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PUBLIC UTILITIES
COMMISSION

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

Dear Commissioners:

Subject: Adequacy of Supply ("AOS")
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 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.*

2015 Adequacy of Supply Report Summary

- Hawaiian Electric's AOS is based on the Company's February 2014 Sales and Peak Forecast and other key assumptions.

- Hawaiian Electric's firm generation capacity, which does not include intermittent energy sources such as wind and solar may not be sufficient to meet projected peak demand in the first quarter of 2015 and from 2017 on.

- Hawaiian Electric may seek to mitigate future capacity needs in 2017 and beyond by deferring future deactivation of units, increasing Demand Response Programs, reactivating units that are currently deactivated, or acquiring additional firm capacity through a competitive bidding process.

- The adjusted peak load experienced on O'ahu in 2014 was 1,170 MW net, and was served by Hawaiian Electric's total capability of 1,671 MW net, including firm power purchases. This represents a reserve margin of approximately 46% over the 2014 adjusted system net peak. This reserve margin did not include the capacity of Honolulu Units 8 and 9, which were deactivated in January 2014.

- Honolulu Units 8 and 9 (with a combined rating of 107.3 MW net) were deactivated on January 31, 2014. The 2015 AOS reference scenario reflects the Honolulu generating units remaining deactivated, and their capacities are not included in the reserve margin calculations.

- Waiau Units 3 and 4 (with a combined rating of 92.6 MW-net) are also candidates for deactivation. The 2015 AOS reference scenario reflects these units being deactivated at the end of 2016.

- Hawaiian Electric is anticipating the addition of approximately 50 MW of utility-owned and operated, firm, 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 O'ahu, as well as enabling the integration of more variable generation renewable resources. It is estimated that the security project may be in service in the 2018 timeframe. Hawaiian Electric anticipates that the acquisition of new firm generation capacity in 2018 may alleviate the projected reserve capacity shortfall in that year and beyond.

1. <u>Peak Demand and System Capability in 2014</u>

The adjusted peak load experienced on O'ahu in 2014 was 1,170 MW net, and was served by Hawaiian Electric's total capability of 1,671 MW net, including firm power purchases. This represents a reserve margin of approximately 46% over the 2014 adjusted system net peak.[1] This reserve margin did not include the capacity of Honolulu Units 8 and 9, which were deactivated in January 2014.

The system peak occurred on Monday, September 22, 2014, at approximately 6:49 p.m., and was 1,165 MW-net based on net Hawaiian Electric generation, net

[1] The total capability value used in the calculation of this reserve margin does not account for units not available due to maintenance outages, forced outages or derates in unit capacities. The reserve margin calculation takes into account the approximately 26 MW of interruptible load that may be available at system peak. In actual real-time operations, reserves may be reduced due to maintenance, forced outages or deratings. A combination of multiple planned and unplanned events led to very tight reserve margins in January 2015.

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 2014 system peak would have been approximately 1,170 MW-net.

Hawaiian Electric's 2014 total generating capability of 1,671 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]

At times during 2014, Hawaiian Electric received energy from seven variable generation energy producers (i.e., Chevron, Hawaii Independent Energy, 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, though the generating system reliability calculations do take into account the contribution of variable generation.

2. Estimated Reserve Margins

Appendix 1 shows the forecasted reserve margin over the next five years, 2015-2019, based on Hawaiian Electric's February 2014 Sales and Peak Forecast, and includes estimated energy efficiency impacts and forecasted load management impacts.

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:

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2 At the time of the peak, certain units at Hawaii Independent Energy, Chevron, and Pearl Harbor were generating about 5 MW 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.

- peak demand, including the forecasted peak reduction benefits of energy efficiency demand-side management ("DSM") programs; [§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]

Each of the current assumptions for these and other factors are 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 one rule[4] 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 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 loads;

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.

[4] In previous Adequacy of Supply filings Hawaiian Electric used two rules. Rule 2was intended to take into account the dynamic response of the system (e.g., the amount of reserve power available within three seconds), will no longer be applied as the characteristics of the system have changed substantially in recent years. In its stead, draft planning standards that were provided in Appendix M of Hawaiian Electric's Power Supply Improvement Plan, filed on August 26, 2014, in Docket No. 2011-0206, will be used to assess the adequacy of supply in combination with the generating system reliability (or loss of load probability) analyses as contained in this report.

