

PUBLIC UTILITIES COMMISSION
STATE OF HAWAII

**REPORT TO THE 2014 LEGISLATURE
ON THE
PUBLIC UTILITIES COMMISSION
REVIEW OF
HAWAII'S RENEWABLE PORTFOLIO STANDARDS**

ISSUED PURSUANT TO
SECTION 269-95(5), HAWAII REVISED STATUTES

December 2013

Executive Summary

The State of Hawaii's ("State") energy policy is driven, in significant part, by a collection of benchmark requirements – the State's Renewable Portfolio Standards ("RPS") – that mandate the percentage of electricity that must be generated from renewable energy resources by the end of identified benchmark years. In conjunction with Hawaii's Energy Efficiency Portfolio Standards ("EEPS"), Hawaii has one of the most progressive sets of clean energy policy targets in the United States. The RPS targets have evolved through several legislative amendments that have followed overall State energy policy developments since the RPS was first established in 2001. The current RPS, under section 269-92, Hawaii Revised Statutes ("HRS"), requires electric utilities in the State to generate at least the following amounts of energy from renewable sources as a percentage of electricity sales:

Benchmark Year	RPS Requirement
2010	10%
2015	15%
2020	25%
2030	40%

The Commission's evaluation of and reporting on the effectiveness and achievability of the current RPS is done pursuant to the specific requirements of HRS §§ 269-95(4) (review) and 269-95(5) (reporting). Measuring the success of Hawaii's clean energy policies is an ongoing process. This report ("Report") is part of a continuing body of study both directly and indirectly related to the impacts of RPS on the State. The Commission anticipates that its analyses and the results of several pending investigations, studies and requests for proposals ("RFP") for new generation resources, will further inform the Commission's findings and conclusions in this Report as each of the future RPS benchmark dates approaches.

This Report examines and presents findings regarding the effectiveness and achievability of the existing RPS requirements, recognizing that there is substantial uncertainty regarding the more distant future RPS targets. Several principal findings in this Report include:

- The 2015 RPS requirement of 15% is achievable for both the HECO Companies¹ and Kauai Island Utility Cooperative (“KIUC”).
- It appears likely that the 2020 RPS requirement of 25% is achievable for both the HECO Companies and KIUC, provided that reasonably expected amounts of currently-proposed utility-scale renewable energy projects and distributed renewable generation are successfully developed and integrated on the utility systems.
- The 2030 RPS requirement of 40% may possibly be achievable, but this cannot be determined with confidence at this time due to uncertainties regarding the magnitude of future utility sales and several substantial outstanding challenges regarding the successful and economical siting and incorporation of requisite renewable energy generation resources. Nonetheless, this target is sufficiently aggressive to effectively focus efforts to address several challenges to the extensive incorporation of renewable resources on the Hawaii utility systems. A number of key issues must be thoughtfully considered when assessing whether current RPS targets should be adjusted or whether additional benchmarks should be established.
- The RPS remains effective in helping the State achieve its policies and objectives with respect to developing renewable energy resources in Hawaii through the 2030 timeframe.

The Commission anticipates that the results of pending investigations and reviews relevant to the RPS will further inform consideration of possible future amendments to the RPS targets.

¹The “HECO Companies” include Hawaiian Electric Company, Inc., Maui Electric Company, Ltd., and Hawaii Electric Light Company, Inc.

Table of Contents

Executive Summary	1
I. Introduction	4
II. Background	6
III. Historical RPS Achievement.....	10
IV. Effectiveness and Achievability of the RPS: Standards and Methodology	14
V. Achievability of the 2015 RPS.....	25
VI. Achievability of the 2020 RPS.....	28
VII. Achievability of the 2030 RPS.....	36
VIII. Challenges and Considerations in Achieving Future RPS Targets	47
IX. Summary, Findings and Recommendations	51

Appendix A – Historical RPS Achievement by Individual Utility

Appendix B – Historical RPS Achievement by Resource Mix

Appendix C – 2012 RPS Status Reports

I. Introduction

This Report provides current information regarding the status, effectiveness and achievability of Hawaii's current RPS targets. In particular, this Report responds to the requirements of HRS § 269-95, which requires that the Commission shall:

Evaluate the renewable portfolio standards every five years, beginning in 2013, and may revise the standards based on the best information available at the time to determine if the standards established by section 269-92 remain effective and achievable; and

Report its findings and revisions to the renewable portfolio standards, based on its own studies and other information to the legislature no later than twenty days before the convening of the regular session of 2014, and every five years thereafter.

Haw. Rev. Stat. §§ 269-95(4) and 269-95(5), respectively.

Hawaii, along with over half of the states in the U.S., has established a renewable portfolio standards law that requires electrical utilities to implement minimum percentages of renewable resources by specified future dates. The purpose of the RPS is to promote Hawaii's energy policy goals by encouraging the development and implementation of renewable energy generation connected to Hawaii's utility energy systems, while displacing existing fossil-fueled generation and reducing the State's dependence on imported oil.² Through the RPS, EEPS and other measures designed to increase renewable energy utilization and energy efficiency, as well as to off-set electrical loads, Hawaii is recognized as having one of the most aggressive clean energy policies in the country.

