (190.7 MW-net). The 2015 and 2016 peaks were also the highest peaks experienced on Maui since 2007. The high 2015 peak was primarily due to unusually high temperature and humidity conditions and the high 2016 peak was primarily due to commercial load growth.

The November 2016 forecast includes peaks that are slightly lower than the May 2015 forecast driven primarily by updated economic information resulting in lower commercial sales.

The AOS assumes that the annual system peaks occur in December. The actual annual peak month can vary from year to year, and occurred in August in 2016. The annual peak is assumed to occur in December because on average it has the highest peak compared to other months.

[6] Maui Electric approved its updated peak forecast in November 2016, and this forecast was used for the purposes of this AOS analysis. This forecast was developed after PSIP inputs were set and analyses in the PSIP Update Report were near completion. Hence, the analyses contained in the PSIP Update Report were not able to use this forecast, and the short term reserve margin analysis performed herein is more current than that provided in the PSIP.
[7] "Hawaiian Electric Companies" or "Companies" refers collectively to Hawaiian Electric Company, Inc., Maui Electric Company, LImited and Hawai'i Electric Light, Inc.

For both the recorded and forecast data, Table 1 includes the peak reduction benefits of energy efficiency programs and naturally occurring conservation. The peak forecast also includes the impact of customer-sited PV and other renewable generation system installations through interconnection programs like Net Energy Metering, Standard Interconnection Agreements, Customer Grid-Supply, and Customer Self-Supply.