Rule 1 includes 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.

Rule 1 is 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, 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 that has been reduced by the total amount of interruptible loads that would be available for interruption 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.

3.2 Hawaiian Electric's Reliability Guideline: Loss of Load Probability

The application of Hawaiian Electric's generating system reliability guideline does take into account the Loss of Load Probability ("LOLP") 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.

The output from variable generation renewable resources such as wind or PV cannot be dispatched to provide a specified level of power upon demand to serve the peak load. Therefore, determining their capacity value (that is, the variable resource's ability to replace firm generation) with a high level of confidence is a considerable challenge. Notwithstanding this uncertainty, estimated capacity values of variable generation and demand response resources are reflected in the LOLP calculations towards meeting customer electricity demand.

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 O'ahu 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.

3.3 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 Hawaiian Electric broaden its consideration to ensure timely installation of generation capacity necessary to meet its customers' energy needs.

Other near-term considerations may include:

1. the current condition and rated capacity of existing units;
2. 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 Hawaiian Electric's isolated electrical system.

In the application of Hawaiian Electric's capacity planning criteria that are used to determine its adequacy of supply, the inputs drive the results. Two of 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. Key Inputs to the 2015 AOS Analysis

4.1. February 2014 Sales and Peak Forecast

Hawaiian Electric developed a sales and peak forecast in February 2014 ("February 2014 forecast"), which was subsequently adopted by the Company for future planning purposes. Hawaiian Electric's AOS is based on the Companies February 2014 sales and peak forecast and other key assumptions.

Figure 1 illustrates Hawaiian Electric's historical system peaks, and the forecast used in the 2015 AOS analyses.

Figure 1: Recorded Peaks and Future Year Projections

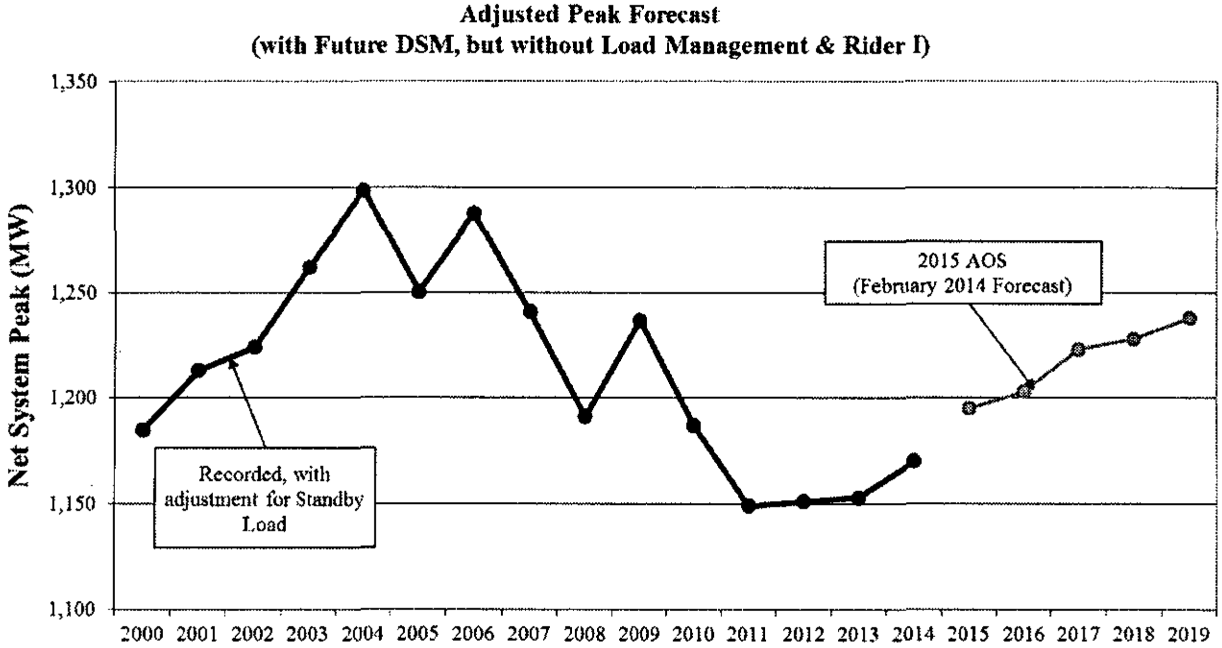

Table 1 below provides the recorded peaks from 2000 and the forecast used in the 2015 AOS.

