4/11 Gen. File
c: JG
MEC

FILED

2014 APR 11 P 3:37

PUBLIC UTILITIES
COMMISSION

JOSEPH P. VIOLA
Vice President
Regulatory Affairs

April 11, 2014

The Honorable Chair and Members of the Hawai'i
Public Utilities Commission
465 South King Street
Kekuanaoa Building, Room 103
Honolulu, Hawai'i 96813

Dear Commissioners:

Subject: Adequacy of Supply
Hawaiian Electric Company, Inc. ("Hawaiian Electric" or "Company")

The following information is respectfully submitted in accordance with paragraph 5.3a. of General Order No. 7[1] 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.*

2014 Adequacy of Supply Report Summary

- Hawaiian Electric currently has sufficient firm capacity to meet projected peak demand in 2014, based on the Company's February 2014 Update Sales and Peak Forecast.

[1] Hawaiian Electric's Adequacy of Supply ("AOS") Report is due within 30 days after the end of the year. On January 24, 2014, Hawaiian Electric requested an extension of time, to no later than March 28, 2014, to file its AOS Report due to Hawaiian Electric's heavy workload related to other proceedings. On March 25, 2014, Hawaiian Electric requested a second extension to no later than April 11, 2014 to submit its AOS report.

- The adjusted peak load experienced on Oahu in 2013 was 1,153MW net, and was served by Hawaiian Electric's total capability of 1,778MW net, including firm power purchases. This represents a reserve margin of approximately 59% over the 2013 adjusted system net peak.

- Peak load is projected to grow at a compounded average growth rate of 1.15% through 2018. Current peak projections are higher than they were in Hawaiian Electric's 2013 AOS.

- Solar generation additions have reduced the daytime load on the system. 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 evening peak.

- Honolulu Units 8 and 9 (with a combined rating of 107.3 MW-net) were deactivated on January 31, 2014. Waiau Units 3 and 4 (with a combined rating of 92.6 MW-net) are also candidates for deactivation. The 2014 AOS Reference Scenario reflects the Honolulu generating units being deactivated on January 31, 2014 and assumes the Waiau units will be deactivated at the end of 2016.

- Under the Reference Scenario, Hawaiian Electric's generation capacity for the next three years (2014-2016) will be sufficient to meet reasonably expected demands for service and provide reasonable reserves for emergencies.

- Depending on system conditions, Hawaiian Electric may experience anywhere from a 10 MW to a 110 MW reserve capacity shortfall by 2017.

- Hawaiian Electric anticipates that it may need additional firm capacity beginning in the 2017 timeframe in anticipation of the potential change in operational status of generating units at the end of 2016. Hawaiian Electric may seek to mitigate this capacity need by delaying the future deactivation of units, increasing Demand Response Programs, reactivating units that are currently deactivated, or acquiring the additional firm capacity through a competitive bidding process.

- Hawaiian Electric is continuing to pursue the addition of approximately 50 MW of utility owned and operated, firm, renewable, dispatchable, generation on federal lands, for the purpose of improving energy security and resiliency for the Hawaiian Electric grid and for the Army facilities in central Oahu, as well as enabling the integration of more variable generation renewable resources. It is estimated that the security project could be in service in the 2017 timeframe, which would change the timing and amount of a reserve capacity shortfall.

1. Peak Demand and System Capability in 2013

Hawaiian Electric's 2013 system peak occurred on Monday, October 28, 2013 at approximately 6:31pm, and was 1,175 MW-gross or 1,144 MW-net based on net Hawaiian Electric generation, net purchased power generation, the peak reduction benefits of energy efficiency demand-side management programs, and with several co-generators[2] operating at the time. Had these cogenerating units not been operating, the 2013 system peak would have been approximately 1,184 MW-gross or 1,153 MW-net.

Hawaiian Electric's 2013 total generating capability of 1,778 MW-net includes 456.5 MW-net of firm power purchased from (1) Kalaeloa Partners, L.P. ("Kalaeloa"), (2) AES Hawaii, Inc. ("AES"), and (3) H-POWER.[3]

Oahu had a reserve margin of approximately 59% over the 2013 adjusted system net peak.[4]

At times during 2013, Hawaiian Electric received energy from seven variable generation energy producers (i.e., Chevron, Hawaii Independent Energy (fka Tesoro), Kahuku Wind Power, Kapolei Sustainable Energy Park, Kawailoa Wind, Kalaeloa Solar Two, Kalaeloa Renewable Energy Park). Since these contracts are not for firm capacity, they are not reflected in Hawaiian Electric's total firm generating capability.

2. Estimated Reserve Margins

Appendix 1 shows the expected reserve margin over the next five years, 2014-2018, based on Hawaiian Electric's February 2014 Update Sales and Peak Forecast, and includes estimated energy efficiency impacts and forecasted load management impacts.

---

2 At the time of the peak, certain units at Hawaii Independent Energy, Chevron, and Pearl Harbor were generating about 9MW of power for use at their sites.

3 On May 25, 2012 in Docket No. 2012-0129, Hawaiian Electric submitted an application for approval of an Amended and Restated Power Purchase Agreement ("PPA") with the City & County of Honolulu to purchase up to an additional 27 MW of power from an expansion of the existing waste-to-energy facility. On November 15, 2012, Hawaiian Electric filed Amendment No. 1 to the PPA. On January 17, 2013 in Decision and Order ("D&O") No. 30950, the Commission approved the PPA as Amended. On July 5, 2013, the demonstrated firm capacity provided by H-POWER in accordance with the PPA was 68.5 MW.

4 The reserve margin calculation takes into account the approximately 38 MW of interruptible load at system peak served by Hawaiian Electric.

3. Criteria to Evaluate Hawaiian Electric's Adequacy of Supply

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

The results of the annual analysis of the adequacy of supply on the Hawaiian 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 ("DSM") programs, (b) net energy metering, and (c) customer-sited photovoltaic ("PV") installations; [§4.1]
- peak reduction benefits of load control programs; [§4.2]
- Equivalent Forced Outage Rate Demand ("EFORd") on the generating units; [§4.3]
- planned maintenance schedules for the generating units on the system; [§4.4]
- additions of firm generating capacity; [§4.5] and
- reductions of firm generating capacity. [§4.6]

The above mentioned forecasts are similar to those used in Hawaiian Electric's 2013 AOS Report. 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 Hawaiian Electric's Capacity Planning Criteria

Hawaiian Electric's capacity planning criteria consist of two rules and one reliability guideline. The reserve capacity shortfalls calculated herein are determined by the application of the reliability guideline based on various key inputs such as the EFORd's of each generating unit, the load to be served, the amount of capacity on the system, and the availability of the generating units.

Rule 1:

The total capability of the system plus the total amount of interruptible loads 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;*

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.*

Rule 2:

There must be enough net generation running in economic dispatch so that the sum of the three second quick load pickup power available from all running units, not including the most heavily loaded unit, plus the net loads of all other running units must equal or exceed 95 percent of the hourly system net load (which excludes power plant auxiliary loads but includes T&D losses). This is based on a minimum allowable system frequency of 58.5 Hz and assumes a 2 percent reduction in load for each 1 percent reduction in frequency.

The two rules include load reduction benefits from interruptible load customers. Because Hawaiian Electric will not build reserve capacity to serve interruptible loads, interruptible load programs such as Hawaiian Electric's current Rider I and load management programs can have the effect of deferring the need for additional firm capacity generation.