Figure 1: Recorded Peaks and Future Year Projections

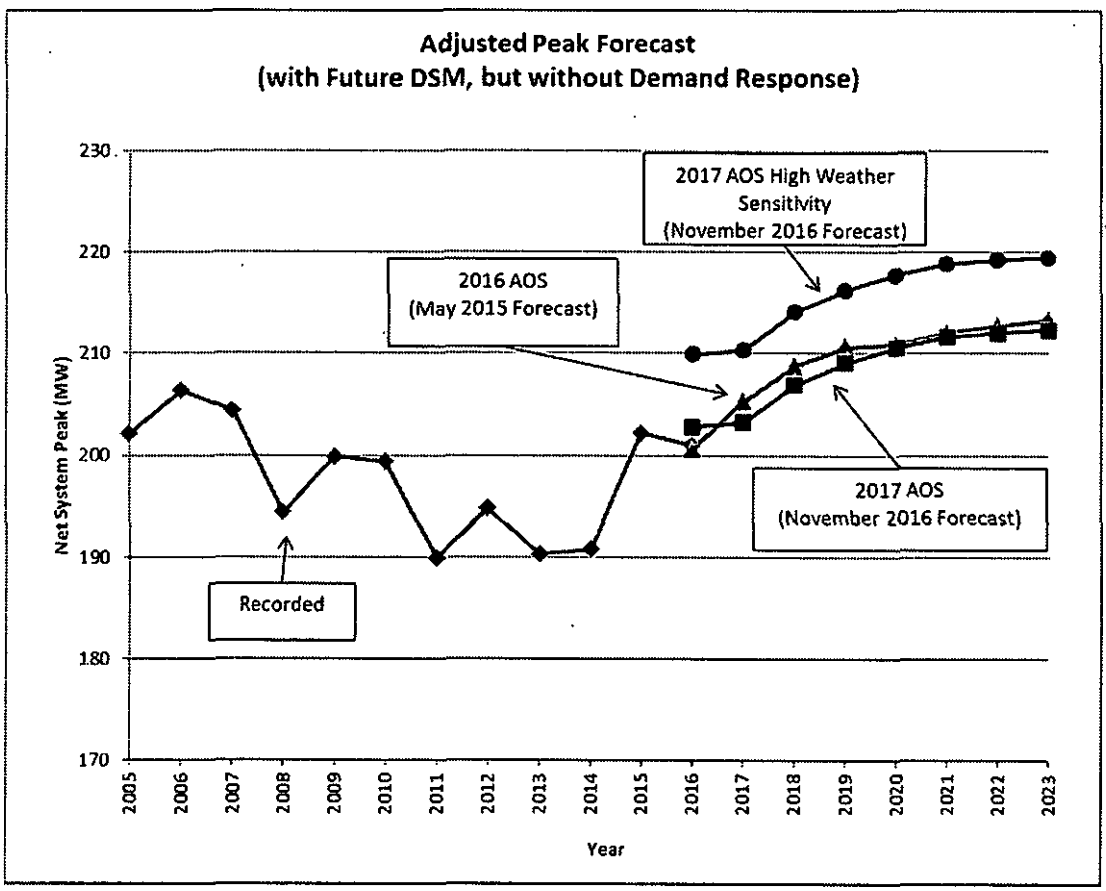

Table 1: Recorded Peaks and Future Year Projections

	Net System Peak (MW) (with Future DSM, but without Demand Response)					
Year	Actual	2016 AOS May 2015 Peak Forecast	Difference 2017 - 2016 AOS	2017 AOS Nov 2016 Peak Forecast	Difference 2017 AOS - 2017 High Weather Sensitivity	2017 AOS High Weather Sensitivity Nov 2016 Peak Forecast
2005	202.1					
2006	206.4					
2007	204.4					
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	200.6	2.2	202.8	7.1	209.9
2017		205.3	-2.0	203.2	7.1	210.3
2018		208.7	-1.8	206.9	7.2	214.1
2019		210.6	-1.6	209.0	7.2	216.2
2020		210.8	-0.3	210.5	7.2	217.7
2021		212.0	-0.4	211.6	7.2	218.8
2022		212.7	-0.7	212.0	7.2	219.2
2023		213.3	-1.0	212.3	7.2	219.5
2024		213.0	-0.6	212.4	7.2	219.6
2025		214.7	-1.4	213.3	7.2	220.5

4.3 Projected Peak Reduction Benefits of Demand Response Programs

Maui Electric is committed to pursuing Demand Response ("DR") programs designed to provide cost-effective resource options to meet the capacity needs and support the reliable operation of the system, as identified in the Integrated Demand Response Portfolio Plan ("IDRPP") filed with the commission on July 28, 2014, Update filed March 31, 2015, and Supplement filed November 20, 2015, in Docket No. 2007-0341.

On December 30, 2015, the Hawaiian Electric Companies submitted to the Commission for approval a DR Portfolio Application requesting:

- Approval of proposed tariff structure for DR programs;
- Approval of cost recovery mechanism;
- Approval of a 2-year program and budget approval cycle; and,

- Approval of the Companies' proposed reporting structure.

On September 2, 2016, Maui Electric filed an application seeking to expand its Fast DR Program to 5.0 MW in order to address an urgent reserve capacity shortfall need ("Fast DR Expansion Application").[8] The current Fast DR Program has 0.2 MW. A Revised DR Portfolio filing, to be filed on February 10, 2017, will publish finalized DR program design and targets (MW). Pending Commission approval of the Revised DR Portfolio filing, the next AOS filing will be updated with the revised DR program load amounts within the final Application. Maui Electric will continue to implement DR in accordance with these targets in future years.

For the purpose of AOS analysis, high distributed generation photovoltaic ("DG-PV") DR peak reduction impacts from the December 23, 2016 PSIP Update Report were used for scenario analysis. The DR impacts can vary each month so Table 2 lists the peak reductions in the month with the highest peaks which is December.

Table 2 – DR Peak Reduction

Year	December DR Peak Reduction Impacts (MW-Net)
2017	6.1
2018	8.4
2019	11.1
2020	13.6
2021	14.5
2022	15.4
2023	17.1
2024	18.9

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 change frequently due to unforeseeable findings during outage inspections or to changes in priorities due to unforeseeable problems or circumstances. When

[8] See Application filed in Docket No. 2016-0232.

major revisions to planned and/or maintenance outages occur, the Planned Maintenance Schedule is revised.