For both the recorded and forecast data (from the 2015 Sales and Peak Forecast), 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 also includes the peak reduction benefits of energy efficiency programs and naturally occurring conservation.

Table 1: 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	2015 AOS Feb 2014 S&P
2000	1,164	1,185	
2001	1,191	1,213	
2002	1,204	1,224	
2003	1,242	1,262	
2004	1,281	1,299	
2005	1,230	1,250	
2006	1,265	1,288	
2007	1,216	1,241	
2008	1,186	1,191	
2009	1,213	1,237	
2010	1,162	1,187	
2011	1,141	1,149	
2012	1,141	1,151	
2013	1,144	1,153	
2014	1,165	1,170	
2015			1,195
2016			1,203
2017			1,223
2018			1,228
2019			1,238

4.2. Projected Peak Reduction Benefits of Load Control Programs

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 Demand Response ("DR") option ("August 9 Letter.") On October 22, 2013, the Commission approved the Companies' request.[6]

On July 28, 2014, the Companies filed their Integrated Demand Response Portfolio Plan ("IDRPP") in Docket No. 2007-0341. The IDRPP included the actions the Companies plan to undertake to acquire cost-effective DR resources that benefit all customers. The DR program year 2015 can be appropriately characterized as a "transition period" for the Hawaiian Electric DR programs. 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 2014.

On September 9, 2014, Hawaiian Electric Company and Maui Electric Company filed a letter to the Commission stating: "Hawaiian Electric Company, Inc. ("Hawaiian Electric") and Maui Electric Company, Limited ("Maui Electric") respectfully request Commission approval to (1) continue their existing demand response programs ("DR Programs") for program year 2015, with modifications for Hawaiian Electric only, and (2) continue to utilize the currently approved Demand Side Management ("DSM") component of the Integrated Resource Planning ("IRP") Cost Recovery Provision for the recovery of the DR Programs' customer incentive payments during the 2015 transition period, as discussed below. These approvals will provide Hawaiian Electric and Maui Electric with the opportunity to commence the transformation of its existing DR Programs to the market-based model proposed in the IDRPP, and will also provide the Commission with the necessary timeframe to conduct its review of the IDRPP." While a

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.

Commission decision is pending, Hawaiian Electric continues to pursue the further development of DR programs as stated in the IDRPP.

For the purposes of this analysis, the assumptions related to Hawaiian Electric's various DR programs are consistent with the forecasts presented in the IDRPP.

Table 2 shows the forecast of the peak reduction benefits towards Rule 1 and reserve margin calculations from Hawaiian Electric's existing and future load management programs[7] as described in the IDRPP.

Table 2: Projected Commercial, Residential Demand Response Impacts for Capacity Planning Purposes (MW)

Year	Residential	Commerical	Rider I	Total
2014	5.3	16.0	4.3	25.6
2015	6.6	17.6	4.3	28.5
2016	8.0	24.1	4.3	36.4
2017	9.2	25.7	4.3	39.2
2018	10.6	27.3	4.3	42.2
2019	11.8	28.8	4.3	44.9

4.3. <u>Hawaiian Electric Generating Unit Forced Outages</u>

Forced outages and de-ratings reduce generating unit availability and are accounted for in the EFORd statistic. EFORd, a measure of forced outages and operations in derated conditions, is a subcomponent of generating unit availability – and a key driver in the capacity planning criteria and reserve capacity shortfall calculations. The definition of EFORd and an example of the application of the EFORd formula is provided in Appendix 2.

Outages for planned work and maintenance will continue to be more numerous and longer in duration than in previous years. Maintenance will continue to be a challenge for the existing units. As the generating units age,[8] they will need to be maintained more often and for longer periods of time. As the demand on existing generating units change to mitigate different resources on the system such as variable generation resources, the generating units operate harder to counteract the uncertainty, which increases the likelihood of unscheduled (forced) outages and operations at derated power levels. Generating units that were shutdown unexpectedly generally require

[7] Forecasted impacts available at system peak at the net-to-system level.
[8] Hawaiian Electric's generating units (not including the Campbell Industrial Park combustion turbine installed in 2009) are between 34 and 68 years old. Firm capacity IPP units are between 23 and 25 years old.

immediate maintenance. As resources are shifted to make the emergency repairs, maintenance outage schedules slip, making maintenance scheduling flexibility difficult. In addition, generating units operating in a derated capacity cannot be afforded the luxury of a maintenance shutdown to restore the unit to full power operations. These units are generally operated for long periods in a derated state.