Rules 1 and 2 are deterministic in nature, meaning that the adequacy of supply can be determined through simple additions or subtractions of capacity without regard to the probability that the capacity will be available at any given time. For example, to determine whether or not Rule 1 would be satisfied at a given point in time, one would take the total capacity of the system in MW, add the total amount of interruptible loads that would be available for interruption at that time, subtract the capacity of the unit or units that are unavailable due to planned maintenance, subtract the capacity of the largest available unit, and determine whether the result is greater than or less than the system peak at that time. If the result is greater than the system peak, Rule 1 would be satisfied and no additional firm capacity would be needed. If the result is less than the system peak, Rule 1 would not be satisfied and additional firm capacity would be needed. The likelihood (or probability) that the largest unit will be lost from service during the peak is not a factor in the application of this rule.

Rule 2 takes into account the amount of quick load pickup that must be available at the time of the peak to avoid shedding load from the system in the event the largest loaded unit is unexpectedly lost from service. Rule 2 is also deterministic in nature. It does not take into account the probability that the largest unit could be lost from service during the peak.

3.2 <u>Hawaiian Electric's Reliability Guideline: Loss of Load Probability ("LOLP")</u>

The application of Hawaiian Electric's generating system reliability guideline does take into account the probabilities that generating units could be unexpectedly lost from service.

Reliability Guideline:

"Capacity planning analysis will include a calculation of risk (Loss of Load Probability) in years per day for each year of each plan of the long-range expansion study. In cases where risk is calculated to be less than 4.5 years per day, the plan will be reviewed by the Vice President of Power Supply, Senior Vice President of Operations, and the President for approval of use of the plan in the study."

In order to determine whether there is enough capacity on the system to account for the probability that multiple units may be unexpectedly lost from service, the result of an LOLP calculation must be compared against Hawaiian Electric's generating system reliability guideline.

Hawaiian Electric has a reliability guideline threshold of 4.5 years per day. Hawaiian Electric plans to have sufficient generating capacity to maintain generating system reliability above 4.5 years per day. There should be enough generating capacity on the system such that the expectation of not being able to satisfy demand due to insufficient generation occurs no more than once every 4.5 years. Values less than 4.5 years per day indicate lower levels of reliability and an increased likelihood of generation-related customer outages.

One potential means to address the planning uncertainty and complexity would be to revise the capacity planning guideline. If the existing Loss of Load Probability of 4.5 years per day does not provide an adequate cushion to respond to quickly-changing parameters, such as changes in peak demand and individual unit availability factors, many of which may change rapidly from year to year, then the utility could plan for a higher reliability standard similar to that of many mainland utilities. Such an approach would not eliminate quickly-changing parameters, but it would add a measure of conservatism in recognition that the uncertainties undoubtedly exist.

In its direct testimony for the Campbell Industrial Park Generating Station and Transmission Additions Project (Docket No. 05-0145), filed on August 17, 2006, the Consumer Advocate stated:

> [HECO's reliability guideline] is less stringent than the guidelines used by mainland utilities. As will be addressed later in my testimony, this guideline should be re-evaluated to determine if it should be more stringent in the future (e.g., one day in 6 years) to ensure reliable service. However, this determination should be based on analyses that assess the tradeoff between *electric service costs to the consumer and the increase in reliability to be* gained. CA-T-1 at 32.

The typical reliability standard on the mainland is 10 years per day, which is more stringent than the 6 years per day suggested by the Consumer Advocate and the 4.5 years per day in Hawaiian Electric's reliability guideline. A scenario analysis of the reserve capacity shortfall based on a higher reliability guideline threshold of 10 years per day is included in Section 5. The results of the analysis show the additional amount of firm capacity that would be needed on the Oahu grid to meet a higher, 10 years per day, reliability standard based on the assumptions provided herein.

Please refer to Appendix 3 of the 2005 AOS for additional information related to Hawaiian Electric's reliability guideline.

4. Key Inputs to the 2014 AOS Analysis

4.1. February 2014 Update Sales and Peak Forecast

Hawaiian Electric developed a short-term sales and peak forecast in February 2014 ("February 2014 forecast"), which was subsequently adopted by the Company for future planning purposes. Hawaiian Electric's February 2014 sales and peak forecast was used for the purposes of this analysis.

Figure 1 illustrates Hawaiian Electric's historical system peaks and compares them to the forecast used in the 2013 and 2014 AOS analyses. The analyses contained in the 2013 AOS were based on an August 2012 sales and peak forecast.

Figure 1: Recorded Peaks and Future Year Projections

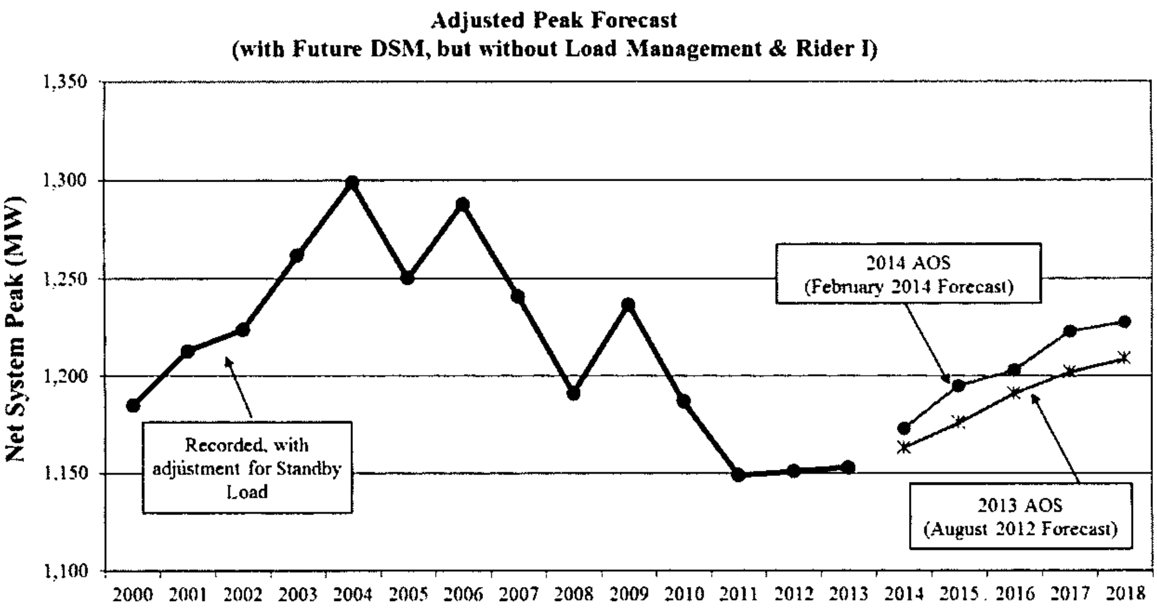

Table 2 below provides the recorded peaks from 2000 and compares the forecasts used in the 2013 AOS and this 2014 AOS. The comparison between forecasts indicate the degree to which key planning assumptions such as the peak forecast can change significantly in one year.