4.5 Reductions of Firm Generating Capacity

4.5.1 Kahului Units 1 and 2 Deactivation

Kahului Units 1 and 2 (with a combined rating of 11.4 MW-net) were deactivated at the end of February 2014, and were laid up in a manner that enabled their return to service in emergency conditions and/or generation shortfalls (based on reserve planning criteria). However, with the termination of the HC&S PPA and increased peak load growth, the generating capacity of K1 and K2 is needed in order to maintain system reliability and to avoid violating Maui Electric's contingency reserve planning criteria and the possible risk of load shed. As a result, in September 2016, K1 and K2 were removed from deactivated status and designated as reactivated.[9]

4.5.2 Kahului Power Plant Retirement

Maui Electric will retire Kahului Power Plant by (KPP) 2024 to comply with mandatory National Pollution Discharge Elimination System requirements. In the AOS analysis, KPP is assumed to retire at the end of 2022.

4.5.3 Capacity from HC&S

On January 6, 2016, HC&S issued a Notice of Termination of Power Purchase Agreement to Maui Electric.[10] The termination was to be effective as of twelve (12) months from the date of the notice. Subsequently, HC&S and Maui Electric agreed to terminate the PPA effective December 23, 2016 in consideration of the end of HC&S's harvesting operations.[11] Therefore, HC&S provides no contribution to the total system firm capacity in 2017 and beyond.

4.6 Other Inputs

For the purposes of the analysis, DG-PV additions and demand response impacts were included. No future firm or variable resource additions were

[9] See the Third Annual Status Update of the Milestone Metrics for the System Improvement and Curtailment Reduction Plan filed on September 30, 2016 in Docket 2011-0092.
[10] See Notice of Termination received from HC&S filed on January 19, 2016 in Docket No. 2015-0094 ("HC&S January 6, 2016 letter").
[11] See Termination Agreement between Maui Electric and HC&S filed on January 5, 2017 in Docket No. 2015-0094.

included so that capacity needs could be examined without the addition of future resources.

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 demand response and customer-sited battery systems were added. Reserve capacity shortfalls under Rule 1 and reserve margin were calculated under these different scenarios. A sensitivity for unusually high temperature and humidity conditions, as seen in 2015, was also investigated.

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 2.8 MW for the existing wind generation. This probability level means the wind output is expected to be 2.8 MW or higher during 90% of the daily peaks. Conversely, the risk is that wind power output is expected to be less than 2.8 MW during 10% of the daily peaks.

The contributions of demand response programs and customer-sited batteries in an additional scenario were evaluated in a 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 and higher than the previous seven years. This peak was due to abnormal weather. Because Maui's generating capability is on the brink of a reserve capacity shortfall an unexpectedly high peak poses an asymmetrical risk of not meeting the load.

5.2 Results of Analysis

Table 4 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 2017 under a set of assumptions including, but not limited to: (1) continued implementation of third-party energy efficiency and (2) planned retirement of the Kahului Power Plant in December 2022. Demand response program impacts have not been included in the reference analysis. Also included in Table 4 is the result for Rule 1 of the scenario that includes 2.8 MW toward total system firm capacity from the existing wind facilities and a scenario that includes the impacts of combined wind capacity, demand response, and customer-sited batteries.

The Rule 1 analysis is based on annual peaks occurring in December 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 4 Maui Division Rule 1 Analysis

Year	Reference Case (MW)	Wind Capacity Scenario (MW)	Wind Capacity and DR Scenario (MW)
2017	-3.3	-0.5	0.5
2018	-6.6	-3.8	1.8
2019	-8.6	-5.8	0.2
2020	-10.5	-7.7	4.9
2021	-7.4	-4.6	9.5
2022	-6.2	-3.4	11.0
2023	-42.4	-39.6	-23.7
2024	-44.5	-41.7	-23.3

Table 5 shows the reserve margin of the reference case and the two scenario analyses.

Table 5: Maui Division Reserve Margin Analysis

Year	Reference Case (%)	Wind Capacity Scenario (%)	Wind Capacity and DR Scenario (%)
2017	21%	23%	26%
2018	19%	20%	26%
2019	18%	19%	26%
2020	17%	18%	26%
2021	16%	18%	26%
2022	16%	17%	27%
2023	-1%	0%	9%
2024	-1%	0%	10%

The 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 in the Rule 1 analysis, shortfalls are eliminated until after KPP retires at the end of 2022.