Based on Hawaiian Electric's maintenance experience, lower generating unit availabilities and higher EFORd estimates are expected to continue in the near future.

Lower generating unit availability and higher EFORd both contribute to an increase in reserve capacity shortfalls.

Table 3 provides recorded Hawaiian Electric EFORd data by unit for the period 2010-2014. The forward looking EFORd values utilized in the 2015 AOS analysis are forecasted EFORd expectations for planning purposes based on a combination of historical data, experience, and operational judgment. 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. It is difficult to forecast EFORd due to unforeseen conditions of aging units, longer planned maintenance schedules, and the operating stress placed on the units. Refer to Appendix 3 for specific generating unit information on EFORd.

Table 3: Historical and Forward-looking EFORd

Recorded EFORd						AOS EFOR Rates
	2010	**2011**	**2012**	**2013**	**2014**	**2015 Forward Looking**
Honolulu 8 *	17.5%	3.4%	4.0%	5.2%	7.5%	8.5%
Honolulu 9 *	9.1%	6.1%	24.5%	9.1%	36.9%	8.5%
Waiau 3	3.3%	11.2%	4.4%	13.7%	33.2%	13.2%
Waiau 4	0.9%	9.0%	2.2%	1.7%	5.0%	3.8%
Waiau 5	1.6%	0.5%	1.9%	1.4%	3.5%	2.7%
Waiau 6	0.2%	2.2%	6.5%	2.4%	7.2%	2.7%
Waiau 7	0.1%	7.4%	0.4%	1.6%	0.0%	3.8%
Waiau 8	1.3%	11.2%	3.7%	4.7%	6.7%	3.8%
Waiau 9	0.6%	8.6%	25.5%	2.1%	0.9%	7.2%
Waiau 10	9.0%	9.8%	4.8%	7.1%	3.4%	7.2%
Kahe 1	0.7%	2.7%	0.5%	0.6%	2.8%	4.0%
Kahe 2	8.8%	2.4%	7.2%	3.1%	10.6%	4.0%
Kahe 3	3.9%	2.2%	2.5%	1.3%	2.2%	3.8%
Kahe 4	10.4%	3.0%	2.7%	2.3%	9.0%	3.8%
Kahe 5	1.1%	6.0%	4.6%	2.3%	6.1%	4.3%
Kahe 6	2.0%	3.0%	3.4%	12.8%	1.8%	4.3%
CIP CT-1	9.9%	8.4%	3.9%	0.7%	9.0%	6.4%
System	**3.8%**	**5.0%**	**4.1%**	**3.4%**	**5.9%**	**4.1%**

* Honolulu 8 and Honolulu 9 were deactivated on January 31, 2014. Forward looking EFORd values for these units are based on historical data and shown for comparison purposes.

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. The uncertainty of future maintenance schedules contributes to future planning uncertainty and may influence the magnitude of reserve capacity surplus or shortfalls.

4.5. Additions of Capacity

4.5.1 Firm Capacity Additions

The State of Hawai'i Department of Transportation, Airports Division ("DOT"), 8 MW of distributed standby generation ("Airport DSG") is anticipated to be on-line and available for Hawaiian Electric's dispatch in mid-2015. 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 by Decision and Order issued 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 Decision and Order ("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 anticipated that this project could be in service in the 2018 timeframe. For the purposes of this analysis, 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.

Several variable generation independent power producers have power purchase agreements ("PPA") with Hawaiian Electric and others are in various stages of Commission approval. For example:

On December 12, 2013, in Docket No. 2013-0423, 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. On December 31, 2014 in D&O No. 32600, the Commission approved a waiver from the Framework for Competitive Bidding, subject to the conditions set forth in D&O No. 32600.