For both the recorded and forecast data, figures reflect an upward (stand-by) adjustment to account for the potential need to serve certain large customer loads (i.e., Chevron, Hawaii Independent Energy and Pearl Harbor) that are frequently served by their own internal generation. Figure 1 includes the peak reduction benefits of energy efficiency programs and naturally occurring conservation. The forecast also includes the impact of customer-sited PV and other renewable generation system installations through the Net Energy Metering ("NEM") program, Standard Interconnection Agreements ("SIA"), and Feed-In Tariffs ("FIT") in the derivation of sales. Table 3 shows the projected MW capacities for NEM, FIT and SIA installations, and the corresponding Annual (Ramped) MWh Reductions that are assumed to reduce sales and day peaks. 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 evening peak.

Table 2: Recorded Peaks and Future Year Projections

Net System Peak (MW) (with Future DSM, but without Load Management & Rider I)					
Year	Actual	Actual Adj for Standby	2013 AOS Aug2012 S&P	2014 AOS Feb 2014 S&P	Difference 2014-2013 AOS
2000	1164	1185			
2001	1191	1213			
2002	1204	1224			
2003	1242	1262			
2004	1281	1299			
2005	1230	1250			
2006	1265	1288			
2007	1216	1241			
2008	1186	1191			
2009	1213	1237			
2010	1162	1187			
2011	1141	1149			
2012	1141	1151			
2013	1144	1153			
2014			1,163	1,173	10
2015			1,176	1,195	19
2016			1,191	1,203	12
2017			1,202	1,223	21
2018			1,209	1,228	19

Table 3: SIA, NEM & FIT Projections
February 2014 Sales Forecast

	Forecasted MW Installations (I)		Annual (Ramped)
Year	MW	Cumulative	MWh Reduction (II)
2014	133	363	494,748
2015	117	480	700,640
2016	49	529	837,735
2017	25	554	883,955
2018	25	579	920,250

Notes:

I. Impacts to the peak demand from systems installed under SIA, NEM and FIT are assumed to affect the day peak only.
II. MWh reduction from the systems under FIT are associated with the output from the system that offsets a customer's load and not energy sold to Hawaiian Electric.

4.2. <u>Projected Peak Reduction Benefits of Load Control Programs</u>

Hawaiian Electric continues to administer the Commercial & Industrial Direct Load Control ("CIDLC") and Residential Direct Load Control ("RDLC") programs (collectively referred to as the "EnergyScout Programs"). On October 21, 2013, the Commission issued Order Nos. 31558 and 31559 approving the continuation of the RDLC and CIDLC Program with approval to replace participants who drop out of the program through December 31, 2014, or until a final and decision and order is issued.[5]

On August 9, 2013, the Companies filed a letter to the Commission requesting approval to extend the FastDR pilot by one year to December 31, 2014, carryover unspent program funds into 2014, continue enrollment of customers into 2014 and replace customers that drop out of the Fast DR Pilot Program; and expand Maui Electric's pilot program design to include an Automated DR option ("August 9 Letter.") On October 22, 2013, the Commission approved the Companies' request.[6]

---

[5] See Order No. 31558, issued on October 21, 2013, in Docket No. 2012-0079 and Order No. 31559, issued on October 21, 2013 in Docket No. 2012-0118.

[6] See Order No. 31557, "Decision and Order Approving the HECO Companies Fast DR Extension, Carryover, and program modifications," filed on October 22, 2013, in Docket No. 2007-0341.

Hawaiian Electric estimates it had approximately 14 MW (net-to-system generation) of controlled load under its CIDLC program, 2 MW (net-to-system) of controlled load under FastDR, and approximately 16 MW (net-to-system level) of controlled load under its RDLC program in 2013.

For the purposes of this analysis, the expansions of the EnergyScout programs, the FastDR pilot, and the Commercial and Industrial Dynamic Pricing Pilot ("CIDP Pilot")[7] are assumed to reflect the continued contribution of these programs to Hawaiian Electric's capacity planning analysis aligned to phased deployment of the smart grid infrastructure.[8]

Table 4 shows the forecast of the peak reduction benefits from Hawaiian Electric's existing and future load management programs[9] predicated upon Commission approval of the expansion of these programs.

Table 4: Projected Commercial, Residential and Rider I Impacts (MW)[10]

Year	Residential	Commercial	Rider I	Total
2014	16	27	4	47
2015	16	24	4	44
2016	19	27	4	50
2017	23	31	4	57
2018	27	34	4	65

The Hawaiian Electric Companies have retained the consulting services of PA Consulting Group to assist in the development and implementation of a company-wide DR strategy that will take full advantage of the economic DR opportunities available on Oahu, Maui and the island of Hawaii. This company-wide DR strategy will be aligned with the company-wide smart grid plans, and will differentiate DR initiative potential, scope, timing and pricing in order to maximize the use of cost-effective DR resources on each island (DR action plans may be different for each island due to differing operational needs and timing).

7 See *Request for Approval of a Commercial and Industrial Dynamic Pricing Pilot Program and Recovery of Program Costs*, filed on December 29, 2011, in Docket No. 2011-0392.

8 A letter to the Commission has been filed by Hawaiian Electric on March 14, 2014 presenting a smart grid roadmap that would cover all 5 islands operated by Hawaiian Electric Companies.

9 Forecasted impacts available at system peak at the net-to-system level.

10 The values in Table 4 reflect, for planning purposes, the cumulative amount of forecasted load available for interruption at the net-to-system level assuming expansion of the DR programs. The CIDLC program has a limit of 300 cumulative hours, and the CIDP Pilot program has a limit of 100 hours per year, that each contracted load can be interrupted in a year, which is taken into account in the loss of load probability calculations reflected in Table 10.

4.3. Hawaiian Electric Generating Unit Forced Outages

Forced outages and de-ratings reduce generating unit availability and are accounted for in the EFORd statistic. The definition of EFORd and an example of the application of the EFORd formula is provided in Appendix 2.

Table 5 provides recorded Hawaiian Electric EFORd data by unit for the period 2009-2013. The forward looking EFORd values utilized in the 2014 AOS analysis are forecasted EFORd expectations for planning purposes based on a combination of historical data, experience, and operational judgment. Table 5 also illustrates the EFORd projections for the Independent Power Producers used in the 2014 AOS analysis. The EFORd assumption generally reflects the 5-year average of the specific unit, or group of similar units. EFORd projections are not certain, however, and actual experience may differ from the projections. Refer to Appendix 3 for specific generating unit information on EFORd.