Under the 20% reserve margin consideration described in Section 3.1, the Maui system falls below the 20% reserve margin threshold starting in 2018 for the reference case. The reserve margin is -1% in 2023 and 2024 which means that there is no reserve margin and that the annual peak is 1% higher than the installed capacity. Counting the capacity value of wind, implementing demand response programs, and customer batteries, eliminates the reserve capacity shortfalls until the retirement of KPP.

If the reserve margin guideline were assessed at a 30% level following the retirement of KPP then the Maui system falls below the reserve margin in 2023 by 21% or 44 MW in the scenario when wind capacity value and DR are included.

The results described above are consistent with those provided in response to CA-IR-1, in Docket No. 2016-0234 (Maui Electric Temporary Distributed Generation Project).[12]

[12] The high weather peak sensitivity analysis contained in this AOS was not included in the Company's response to CA-IR-1.

Table 6 shows the Rule 1 analysis and Table 7 shows the Reserve Margin for the high weather peaks sensitivities.

Table 6: Maui Division Rule 1 Analysis – High Weather Peaks Sensitivity Forecast

Year	Reference Case (MW)	Wind Capacity Scenario (MW)	Wind Capacity and DR Scenario (MW)
2017	-10.0	-7.2	-6.2
2018	-13.4	-10.6	-4.9
2019	-15.4	-12.6	-6.6
2020	-17.3	-14.5	-1.9
2021	-14.4	-11.6	2.4
2022	-12.8	-10.0	4.3
2023	-49.6	-46.7	-30.4
2024	-51.6	-48.8	-30.3

Table 7: Maui Division Reserve Margin Analysis – High Weather Peaks Sensitivity Forecast

Year	Reference Case (%)	Wind Capacity Scenario (%)	Wind Capacity and DR Scenario (%)
2017	17%	18%	22%
2018	15%	16%	21%
2019	14%	15%	22%
2020	13%	14%	22%
2021	13%	14%	22%
2022	12%	14%	22%
2023	-4%	-3%	5%
2024	-4%	-3%	6%

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

occurs in all years except 2021 and 2022. DR grows enough to cover the shortfalls in 2021 and 2022 for this scenario.

For the high weather peaks sensitivity under the 20% reserve margin consideration, the Maui system falls below the 20% reserve margin threshold starting in all years under the reference case and in the scenario with wind capacity. Counting the capacity value of wind, implementing demand response programs, and customer batteries could eliminate the shortfalls until the retirement of Kahului.

If the reserve margin guideline were assessed at a 30% level following the retirement of KPP, then the Maui system falls below the reserve margin in 2023 by 25% or 54 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 submitted applications to the Commission to: 1) expand the Fast Demand Response Program, and 2) purchase and install temporary distributed generation at the future Kuihelani Substation. In addition, Maui Electric will be repurposing the existing battery energy storage system ("BESS") at the Wailea substation to help provide additional capacity. Maui Electric has taken this portfolio approach because individually, none of the above measures will be able to fully mitigate the near-term reserve capacity shortfalls.

6.1 Fast Demand Response Expansion

On September 2, 2016, Maui Electric filed an application with the Commission requesting the expansion of the Fast Demand Response program from the current 0.2 MW of capacity to 5.0 MW in order to help mitigate previously forecasted capacity shortfalls starting in 2017.[13] Maui Electric estimates that an enrollment of 5 MW will result in an average peak performance of 4 MW. For capacity planning purposes, this would provide 1 MW over a four-hour period.

6.2 Temporary Distributed Generation

On September 6, 2016, Maui Electric filed an application with the Commission requesting approval to purchase and install 4.95 MW of temporary distributed generation ("DG") units at the future Kuihelani Substation.[14] As part of the project, three used mobile diesel generators will be purchased, and later

[13] See Docket No. 2016-0232.
[14] See Docket No. 2016-0234.

sold after they are no longer required to satisfy the reserve capacity shortfall. The reserve capacity shortfall is anticipated to be eliminated with the installation of new firm generation in 2022.