On April 11, 2014, in Docket No. 2014-0077, Hawaiian Electric submitted an application for Commission approval of a waiver from the Framework for Competitive Bidding and approval of a PPA with Lanikuhana Solar, LLC, for up to 20 MW of solar power.

October 10, 2014, in Docket No. 2014-0308, Hawaiian Electric submitted an application for Commission approval of a Power Purchase Agreement with Ka La Nui Solar, LLC, for up to 15 MW of solar power.

On December 4, 2014, Hawaiian Electric submitted applications for Commission approval of six (6) Power Purchase Agreements. The projects (Docket No. 2014-0354 – EE Waianae Solar; Docket No. 2014-0355 – Ho'ohana Solar 1, LLC; Docket No. 2014-0356 – Kawailoa Solar, LLC; Docket No. 2014-0357 – Lanikuhana Solar, LLC; Docket No. 2014-0358 – SunE Waiawa Solar, LLC; and Docket No. 2014-0359 – Waiawa PV, LLC) are planned to produce a combined total of up to 208 MW of solar 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. The 2015 AOS reference scenario reflects the Honolulu generating units remaining deactivated, and their capacities are not included in the reserve margin calculations.

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 candidates for deactivation. The 2015 AOS reference scenario reflects these units being deactivated at the end of 2016. 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.

4.6.3. Reactivation

Deactivated units may be reactivated in the event of an emergency and/or to mitigate reserve capacity shortfalls. Reserve capacity shortfalls may occur for a variety of reasons including unexpected long term outages of generating units or existing PPAs with IPPs for firm capacity being terminated or not being renegotiated and extended In the case of Honolulu Units 8 and 9, reactivation would take approximately 3 months. In the event a situation warranted the reactivation of any deactivated units, the Company would inform the Commission accordingly and provide details supporting the basis for the need for such reactivation and its planned course of action.

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

The existing PPA with 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 2015 AOS analysis, it is assumed that the 208 MW of capacity provided by Kalaeloa remains in service beyond May 23, 2016.

4.8 Capacity from AES Hawaii, Inc.

The existing PPA with 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.

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)
- Hypothetical planning scenario if Honolulu 8 and 9 and Waiau 3 and 4 generating units are reactivated and remain in service, respectively
- Revised system reliability guideline - Increased stringency of Hawaiian Electric's generating system reliability guideline from 4.5 years per day to 10 years per day.
- Alternate capacity planning standard from PSIP

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 4 summarizes the Higher Load Scenario peak requirements.

Table 4: Higher Load Scenario

Year	2015 AOS Feb 2014 S&P Forecast (MW)	60 MW higher Feb 2014 S&P Forecast (MW)	Difference (MW)
2015	1,195	1,255	60
2016	1,203	1,263	60
2017	1,223	1,283	60
2018	1,228	1,288	60
2019	1,238	1,298	60

5.1.2 Honolulu 8 and 9, Waiau 3 and 4

The hypothetical 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 are reactivated, 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.

5.1.4 Alternate Capacity Planning Standard from PSIP[9]

In Hawaiian Electric's Power Supply Improvement Plan filed on August 26, 2014 in Docket No. 2011-0206, a proposed reserve margin target of 30% was used for capacity planning analysis.[10]

5.2 Results of Analysis

Table 5 shows the capacity, in MW, in excess of the amount needed to satisfy Rule 1 of the capacity planning criteria. The analysis shows that Rule 1 is satisfied for the reference scenario for each year through 2019 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 2; and (2) continued acquisition of third-party energy efficiency. However, as previously explained, Rule 1 results are deterministic and do not incorporate unit specific EFORd rates in their calculation.

Table 5: Rule 1 Analysis

Year	Rule 1 Results (MW)
2015	56
2016	179
2017	72
2018	56
2019	132

The LOLP for the reference and planning scenarios were calculated using a production simulation model for each year through 2019 under reference and variable sets of assumptions described in Section 4.

In 2015, and from 2017, the generating system reliability is projected to be less than 4.5 years per day in the reference scenario. Based on the Company's February 2014 forecast, Hawaiian Electric's firm generating capacity, which does not include intermittent energy sources such as wind and solar may not be sufficient to meet projected peak demand in the first quarter of 2015 and from 2017 on. The anticipated acquisition of new firm generating capacity in 2018 may alleviate the projected reserve capacity shortfall in that year and beyond. Reactivation of Honolulu Units 8 and 9 or the

[9] On August 26, 2014, Hawaiian Electric filed its Power Supply Improvement Plans ("PSIPs") in Docket No. 2011-0206. Order No. 32291 issued on September 12, 2014, transferred Hawaiian Electric's PSIP Report from Docket No. 2011-0206 into Docket No. 2014-0183.