Table 5: Historical and Forward-looking EFORd

	Recorded EFORd					AOS EFORd Rates
	2009	**2010**	**2011**	**2012**	**2013**	**2014 Forward Looking**
Honolulu 8	1.8%	17.5%	3.4%	4.0%	5.2%	8.5%
Honolulu 9	3.9%	9.1%	6.1%	24.5%	9.1%	8.5%
Waiau 3	0.8%	3.3%	11.2%	4.4%	13.7%	6.7%
Waiau 4	5.5%	0.9%	9.0%	2.2%	1.7%	3.8%
Waiau 5	2.7%	1.6%	0.5%	1.9%	1.4%	2.0%
Waiau 6	0.0%	0.2%	2.2%	6.5%	2.4%	2.0%
Waiau 7	2.4%	0.1%	7.4%	0.4%	1.6%	3.7%
Waiau 8	1.9%	1.3%	11.2%	3.7%	4.7%	3.7%
Waiau 9	1.3%	0.6%	8.6%	25.5%	2.1%	7.2%
Waiau 10	3.6%	9.0%	9.8%	4.8%	7.1%	7.2%
Kahe 1	2.4%	0.7%	2.7%	0.5%	0.6%	3.6%
Kahe 2	7.7%	8.8%	2.4%	7.2%	3.1%	3.6%
Kahe 3	3.8%	3.9%	2.2%	2.5%	1.3%	3.7%
Kahe 4	7.0%	10.4%	3.0%	2.7%	2.3%	3.7%
Kahe 5	9.0%	1.1%	6.0%	4.6%	2.3%	4.7%
Kahe 6	3.3%	2.0%	3.0%	3.4%	12.8%	4.7%
CIP CT-1	18.3%	9.9%	8.4%	3.9%	0.7%	8.2%
HECO	**3.5%**	**3.8%**	**5.0%**	**4.1%**	**3.4%**	**4.0%**

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

4.5. Additions of Capacity

4.5.1 Firm Capacity Additions

The State of Hawai'i Department of Transportation, Airports Division ("DOT"), plans to complete installation of 8 MW of distributed standby generation ("Airport DSG") in mid-2014. Under an agreement between Hawaiian Electric and DOT ("Airport DSG Agreement"), Hawaiian Electric will be able to use the Airport DSG to serve system needs under certain conditions. Nearly all of the generation provided by the Airport DSG will be dispatchable by Hawaiian Electric under the conditions given in the agreement. The Commission approved the Airport DSG Agreement on March 2, 2010 in Docket No. 2009-0317. This capacity was included in the adequacy of supply analysis.

On December 27, 2011, in Docket No. 2011-0386, Hawaiian Electric submitted to the Commission a request for approval of a waiver from the competitive bidding framework for an approximately 50 MW of utility owned and operated, firm, renewable, dispatchable, generation security project on federal land. On August 1, 2012, in D&O No. 30552, the Commission granted, subject to conditions, Hawaiian Electric's request for a waiver from the framework for competitive bidding for the purposes of allowing discussions and negotiations to occur with the United States Department of the Army ("Army"). It is estimated that the project could be in service in the 2017 timeframe. For the purposes of this analysis, due to the level of uncertainty regarding the service date of this facility as PUC approval for the project has not been obtained yet, this capacity was not included in the analysis.

4.5.2 Non-Firm Additions

In addition to firm generation power projects, Hawaiian Electric purchases energy on an as-available basis from seven producers and anticipates adding additional variable generation renewable energy projects to the Hawaiian Electric system in the near future as these facilities achieve commercial operation. The output from variable generation renewable resources cannot be dispatched to provide a specified level of power upon demand to serve the peak load, and power from these units is not included in the planning criteria and reliability guideline calculations. Due to the increasing amount of variable generation renewable resources on the Oahu grid and the prospects for better forecasting of variable generation, Hawaiian Electric is evaluating the reliability impact of variable generation in its AOS analyses in the future.

Several independent as-available producers have power purchase agreements with Hawaiian Electric and are in various stages of Commission approval, or under construction. For example:

On January 19, 2011, the Commission approved a power purchase contract with Honua Power, LLC, to purchase approximately 6.6 MW of as-available energy from a biomass gasification facility. On February 27, 2013, in D&O No. 31044, the Commission approved, subject to conditions described in the D&O, the second amendment to the power purchase contract.

On December 12, 2013, Hawaiian Electric submitted an application for Commission approval of a waiver from the Framework for Competitive Bidding and approval of a PPA with Na Pua Makani Power Partners, LLC, for up to 24 MW of wind power.

4.6. Reductions of Firm Generating Capacity

4.6.1 Honolulu Units 8 and 9 Deactivation

Honolulu Units 8 and 9 (with a combined rating of 107.3 MW net) were deactivated on January 31, 2014. Deactivation of the units is consistent with the Hawaiian Electric Action Plan from the 2013 Integrated Resource Planning Report filed with the Commission in June 2013. For the purposes of the 2014 AOS analysis, in the Reference Scenario Honolulu Units 8 and 9 were removed from service at the end of January 2014.

4.6.2. Waiau Units 3 and 4 Deactivation

Waiau Units 3 and 4 (with a combined rating of 92.6 MW-net), are also slated for deactivation in the 2016 timeframe as stated in the Hawaiian Electric Action Plan in the 2013 IRP Report. The decision on whether to continue operating or deactivating these units would depend largely on factors such as operation and maintenance costs, environmental regulations, new and replacement capacity, timing available to install replacement capacity, and transmission infrastructure improvements. For the purposes of the 2014 AOS analysis, the Reference Scenario forecasts Waiau Units 3 and 4 to be deactivated from service at the end of 2016.

4.6.3. Reactivation

Deactivated units may be reactivated in the event of an emergency and/or to mitigate reserve capacity shortfalls. In the event existing PPAs with IPPs for firm capacity are terminated or are not renegotiated and extended, deactivated units may be reactivated to mitigate potential reserve capacity shortfalls.

4.7 Capacity from Kalaeloa Partners, L.P., Combined Cycle Unit

The existing PPA with Kalaeloa Partners, L.P. ("Kalaeloa") expires on May 23, 2016. On November 10, 2011, Hawaiian Electric submitted to the Commission a Petition for Declaratory Order regarding the Exemption of Kalaeloa Partners, LP's project from the Framework for Competitive Bidding, or in the alternative, Approval of Application for Waiver from the Framework for Competitive Bidding. On May 14, 2012, in D&O No. 30380, the Commission declared that the proposed renegotiation of the amended PPA is exempt from the competitive bidding process. Hawaiian Electric is currently in discussions with Kalaeloa to renegotiate the existing PPA.

For the purposes of the 2014 AOS analysis, it is assumed that the 208 MW of capacity provided by Kalaeloa remains in service beyond May 23, 2016.

4.8 <u>Capacity from AES Hawaii, Inc.</u>

The existing PPA with AES Hawai'i, Inc. ("AES") expires on September 1, 2022. On August 13, 2012, Hawaiian Electric submitted to the Commission a Petition for Declaratory Order regarding the Exemption of AES Hawaii's project from the Framework for Competitive Bidding, or in the alternative, Approval of Application for Waiver from the Framework for Competitive Bidding. On April 25, 2013, in D&O No. 31200, the Commission declared that the proposed renegotiation of the amended and restated PPA is exempt from the competitive bidding process. Hawaiian Electric is currently in discussions with AES to negotiate an amended and restated PPA.

4.9 <u>Environmental Considerations</u>

The Environmental Protection Agency has established regulations with the associated compliance dates as follows:

- Mercury and Air Toxics Standards ("MATS") – April 2016 with provision for a one-year extension on compliance deadline.

- 1-Hour SO_2 National Ambient Air Quality Standards ("NAAQS") – Compliance date in the 2022 timeframe.

Hawaiian Electric is pursuing a multiple-path strategy for MATS compliance

On April 16, 2012, Hawaiian Electric submitted to EPA a Petition for Reconsideration and Stay on the MATS rule, identifying inconsistencies in the calculations EPA used in determining the MATS filterable particulate matter (fPM) standard for the small data set of noncontinental oil-fired boilers. Hawaiian Electric believes that proper calculation technique will yield an fPM standard that can be met firing LSFO and modifying boiler wash practice. A year and a half after submitting the rule petition, on August 14, 2013 Hawaiian Electric submitted to EPA a Request for Expedited Consideration of the pending MATS Reconsideration Petition. On October 29, 2013, the Hawai'i Congressional Delegation wrote a joint support letter to EPA Administrator Regina McCarthy, requesting prompt consideration of Hawaiian Electric's

April 2012 Petition for Reconsideration. On November 4, 2013, Hawai'i Governor Neil Abercrombie also sent Gina McCarthy a letter strongly urging expeditious resolution to this matter. Hawaiian Electric has provided supplemental information to EPA to aid in developing an fPM standard for the noncontinental oil-fired boilers consistent with the requirements of the Clean Air Act.