6.3 BESS at Wailea

The Wailea BESS will be repurposed away from distribution circuit management toward providing system capacity during the peak period as needed. It is assumed the BESS could provide 0.25 MW for 4 continuous hours.

6.4 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.

6.5 Call for Conservation

Maui Electric may request voluntary customer curtailment of demand during capacity reserve shortfall conditions.

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 HRS §§ 269-7 and 269-15, and Hawai'i Administrative Rules § 6-61-71.

Maui Electric stated in the Companies' Five-Year Action Plan in the PSIP Update Report:

> Maui Electric will be pursuing a transparent and competitive effort to procure cost effective renewable resources as identified in the Near-Term Resource Plan. Maui Electric is considering various options for a competitive procurement process in compliance with the Commission's Framework for Competitive Bidding. From time to time, the Companies may receive unsolicited proposals for renewable energy projects outside of a competitive procurement cycle that provide clear benefits to customers. In such cases, the Companies will review the

> merits of these proposals in accordance with established rules and practices.[15]

Maui Electric stated further with respect to replacement capacity in 2022:

> In May 2016, Maui Electric filed a request with the Commission for a docket to be opened, facilitating the acquisition of replacement capacity for the planned retirement of KPP in 2022. In addition to replacing the capacity that will be lost with KPP's retirement additional generation capacity is needed on the island of Maui to address anticipated load growth, constrained South Maui transmission capability, and Hawaiian Commercial & Sugar (HC&S) ceasing operations. In total, Maui Electric plans to acquire approximately 40 MW of dispatchable firm generation on the island of Maui through competitive bidding. As a temporary near term measure, Maui Electric has begun the procurement of DG just under 5 MW in size to be located at the Kuihelani Substation in central Maui. An application for approval for the DG units was submitted to the Commission in September 2016. Additionally, Maui Electric filed an application with the Commission to expand the existing Fast Demand Response (DR) Pilot Program on Maui from 200 kW to 5.0 MW as a complementary potential near-term capacity strategy.[16]

8.0 Lana'i Division

8.1 Peak Demand and System Capability in 2016 - 2019

Lana'i's 2016 system peak of 5,700 kW (gross) occurred on December 30, 2016 (7:05p.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 65% over the 2016 system peak.

At times during 2016, Lana'i received energy from Lanai Sustainability Research, LLC (LSR), a photovoltaic independent energy producer. Since this contract is not for firm capacity, it is not reflected in Lana'i's total firm generating capability.

[15] PSIP Update Report, page 7-22.
[16] PSIP Update Report, page 7-22.

On March 6, 2015, the Maui Electric's combined heat and power system, located at the Manele Bay Four Seasons Resort, incurred extensive and irreparable damage due to a fire. Therefore, the total system capability for Lana'i has been reduced to 9,400 kW for years 2016 and 2017. Maui Electric plans to replace the unit with similar equipment as soon as reasonably possible. The estimated return to service is currently November, 2017.

Maui Electric developed and adopted its peak forecast in November 2016 that was used in this analysis for Lana'i.

Table 8 shows the expected reserve margins over the next three years, based on the November 2016 Forecast.

Table 8: 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]
2016	9,400	5,700	65%
2017	9,400	5,800	62%
2018	10,230	5,800	76%
2019	10,230	5,800	76%

8.2 Reductions in Peak Demand: Lana'i's Energy Efficiency DSM Programs

Lana'i has had residential and commercial & industrial demand side management programs in place since 1996, which reduced the system peak by an estimated 247.6 kW-net (net of free riders).[17]

8.3 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

[17] Includes impacts from Maui Electric implemented energy efficiency programs and Hawai'i Energy Public Benefits Fee Administrator, for Program Years 2009-2014 as reported by Leidos Engineering in the Annual Reports to the Hawai'i Public Utilities Commission.

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 2016 - 2019

Moloka'i's 2016 system peak of 5,650 kW (gross) occurred on October 18, 2016 (6:27p.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 112% over the 2016 system peak.