[10] Refer to Appendix M of Hawaiian Electric's PSIP report for reference.

deferral of the deactivation of Waiau Units 3 and 4 may also alleviate, or remove, the future projected reserve capacity shortfall.

Table 6 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 6: Generation System Reliability Guideline (years/day)

Generation System Reliability (years/day)				
Year	Reference Scenario	Higher Load (Add 60 MW)	No Deactivations	10 yrs/day reliability scenario
2015	2.3	0.7	16.9	2.3
2016	15.2	3.7	142.9	15.2
2017	1.7	0.5	90.9	1.7
2018	1.4	0.4	83.3	1.4
2019	4.0	1.1	250.0	4.0

Table 7 shows the reserve capacity surpluses or shortfalls corresponding to the calculated reliability shown in Table 6. 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 2018, the number -60 would indicate that about 60 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 7: 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
2015	-40	-100	50	-70
2016	50	-10	140	20
2017	-50	-110	120	-80
2018	-60	-120	110	-90
2019	-10	-70	160	-40

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

The analysis indicates a reserve capacity shortfall occurs in 2015. A major contributor to this outcome is planned outages[11] of multiple firm capacity generating units in January 2015. Following the high risk period in January 2015, the planned outages and reserve capacity for the remainder of 2015 appear reasonable. Hawaiian Electric is not anticipating a need to reactivate Honolulu Units 8 and 9 in 2015 or 2016.

On January 12, 2015, Hawaiian Electric experienced a generation shortfall event due to the unexpected loss of several generating units, including the 180 MW AES plant and Hawaiian Electric's Kahe 5 generating unit at the Kahe Power Plant. In addition, the Kalaeloa power plant was providing less than half of its maximum output of 208 megawatts as it was undergoing repairs for an equipment problem. Hawaiian Electric's customers were asked to conserve energy during the peak hours of 5 p.m. to 9 p.m.; however, rolling outages needed to be implemented at approximately 6:23 p.m. as there was not a sufficient amount of available generation to serve all of the load. The first outage block consisted of about 13,970 customers, which represented approximately 18 MW, who were restored at approximately 7:25 p.m. Just prior to the restoration of the first outage block, a second block of about 14,870 customers, which represented approximately 17 MW was implemented starting at about 7:23 p.m. to replace and in preparation to restore the first outage block. This outage lasted for about 20 minutes, being restored at 7:46 p.m. During this event, Hawaiian Electric also deployed its EnergyScout demand response program, which has more than 34,000 customers and whose electric water heaters were temporarily de-energized in order to reduce the load by approximately 8 MW on the system. These customers' water heaters were restored at

[11] Planned maintenance outages on Hawaiian Electric's Kahe Units 6 and 4 began in October and December 2014 respectively, and continue into early 2015. Planned maintenance at the Kalaeloa power plant also began in December 2014 to repair damaged turbine blades.

about 8:14 p.m. Solar/PV systems were not producing power during this time period since there was no sunlight. Also, winds were extremely light and there was very little generation (approximately between 0.2 to 3.6 MW out of a total of 99 MW of nameplate capacity during this period) from the wind farms.

Hawaiian Electric's deactivated generating units at the Honolulu Power Plant were not able to mitigate this unexpected shortfall in generation. Moreover, Honolulu 8 and 9 are in long-term layup without fuel, on-site operating personnel, and other conditions that preclude them from being reactivated in a short time period. It is estimated that it would take approximately three (3) months to reactivate these generating units.

The January 12, 2015 outage event is in line with the LOLP analysis. The analysis indicated a higher than normal probability of a generation shortfall in 2015, due primarily to the high amount of necessary planned outages early in the year. The reserve capacity outlook for the latter portions of 2015 appears reasonable.

The forecasts and analysis for 2016 appear to indicate that there will be sufficient generation available for reasonable emergencies and reserve capacity. In 2017, a reserve capacity shortfall may occur based on the assumptions analyzed, such as the anticipated deactivation of Waiau generating units 3 and 4.