Since the issuance of the MATS rule in 2012, Hawaiian Electric has been performing field testing of boilers to identify technical alternatives for compliance with the current fPM standard. If Hawaiian Electric does not receive a proper and timely outcome of the Petition for Reconsideration, then MATS compliance will likely be achieved with a combination of firing an LSFO/distillate fuel blend and more frequent boiler washes.

Hawaiian Electric boilers can comply with the MATS fPM standards by co-firing natural gas with LSFO. The boilers will not be subject to MATS after three years of firing with all natural gas with liquid fuel as a back-up, provided that no more than ten percent of the average annual heat input is from liquid fuel.

Hawaiian Electric recently received a one-year MATS compliance extension from the Hawai'i Department of Health, which results in an April 16, 2016 compliance deadline. The EPA Office of Enforcement and Compliance Assurance developed a enforcement response policy memorandum in December 2011 that provides for a second one-year extension under §113(a) of the Clean Air Act. Hawaiian Electric would need to include PUC concurrence of a reliability analysis in a request for this second one-year extension. EPA could then choose to issue a one-year Administrative Order (AO) after April 16, 2016; however, discretion to issue an AO rests solely with EPA. EPA has indicated that an AO would be issued if the agency finds that continued operation is critical to ensure compliance with reliability standards or required system reserve margins.

Switching Hawaiian Electric's generation from oil to natural gas is the basis of Hawaiian Electric's compliance plan for the new 1-hour SO2 NAAQS. Recent guidance from the EPA indicates that the likely compliance deadline for Hawaiian Electric will be in the 2022 timeframe which is consistent with the current schedule for bringing bulk liquefied natural gas shipments to Oahu.

5. Scenario Analysis

5.1 Description of Scenarios

Forecasts of the inputs to the analysis are subject to uncertainties. Therefore, a range of forecasts was considered in the analysis. Descriptions of the various planning scenarios are provided below:

- Higher load forecast (60 MW increase in peak load);
- Honolulu 8 and 9 and Waiau 3 and 4 generating units are reactivated and remain in service
- Increased stringency of Hawaiian Electric's generating system reliability guideline from 4.5 years per day to 10 years per day.

A scenario using a lower load forecast was not performed in the analysis. However, should lower loads occur in the future, it may provide more certainty regarding decisions to deactivate or decommission existing generation units.

5.1.1 Higher Load Forecast

The Higher Load Scenario uses the assumption that the system peaks are higher by 60 MW. Such a scenario is possible, for example if, (1) customer acceptance and/or awareness is less than expected in the case of the load management programs, or energy efficiency programs; (2) electricity use is higher than that projected by the Hawaiian Electric sales and peak forecast due to a recovering economy; or (3) a combination of these or other factors occur in the future. A 60 MW higher peak load is roughly equivalent to one standard deviation over a 20 year period of historical peaks. Table 7 summarizes the Higher Load Scenario.

Table 7: Higher Load Scenario

Year	2014 AOS Feb 2014 S&P Forecast (MW)	60 MW higher Feb 2014 S&P Forecast (MW)	Difference (MW)
2014	1,173	1,233	60
2015	1,195	1,255	60
2016	1,203	1,263	60
2017	1,223	1,283	60
2018	1,228	1,288	60

5.1.2 Honolulu 8 and 9, Waiau 3 and 4

The scenario of Honolulu Units 8 and 9 and Waiau Units 3 and 4 being reactivated or remaining in service examines the generating system reliability if the Honolulu units were not deactivated at the end of January 2014, and the Waiau Units are not deactivated at the end of 2016.

5.1.3 Revised System Reliability Guideline

Another potential means to address the ever increasing planning uncertainty and complexity is to revise the capacity planning guideline. As explained in Section 3.2, Hawaiian Electric currently uses a reliability guideline threshold of 4.5 years per day. If the existing Loss of Load Probability of 4.5 years per day does not provide an adequate cushion to respond to quickly-changing parameters, such as changes in peak demand and individual unit availability factors, many of which may change rapidly from year to year, then the utility could plan for a higher reliability standard similar to that many mainland utilities. Such an approach would not eliminate quickly-changing parameters, but it would add a measure of conservatism in recognition that the uncertainties undoubtedly exist.

Hawaiian Electric performed a high-level evaluation using a more stringent reliability guideline of 10 years per day. The purpose of this analysis was to determine the amount of firm capacity that would be required to meet this higher reliability guideline. The results of this high level evaluation are shown in Section 5.2.

5.2 Results of Analysis

Table 8 shows the capacity, in MW, in excess of the amount needed to satisfy Rule 1 and Rule 2 of the capacity planning criteria. The analysis shows that Rule 1 and Rule 2 are satisfied for the Reference Scenario for each year through 2018 under a reference set of assumptions including, but not limited to: (1) continued residential and commercial load management impacts at the levels described in Table 4; and (2) continued acquisition of third-party energy efficiency. However, as previously explained, Rule 1 and Rule 2 results are deterministic and do not incorporate unit specific EFORd rates in their calculation.

Table 8: Rule 1 and Rule 2 Analysis
Reserve Capacity Available

Year	Rule 1 Results (MW)	Rule 2 Results (MW)
2014	160	120
2015	175	135
2016	120	80
2017	114	74
2018	125	85

The LOLP for the Reference and Planning Scenarios were calculated using a production simulation model for each year through 2018 under reference and variable sets of assumptions described in Section 4.

For the years 2017 to 2018, the generating system reliability is projected to be less than 4.5 years per day in the Reference Scenario. The generating system reliability in the Higher Load Scenario is projected to be less than 4.5 years per day for the years 2014 to 2018. A higher generating system reliability of 10 years per day is also projected to not be met in this timeframe with the exception of year 2015.

Table 9 shows the results of the Generation System Reliability analysis. The system reliability in the scenarios shown varies depending on the firm generating units available, and the planned maintenance schedules.

Table 9: Generation System Reliability Guideline (years/day)

Generation System Reliability (years/day)				
Year	Base Case	Higher Load (Add 60 MW)	No Deactivations	10 yrs/day reliability scenario
2014	9.4	2.4	83.3	9.4
2015	14.7	3.6	142.9	14.7
2016	7.6	2.1	66.7	7.6
2017	1.6	0.5	76.9	1.6
2018	1.3	0.4	76.9	1.3

Table 10 shows the reserve capacity surpluses or shortfalls corresponding to the calculated reliability shown in Table 9. Reserve capacity shortfall is the approximate amount of additional firm capacity needed to restore the generating system LOLP to be greater than the 4.5 years per day reliability guideline. A positive number indicates the amount of capacity over and above that amount needed to satisfy the 4.5 years per day reliability guideline. A negative number indicates the amount of capacity below the amount needed to satisfy the 4.5 years per day reliability guideline. For example in the Reference Scenario for 2017, the number -50 would indicate that about 50 MW of firm generating capacity would have to be added, in order for the expectation of not being able to satisfy demand due to insufficient generation occurs no more than once every 4.5 years.