Maui Electric developed and adopted its peak forecast in November 2016 that was used in this analysis for Moloka'i.

Table 9 shows the expected reserve margins over the next three years, based on the November 2016 Peak Forecast.

Table 9: 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]
2016	12,010	5,650	113%
2017	12,010	5,800	107%
2018	12,010	5,800	107%
2019	12,010	5,800	107%

9.2 Reductions in Peak Demand: Moloka'i's Rider M and Energy Efficiency DSM Programs

At the time of system peak, Moloka'i had in place one load management contract totaling approximately 369 kW under Rider M, which reduced evening peak by approximately 359 kW. In addition, Moloka'i has had residential and commercial and industrial energy efficiency DSM program from 1996, which reduced the system peak by and estimated 623.8 kW-net (net of free riders).[18]

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 (2017, 2018, and 2019) is sufficiently large to meet all reasonably expected demands for service and provide reasonable reserves for emergencies.

Maui Electric forecasts small reserve capacity shortfalls for the island of Maui to occur starting 2017, under its November 2016 forecast. Maui Electric is planning to implement mitigations measures, including but not limited, to the expansion of Fast DR and installing temporary DG units.

[18] Includes impacts from Maui Electric implemented energy efficiency programs and Hawai'i Energy Public Benefits Fee Administrator, for Program Years 2009-2013 as reported by Leidos Engineering in the Annual Reports to the Hawai'i Public Utilities Commission.

Maui Electric forecasts larger reserve capacity shortfalls for the island of Maui to occur in year 2023 with the planned retirement of the units at the Kahului Power Plant in 2022. On May 5, 2015 Maui Electric requested to open a docket for firm RFPs to acquire approximately 40 MW through competitive bidding based on the PSIP Update filed on April 1, 2016. The 2017 AOS confirms the need of replacement capacity of Kahului Power Plant in 2022 with a projected reserve margin shortfall of 44 MW based on a 30% reserve margin with wind capacity value and DR.

Very truly yours,

Sharon M. Suzuki
President

Attachments

c: Division of Consumer Advocacy (with Attachments)

Table A1:
Maui Division Projected Reserve Margins

	System Capability at Annual Peak Load (Net MW)	System Peak (Net MW)	Interruptible Load (net MW)	Reserve Margin (%)
Year	[A] (I)	[B] (II)	[C] (III)	[A - (B-C)] / (B-C)
2016	250	201	0	25%
2017	246	203	0	21%
2018	246	207	0	19%
2019	246	209	0	18%
2020	246	211	0	17%
2021	246	212	0	16%
2022	246	212	0	16%
2023	210	212	0	-1%
2024	210	212	0	-1%

Notes:

I. System Capability includes:
- Maui Electric central station units at total normal capability in 2016 were 246.3 MW-net.
- Reduction of firm power from HC&S to 4.0 MW in starting October 27, 2015.
- HC&S power purchase contract terminated December 23, 2016.
- Planned retirement of the units at the Kahului Power Plant (35.9 MW-net) in 2022.

II. System Peaks:
- The 2017-2024 annual forecasted system peaks are based on Maui Electric's November 2016 Forecast.
- The forecasted System Peaks for 2017-2024 include the estimated peak reduction benefits of third-party energy efficiency DSM programs.
- The Maui Electric annual forecasted system peak is expected to occur in the month of December.

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

As of December 31, 2016

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
HC&S[III]	-	-	-	-
Hana 1[IV]	1.00	1.00	0.97	0.97
Hana 2[IV]	1.00	1.00	0.97	0.97
Wind Cap[V]	2.81	2.81	2.81	2.81
Maui System	254.51	250.91	249.09	245.50

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) On January 6, 2016, HC&S issued a Notice of Termination of Power Purchase Agreement to Maui Electric. The termination was to be effective as of twelve (12) months from the date of the notice. Subsequently, HC&S and Maui Electric agreed to terminate the PPA effective December 23, 2016 in consideration of the end of HC&S's harvesting operations.

(IV) 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.