The results indicated for the 2018-2019 timeframe are based on present day assumptions, and will change as the Hawaiian Electric system transforms into the future. The lower reserve capacity shortfall in 2019 compared to 2017 and 2018 is largely a factor of forward-looking maintenance schedules that will be revised in the years ahead.

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 all years 2015-2019. 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 7 further projects that approximately 90 MW of firm capacity would have to be added to the Hawaiian Electric system by 2018 to achieve a higher reliability guideline of 10 years/day in the near term. The approximate 30MW 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.

Delaying the deactivation of Waiau Unit 3 and/or Waiau Unit 4 may help to mitigate short term reserve capacity shortfall risk and help Hawaiian Electric to meet its reliability guideline of 4.5 years per day. Additionally, if the capacity that could be supplied by Honolulu units 8 and 9 were included in a planning scenario in combination with the delayed deactivation of the Waiau units, the results in Tables 5 and 6 indicate the 4.5 years/day reliability criteria may be met for all years examined.

5.3 Additional Capacity Planning Criteria

As indicated in Section 5.1.4, Hawaiian Electric's Power Supply Improvement Plan, Chapter 5 of the PSIP included reserve margin planning analysis based on the criteria further described in Appendix M of the PSIP. The reserve margin analysis is a deterministic calculation based on the system peak demand and includes the contributions from firm capacity resources, variable generation resources, and interruptible loads.

Table 8 illustrates Hawaiian Electric's reserve margin calculation consistent with the PSIP criteria. For comparison, Appendix 1 of this report provides a reserve margin calculation without contributions from variable generation.

Table 8: Reserve Margin Calculation

Year	System Capability at Annual Peak Load (net MW) [A][I]	System Peak (net MW) [B][II]	Interruptible Load (net MW) [C][III]	Variable Generation [D]	Reserve Margin (%) $\frac{[A+D-(B-C)]}{(B-C)}$
2014	1,671	1,170	26	10	47%
2015	1,679	1,195	29	10	45%
2016	1,679	1,203	36	10	45%
2017	1,586	1,223	39	10	35%
2018	1,586	1,228	42	10	35%
2019	1,586	1,238	45	10	34%

8 Conclusions

Under the reference scenario, Hawaiian Electric's generation capacity for the next five years (2015-2019) at times may not be sufficient to meet reasonably expected demands for service and provide reasonable reserves for emergencies. Deferring the deactivation of Waiau Units 3 and 4 until additional firm capacity is acquired may mitigate the capacity shortfall risk and help Hawaiian Electric to meet its reliability guideline.

As indicated in Section 4.5, Hawaiian Electric is anticipating the addition of approximately 50 MW of utility owned and operated, firm, 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 O'ahu, as well as enabling the integration of more variable generation renewable resources. Hawaiian Electric anticipates that the acquisition of new firm generation capacity in 2018 may alleviate the projected reserve capacity shortfall in that year and beyond.

The scenario analysis indicates that depending on system conditions, Hawaiian Electric may experience anywhere from a 60 MW reserve capacity shortfall under the reference scenario to a 120 MW reserve capacity shortfall in the Higher Load Scenario in the timeframe analyzed. Hawaiian Electric may seek to mitigate future capacity needs in 2017 and beyond by deferring future deactivation of units, increasing Demand Response Programs, reactivating units that are currently deactivated, or acquiring additional firm capacity through a competitive bidding process.

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)

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)
2014	1,671	1,170	26	46%
2015	1,679	1,195	29	44%
2016	1,679	1,203	36	44%
2017	1,586	1,223	39	34%
2018	1,586	1,228	42	34%
2019	1,586	1,238	45	33%

Notes:

I. System Capability includes:
- Hawaiian Electric central station units at total normal capability in 2014 was 1,214.3 MW-net.
- Firm power purchase contracts with a combined net total of 456.5 MW in 2014 from Kalaeloa (208 MW), AES Hawaii (180 MW), and H-POWER (68.5 MW).
- Expected addition of Airport DSG in 2015 (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 from 2017 (-92.6 MW)