Table 10: Reserve Capacity Shortfall for Reference and Planning Scenarios (MW)

Year	Reference Scenario	Alternate Scenarios		
		Higher Load (Add 60 MW)	No Deactivations	10 yrs/day reliability scenario
2014	30	-30	120	-10
2015	50	-10	140	10
2016	20	-40	110	-20
2017	-50	-110	110	-90
2018	-60	-120	110	-90

(Note: Negative values indicate a shortfall of generating capacity; positive values indicate a surplus of generating capacity)

The analysis shows that the reserve capacity shortfall is sensitive to the load forecast. In the case of the Higher Load Scenario, a nominal 60 MW increase in the forecasted load resulted in a 60 MW change to the results, indicating a projected capacity shortfall to occur earlier, for the years 2014-2018, in contrast to the capacity shortfall projected in the Reference Scenario. Expectations regarding future loads can change quickly, and Hawaiian Electric may not be able to respond quickly to increases in demand. This illustrates the importance of using scenario analysis as a planning tool.

Table 10 further projects that for the years 2017 and 2018, approximately 90 MW of firm capacity would have to be added to the Hawaiian Electric system to achieve a higher reliability guideline of 10 years/day in the near term. The approximate 40MW difference between the 4.5 years/day Reference Scenario and the 10 years/day Scenario to achieve higher levels of reliability is a non-linear relationship between MW capacity added and improvement in LOLP.

5.3 <u>Additional Scenario</u>

If the additional generating capacity from the 50 MW unit to be located on federal lands is installed in the October 2017 timeframe, the generating system LOLP is projected to be 1.8 years per day in 2017 and 3.6 years per day in 2018, under the Reference Scenario. In order to satisfy the 4.5 years per day reliability guideline, 10 to 50 MW of firm generating capacity would have to be added in the 2017 timeframe in addition to the 50 MW of generating capacity to be located on federal lands. Delaying the deactivation of Waiau Unit 3 and/or Waiau Unit 4 until the 2019 timeframe would mitigate the reserve capacity shortfall risk and allow Hawaiian Electric to meet its reliability guideline of 4.5 years per day.

6. Acquisition of Additional Firm Capacity

6.1 Competitive Bidding is the Required Acquisition Mechanism

On December 8, 2006, the Framework for Competitive Bidding ("CB Framework") was adopted by the Commission in Decision and Order No. 23121, in Docket No. 03-0372, pursuant to HRS §§ 269-7 and 269-15 and Hawai'i Administrative Rules § 6-61-71. The Commission's CB Framework states that "[c]ompetitive bidding, unless the Commission finds it to be unsuitable, is established as the required mechanism for acquiring a future generation resource or a block of generation resources, whether or not such resource has been identified in a utility's IRP."[11]

As indicated above, Hawaiian Electric may need additional firm capacity beginning in the 2017 timeframe due to the deactivation of Honolulu Units 8 and 9 in 2014 and in anticipation of the deactivation of Waiau Units 3 and 4 at the end of 2016. Delaying the deactivation of Waiau Units 3 and 4 would allow Hawaiian Electric to meet its reliability guideline while pursuing additional firm capacity through a competitive bidding process.

In addition, as indicated in Section 4.5, Hawaiian Electric is continuing to pursue the addition of approximately 50 MW of utility owned and operated, firm, renewable, dispatchable, generation security project on federal lands for the purpose of improving energy security and resiliency for the Hawaiian Electric grid and for the Army facilities in central Oahu, as well as enabling the integration of more variable generation renewable resources. It is estimated that the project could be in service in the 2017 timeframe, which would reduce the amount of the reserve capacity shortfall as described above in Section 5.3.2.

6.2 Scope of Request For Proposals ("RFP") for Additional Firm Capacity

Section II.B.1. of the CB Framework states "An electric utility's IRP shall specify the proposed scope of the RFP for any specific generation resource or block of generation resources that the IRP states will be subject to competitive bidding."

On March 1, 2012, the Commission issued Order No. 30233 in Docket No. 2012-0036 that commenced the IRP cycle for the Hawaiian Electric Companies. The Hawaiian Electric Companies filed their IRP Report and Action Plans with the Commission on June 28, 2013 ("IRP Report"). The Commission is currently reviewing: 1) Whether the IRP process and IRP Report, including Scenarios, Resource Plans, and Action Plans, are consistent with the IRP Framework; 2) Whether the IRP Report meaningfully addresses the Principal Issues identified in the IRP process, including the questions and issues

[11] CB Framework, Section II.A.3. on page 3.

identified by the commission by Order No. 30534; and 3) Whether the commission should approve, reject, either in whole or in part, or require modifications of the submitted IRP Report, including Scenarios, Resource Plans, or Action Plans.

Chapter 18 of the IRP Report, *Competitive Bidding and Resource Acquisition*, discusses the relationship between the IRP and the Competitive Bidding Framework along with the status of competitive bidding processes and specific exempt projects. The specific Hawaiian Electric system discussion can be found on pages 18-11 through 18-38 and is continued in Hawaiian Electric's Action Plan beginning on page 20-4 of the IRP Report.

7. Acquisition of Energy Storage Resource

Energy storage has the potential to address some of the issues on Hawaiian Electric's grid now and in the future. It can help provide frequency response when large generating units unexpectedly trip off the system and help provide load following capability to counteract the fluctuating output of variable generation such as wind and PV. If energy storage can provide this capability, then Hawaiian Electric may be able to reduce the amount of spinning reserve maintained on the system. If the amount of spinning reserve is reduced, the amount of curtailment of variable generation may also be reduced, depending on factors such as the load on the system, the output of the variable generation and the number of firm generating units in operation. In addition, energy storage may also be used to store energy when there is excess energy[12] on the system and discharge energy during peak demand periods, thereby reducing the amount of firm generation that must operate during this period.

Several factors will influence how much energy storage resources should be installed and when they should be installed. The amount of energy storage and the timing of its integration into the system will depend on factors such as the amount of variable generation on the system, the extent of variable generation curtailment, the cycling or deactivation of generating units that are now baseloaded and the characteristics (e.g., inertia and frequency response) of replacement generation. The cycling or deactivation of currently baseloaded units will result in the loss of inertia, spinning reserve and upward ramping capability.

In order for energy storage resources to be integrated into the Companies' grids in an orderly fashion that meets system needs, the Companies will establish an energy storage strategy. This strategy will take into account Hawaiian Electric's vision on energy storage, anticipated changes in the mix of firm and variable generation, business case considerations, business model options, and implementation plans and costs.

[12] Excess energy occurs when the sum of the output of variable generation plus the minimum output of firm capacity generating units exceeds the amount of demand on the system.

business case considerations, business model options, and implementation plans and costs.

While a formal energy storage strategy has yet to be developed, Hawaiian Electric already has system needs that can be addressed by energy storage resources. For example, the increasing amount of PV on distribution circuits is rendering Hawaiian Electric's load shedding scheme less effective in arresting frequency decay upon the sudden loss of generation. When a generating unit trips out of service, there is more load than generation on the system and system frequency will begin to decline. If the decline is not stopped, it will lead to loss of all generating units and loss of electrical service to all customers. Load shedding is used to remove load from the utility's generating units in order to help restore the balance between generation and load so that system frequency can be stabilized. Because PVs are serving an increasing amount of load on the circuits, the amount of load served by the utility's generating units is declining. Therefore, when the distribution circuits are tripped by the load shedding scheme to prevent a total system collapse, a smaller amount of load is removed from the utility's generating units. More blocks of load shedding (meaning more customers experiencing service interruptions) must be employed to restore the balance of supply and demand for the same unit trip scenario.

Energy storage resources can help mitigate this issue. They can immediately discharge and provide power to the system when frequency begins to decline. Instead of reducing load on the system through load shedding, it will increase the amount of generation on the system.

Given that Hawaiian Electric already has system needs that can be addressed by energy storage resources, it plans to issue an RFP for energy storage resources in the near future, even though the Companies' energy storage strategy may not yet be established. The precise content of the energy storage RFP is currently under development; however, the RFP will generally seek energy storage resources that provide three system needs:

(1) immediate frequency response to respond to events such as the sudden loss of generation;

(2) load following to help maintain the balance between generation and load; and

(3) load shifting capability to absorb energy during load demand periods and discharge energy during high system demand periods.

The provision of these capabilities by energy storage resources could help Hawaiian Electric reduce system generation costs, lower fuel consumption, integrate additional renewable generation and improve system reliability. Depending on the size and duration of the power output, the energy storage resource may also provide capacity value.

8. Conclusions

Under the Reference Scenario, Hawaiian Electric's generation capacity for the next three years (2014-2016) will be sufficient to meet reasonably expected demands for service and provide reasonable reserves for emergencies, with accommodations for environmental compliance options.[13] Hawaiian Electric may need additional firm capacity in the 2017 timeframe, and would seek to acquire the additional capacity through a competitive bidding process if time permits. Delaying the deactivation of Waiau Units 3 and 4 until additional firm capacity is acquired may allow Hawaiian Electric to meet its reliability guideline.

The scenario analysis indicates that depending on system conditions, Hawaiian Electric may experience anywhere from a 50 MW reserve capacity shortfall under the Reference Scenario to a 120 MW reserve capacity shortfall in the Higher Load Scenario in the 2017-2018 timeframe. A portion of potential reserve capacity shortfalls may be addressed through mitigation measures such as the acquisition of additional energy efficiency and load management resources over the near-term (if approved by the Commission), or adjustments to Hawaiian Electric's planned maintenance schedules, depending on the circumstances. The addition of 50 MW of utility owned and operated generation described in Section 4.5 would also reduce the amount of reserve capacity shortfall in the 2017 timeframe.

Hawaiian Electric must, therefore, be proactive, anticipating the what-ifs, and cannot count on the Reference Scenario occurring. Hawaiian Electric will continue its portfolio approach to meet its obligation to serve, which includes increased renewable energy contributions, demand-side management programs, energy storage resources and the pursuit of firm capacity supply side options. Hawaiian Electric also recognizes that the environment for resource planning has increased in complexity and uncertainty.

Very truly yours,

Joseph P. Viola
Vice President
Regulatory Affairs

Attachments

c: Division of Consumer Advocacy (with Attachments)

---

13 As a result of the higher reserve margins currently available and the lower forecasted peak loads, Hawaiian Electric is evaluating the operational status of its generating units, including consideration to "deactivate" selected units, and plans to implement changes once the evaluation is completed in order to achieve generation operating efficiencies. While these efficiencies should result in cost savings, they should not affect the adequacy of supply analyses.

**Table A1:
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)
2013	1,778	1,153	47	61%
2014	1,679	1,173	44	49%
2015	1,679	1,195	50	47%
2016	1,679	1,203	57	47%
2017	1,586	1,223	65	37%
2018	1,586	1,228	71	37%

Notes:

I. System Capability includes:
- Hawaiian Electric central station units at total normal capability in 2013 was 1,321.6 MW-net or 1,383 MW-gross.
- Firm power purchase contracts with a combined net total of 456.5 MW in 2013 from Kalaeloa (208 MW), AES Hawaii (180 MW), and H-POWER (68.5 MW).
- Expected addition of Airport DSG in 2014 (8 MW)
- Honolulu Units 8 and 9 are deactivated in 2014 (-107.3 MW)
- Kalaeloa assumed to continue in service after 2016
- Waiau Units 3 and 4 are deactivated in 2017 (-92.6 MW)
- AES Hawaii assumed to continue in service after 2022

II. System Peaks
- The 2014-20218 annual forecasted system peaks are based on Hawaiian Electric's February 2014 Sales and Peak Forecast.
- The forecasted System Peaks for 2014-2018 include the estimated peak reduction benefits of third-party energy efficiency DSM programs.
- The peak for 2014-2018 includes approximately 25 MW of stand-by load
- The Hawaiian Electric annual forecasted system peak is expected to occur in the month of October.

III. Interruptible Load:
- Interruptible Load impacts are at the net-to system level, and are approximate impacts at the system peak.

Equivalent Demand Forced Outage Rate Definition and Formula

As defined in IEEE Std-762-2006 [14], Section 3.8:

Equivalent Demand Forced Outage Rate ($EFOR_d$): A measure of the probability that a generating unit will not be available due to forced outages or forced deratings when there is demand on the unit to generate.

$EFOR_d$ is defined in the NERC GADS Data Reporting Instructions[15], Appendix F as:

$$EFORd = \frac{[FOHd + (EFDHd)]}{[SH + FOHd]} \times 100\%$$

where

FOHd = f x FOH

EFDHd = (EFDH – EFDHRS) if reserve shutdown events reported, or

= (fp x EFDH) if no reserve shutdown events reported – an approximation.

fp = (SH/AH)

$$f = \left(\frac{1}{r} + \frac{1}{T}\right) / \left(\frac{1}{r} + \frac{1}{T} + \frac{1}{D}\right)$$

r=Average Forced outage deration = (FOH) / (# of FO occurrences)
D=Average demand time = (SH) / (# of unit actual starts)
T=Average reserve shutdown time = (RSH) / (# of unit attempted starts)

An example of the application of the EFORd formula to Hawaiian Electric's Waiau 9 generating unit in 2012 is shown below:

	Service Hours	Reserve Shutdown Hours	Available Hours				Equivalent Forced Derated Hours	Forced Outage Hours	
Capacity	SH	RSH	AH	Actual Starts	Attempted Starts	Failed Starts	EFDH	FOH	FO Events
53	67	7002.14	7069	26	27	1	0.00	1,067.26	5

=1/ (1067/5)	=1/(7002/27)	=1/(67/26)		=0.021397 *1067	=67/7069	=0.009416* 0		=(22.84/(67+22.84)) *100	=(1067/(1067+67)) *100
1/r	1/T	1/D	f	fxFOH	fp	fp x EFDH	EFORd x MW	**EFORd**	**EFOR**
0.004685	0.003856	0.390625	0.021397	22.83591142	0.009416	0	1,353.87	**25.54**	**94.1**

[14] http://www.nerc.com/docs/pc/gadstf/ieee762tf/762-2006.pdf

[15] http://www.nerc.com/page.php?cid=4|43|45

Hawaiian Electric Equivalent Demand Forced Outage Rate ("EFORd") Discussion

It is extremely difficult to predict unit-specific EFORd rates, as indicated by the variation in historical data. Nonetheless, for planning purposes it is necessary to estimate forward-looking EFORd rates. This is accomplished using a blend of historical data, experience, and judgment. Hawaiian Electric has used a few different methods in determining unit specific EFORd numbers. Generating units are, at any giving time, in various stages of their maintenance plan. Different outage rates are expected following unit overhauls compared to the period prior to unit overalls. Hawaiian Electric has attempted to normalize this variation by comparing similar generating units over the previous five year period, with some exceptions. The rationalization for the selection of EFORd numbers to be used in the 2014 AOS analysis is discussed below:

1. Honolulu Units 8 and 9

   In the 2013 AOS, the forward looking EFORd of 8.6% included the actual average of 5 years for both Honolulu Units 8 and 9. Honolulu Unit 8 and Honolulu Unit 9 are similar units at a similar juncture in their maintenance strategy. For the 2014 AOS analysis, it was decided to use the average of the actual EFORd for both units for the past 5 years. As a result, an EFORd of 8.5% is recommended for the 2014 AOS forward looking EFORd for both Honolulu Units 8 and 9 for any reactivation scenario analysis.