II. System Peaks
- The 2015-2019 annual forecasted system peaks are based on Hawaiian Electric's February 2014 Sales and Peak Forecast.
- The forecasted System Peaks for 2015-2019 include the estimated peak reduction benefits of third-party energy efficiency DSM programs.
- The peak for 2015-2019 includes approximately 27 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[12], 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[13], 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**

12 http://www.nerc.com/docs/pc/gadstf/ieee762tf/762-2006.pdf
13 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 2015 AOS analysis is discussed below:

1. Honolulu Units 8 and 9

   In the 2014 AOS, the forward looking EFORd of 8.5% 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 2015 AOS analysis, it was decided to use the 5 year average of the actual EFORd for both units from 2009-2013. As a result, 8.5% is recommended for the 2015 AOS forward looking EFORd for both Honolulu Units 8 and 9 for any reactivation scenario analysis.

2. Waiau Units 3 and 4

   In the 2014 AOS, the forward looking EFORd for Waiau Unit 3 was 6.7%. The actual EFORd for 2014 for Waiau Unit 3 was 33.2 %. In the 2014 AOS, the forward looking EFORd for Waiau Unit 4 was 3.8%. The actual EFORd for 2014 for Waiau Unit 4 was 5.0%.

   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 2015 AOS forward looking EFORd. Thus, for Waiau Unit 3, an EFORd of 13.2% is recommended and for Waiau Unit 4, an EFORd of 3.8% is recommended for the 2015 AOS forward looking EFORd.

3. Waiau Units 5 and 6

In the 2014 AOS, the forward looking EFORd rate for Waiau Units 5 and 6 was 2.0% based on the average actual EFORd rates for both units for the recent 5 years. The actual EFORd for 2014 for Waiau Units 5 and 6 were 3.5% and 7.2%, respectively. For the 2015 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 2.7% and is recommended for the 2015 AOS forward looking EFORd for both Waiau Units 5 and 6.

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 2015 AOS analysis. Accordingly, in the 2014 AOS, the forward looking EFORd rate of 3.7% was used for these four units. The actual EFORd for 2014 for Waiau Unit 7, Waiau Unit 8, Kahe Unit 3, and Kahe Unit 4 were 0.0%, 6.7%, 2.2%, 9.0%, respectively, with an average of 4.5%. For the 2015 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 2015 as they were in recent years. As a result, an EFORd of 3.8% is recommended for the 2015 AOS forward looking EFORd for Waiau Units 7 and 8, and Kahe Units 3 and 4.

4. Waiau Units 9 and 10

In the 2014 AOS, the forward looking EFORd rate for Waiau Units 9 and 10 was 7.2% based on the average of the actual EFORd's for both units for the recent 5 years. The actual EFORd in 2014 for Waiau Units 9 and 10 were 0.9% and 3.4%, respectively, and averaged to be 2.1% for the two units. For the 2015 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 2015 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 2015 AOS forward looking EFORd for Waiau Units 9 and 10.

5. Kahe Units 1 and 2

In the 2014 AOS, the forward looking EFORd for Kahe Units 1 and 2 was 3.6% based on the average of the actual EFORd for both units for the recent 5 years. The actual EFORd in 2014 for Kahe Unit 1 and 2 were 2.8% and 10.6%, respectively, and averaged to be 6.7% for both units. For the 2015 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 2015 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 4.0% is recommended for the 2015 AOS forward looking EFORd Kahe Units 1 and 2.

6. Kahe Unit 5 and 6

In the 2014 AOS, the forward looking EFORd for Kahe Unit 5 and 6 was 4.7% based on the average of the actual EFORd for the recent 5 years. The actual EFORd for 2014 for Kahe Unit 5 and 6 were 6.1% and 1.8% respectively, and averaged to be 3.9% for both units. Kahe 5 and 6 are similar units and are operated and maintained in similar manner. For the 2015 AOS analysis, it was decided to continue 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 4.3% is recommended for the 2015 AOS forward looking EFORd for Kahe Units 5 and 6.

7. 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 2014 AOS, the forward looking EFORd for CIP CT-1 was 8.2% based on the average of CIP CT-1 actual EFORd for the recent 5 years. The actual EFORd for 2014 for CIP CT-1 was 9.0%. For the 2015 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 2015 as it was in recent years. As a result, an EFORd of 6.4% is recommended for the 2015 AOS forward looking EFORd for CIP Unit CT-1.