2. Waiau Units 3 and 4

   In the 2013 AOS, the forward looking EFORd for Waiau Unit 3 was 6.1%. The actual EFORd for 2013 for Waiau Unit 3 was 13.7%. In the 2013 AOS, the forward looking EFORd for Waiau Unit 4 was 4.9%. The actual EFORd for 2013 for Waiau Unit 4 was 1.7%.

   Hawaiian Electric believes that Waiau Unit 3 and Waiau Unit4 will continue to be operated and maintained in a similar manner in the future. Although Waiau Unit 3 and Waiau Unit 4 are similar units, their maintenance plan includes deactivation in the future. Therefore the maintenance strategies on these units are different compared to other units and the units are at different stages of material condition. Yet, Waiau Unit 3 and Waiau Unit 4 will be operated and dispatched in similar manner compared to recent history. Hawaiian Electric therefore does not believe that averaging the EFORd for Waiau Unit 3 and Waiau Unit 4 together will provide accurate assumption of each unit's future performance and elect to base the Waiau Unit 3 and Waiau Unit 4 EFORd numbers on individual unit averages over the previous five years. Hawaiian Electric believes this will give a reasonable assumption of unit performance to be used as the 2014 AOS forward looking EFORd. Thus, for Waiau Unit 3, an EFORd of 6.7% is recommended and for Waiau Unit 4, an EFORd of 3.8% is recommended for the 2014 AOS forward looking EFORd.

3. Waiau Units 5 and 6

In the 2013 AOS, the forward looking EFORd rates for Waiau Units 5 and 6 were 2.6% based on the average actual EFORd rates for both units for the recent 5 years. The actual EFORd for 2013 for Waiau Units 5 and 6 were 1.4% and 2.4%, respectively. For the 2014 AOS analysis, it was decided to continue to use the average of the actual EFORd rates for the past 5 years. This approach recognizes that Waiau Units 5 and 6 are similar units under the same maintenance strategy yet at different stages of maintenance. Additionally, Waiau Units 5 and 6 will be dispatched and operated similar in coming years. Averaging historic performance gives an accurate estimation of each unit's performance. The combined average of Waiau Units 5 and 6 five year historic EFORd is 2.0% and is recommended for the 2014 AOS forward looking EFORd for both Waiau Units 5 and 6.

4. Waiau Unit 7, Waiau Unit 8, Kahe Unit 3, and Kahe Unit 4

These four units are of similar size, design, and vintage, and are dispatched as baseloaded units with similar duty cycles. They also have a similar maintenance strategy. With each unit at various stages of the maintenance plans it is recommended that averaging all four units provides the best indication of EFORd to be used for the 2014 AOS analysis. Accordingly, in the 2013 AOS, the forward looking EFORd rate of 4.6% was used for these four units. The actual EFORd for 2013 for Waiau Unit 7, Waiau Unit 8, Kahe Unit 3, and Kahe Unit 4 were 1.6%, 4.7%, 1.3%, 2.3%, respectively, with an average of 2.5%. For the 2014 AOS analysis, it was decided to continue to use the average of the actual EFORd rates for the four units for the past 5 years. This approach also recognizes that these units will be dispatched and operated similarly in 2014 as they were in recent years. As a result, an EFORd of 3.7% is recommended for the 2014 AOS forward looking EFORd for Waiau Units 7 and 8, and Kahe Units 3 and 4.

5. Waiau Units 9 and 10

In the 2013 AOS, the forward looking EFORd rates for Waiau Units 9 and 10 were 7.7% based on the average of the actual EFORd's for both units for the recent 5 years. The actual EFORd in 2013 for Waiau Units 9 and 10 were 2.1% and 7.1%, respectively, and averaged 4.6% for the two units. For the 2014 AOS analysis, it was decided to continue to use the average of the actual EFORd rates for both units for the past 5 years. This approach also recognizes that these units will be dispatched and operated similarly in 2014 as they were in recent years and that each unit has similar maintenance strategies. As a result, an EFORd of 7.2% is recommended for the 2014 AOS forward looking EFORd for Waiau Units 9 and 10.

6. Kahe Units 1 and 2

In the 2013 AOS, the forward looking EFORd for Kahe Units 1 and 2 were 3.8% based on the average of the actual EFORd for both units for the recent 5 years. The actual EFORd in 2013 for Kahe Unit 1 and 2 were 0.6% and 3.1%, respectively, and averaged 1.9% for both units. For the 2014 AOS analysis, it was decided to continue to use the average of the actual EFORd for both units for the past 5 years. This approach also recognizes that these units will be dispatched and operated similarly in 2014 as they were in recent years. Additionally these similar units have similar maintenance strategies yet are at different stages of their maintenance strategy. Averaging the two units performance allows for the normalization of performance. As a result, an EFORd of 3.6% is recommended for the 2014 AOS forward looking EFORd Kahe Units 1 and 2.

7. Kahe Unit 5 and 6

In the 2013 AOS, the forward looking EFORd for Kahe Unit 5 was 4.0% based on the average of the actual EFORd for the recent 5 years. The actual EFORd for 2013 for Kahe Unit 5 was 2.3%. In 2013 AOS the forward looking EFORd for Kahe Unit 6 was 2.6%. The actual Kahe Unit 6 EFORd was 12.8%. Kahe 5 and 6 are similar units and are operated and maintained in similar manner. Hawaiian Electric believes that the best strategy for long term planning is to average the two units performance over the last five years. As with other similar units, this normalizes the stage of each unit's maintenance strategy. As a result, an EFORd of 4.7% is recommended for the 2014 AOS forward looking EFORd for Kahe Units 5 and 6.

8. CIP CT-1

On August 3, 2009, CIP CT-1 was placed in service (e.g. tied into the electrical grid and producing power). In the 2013 AOS, the forward looking EFORd for CIP CT-1 was 10.1% based on the average of CIP CT-1 actual EFORd for the recent 4 years. The actual EFORd for 2013 for CIP CT-1 was 0.7%. For the 2014 AOS analysis, it was decided to continue to use the average of the actual EFORd rate for the past 5 years. This approach recognizes that this unit will be dispatched and operated similarly in 2014 as it was in recent years. As a result, an EFORd of 8.2% is recommended for the 2014 AOS forward looking EFORd for CIP Unit CT-1.