The Commission's RPS evaluation indicates that current RPS targets have been and continue to be effective in promoting the State's clean energy goals of increasing the use of renewable energy resources and reducing the usage of fossil fuels for electrical energy generation. The 2015 and 2020 RPS targets are likely to be achievable, provided that reasonably expected amounts of currently-proposed utility-scale renewable energy projects and projected levels of distributed renewable generation are successfully developed and integrated into Hawaii's utility systems. The achievability of the 2030 RPS

²See Part I, Section 1, Act 155, Session Laws of Hawaii 2009.

requirement of 40% renewable generation is not possible to determine with certainty at this time, but this target is sufficiently aggressive to effectively focus efforts to address several challenges to the extensive incorporation of renewable resources on Hawaii's utility systems. A number of key issues must be thoughtfully considered when assessing whether current RPS targets should be adjusted or whether additional benchmarks should be established. To better understand the need for and impact of adjustments to the RPS requirements, the Commission is examining the results of related commission investigations and proceedings, as well as ongoing long-range studies, that will add to the findings regarding RPS effectiveness and achievability discussed in this Report.³

³Investigations in several open dockets are pending before the Commission that will provide additional reliable information regarding the potential availability, costs and integration of renewable resources on Hawaii's electric utility systems. Relevant investigations include, for example, review of the HECO Companies' 2013 Integrated Resource Plan ("IRP") Report in Docket No. 2012-0036 and pending dockets to consider the costs and merits of inter-island electricity transmission (Docket No. 2013-0169), the status of the proposed 200 megawatt ("MW") wind project on Lanai (Docket No. 2013-0168), RFP's for renewable generation resources (Hawaii Island geothermal generation in Docket No. 2012-0092, Oahu as-available generation in Docket No. 2011-0225, Docket No. 2013-0156 and Docket No. 2013-0381), as well as several dockets considering specific renewable generation resources. In addition, the Commission has initiated several targeted technical studies to investigate the economics and feasibility of incorporating renewable generation resources on Hawaii's utility systems, including long-range analysis currently under way by the Hawaii Natural Energy Institute of the University of Hawaii, that will further inform the findings in this Report.

II. Background

The State is heavily reliant on imported petroleum fuels for all aspects of energy production. Since the 1970's, Hawaii has had explicitly-stated legislative policies to reduce imports of petroleum fuels, promote the use of indigenous resources and maintain affordable energy services. To implement these policies, the State has adopted goals and a broad spectrum of measures and programs to promote energy efficiency and renewable power generation. Hawaii's RPS requirements were originally implemented by the Hawaii State Legislature ("Legislature") via statute in 2001. The Legislature has since amended the RPS laws on several occasions, consistently increasing both the proportional amounts of renewable energy the State must produce and the time horizon to which the State commits itself to reach these targets. Relevant legislative enactments and related initiatives in the evolution of the RPS requirements include:

Act 272 (2001)

Hawaii's initial RPS was created by Act 272, Session Laws of Hawaii 2001 ("Act 272"), recognizing "the economic, environmental, and fuel diversity benefits of renewable energy" and establishing policies to encourage the development of local renewable energy resources and the creation of a market for those resources.⁴ The RPS established in 2001 required Hawaii's electric utilities to establish goals where renewable energy, as a percentage of electricity sales, must have met or exceeded:

- 7% by 2003,
- 8% by 2005, and
- 9% by 2010.

"Renewable energy" was defined under Act 272 to include renewable generation and "electrical energy savings" brought about by the use of solar and heat pump water heating. Affiliated electrical utilities (i.e., the HECO Companies) were allowed under Act 272 to aggregate their renewable portfolios in order to achieve the RPS.

⁴See Part I, Section 1, Act 272, Session Laws of Hawaii 2001.

Act 95 (2004)

Act 95, Session Laws of Hawaii 2004 (“Act 95”), increased the RPS percentage requirements and expanded the types of resources included in the definition of “renewable energy.” The RPS levels were amended so that renewable energy, as a percentage of electricity sales, must have met or exceeded:

- 7% by 2003,
- 8% by 2005,
- 10% by 2010,
- 15% by 2015, and
- 20% by 2020.

The definition regarding the kinds of “renewable energy” that could be applied to the RPS was expanded under Act 95 to include quantifiable energy conservation measures and several additional measures that offset electrical energy sales, including seawater air conditioning, ice storage and solar air conditioning.

Hawaii Clean Energy Initiative (2008)

In January of 2008, the State executed a memorandum of understanding with the United States Department of Energy (“USDOE”) that established the Hawaii Clean Energy Initiative (“HCEI”) with energy targets intended to reduce Hawaii’s long-time dependence on imported oil for its energy needs. The HCEI included a goal to reduce energy use in both the transportation and electrical power sectors by 70% by the year 2030. In the electrical sector, goals were identified to reduce projected 2030 electricity use by 30% through energy efficiency measures and to generate 40% of electricity needs from renewable generation sources.

Act 155 (2009)

Act 155, Session Laws of Hawaii 2009 (“Act 155”), recognized the HCEI goals included in the memorandum of understanding between the State and the USDOE and made several corresponding changes to the RPS statute. The RPS goals were substantially increased in two respects. First, as shown below, the RPS percentage requirements were increased under Act 155 to the standards currently in effect that require renewable energy, as a percentage of electricity sales, must meet or exceed:

- 10% by 2010,
- 15% by 2015,
- 25% by 2025, and
- 40% by 2030.

Second, the RPS requirements were re-specified under Act 155, so that starting January 1, 2015, the entire RPS shall be met by electrical generation from renewable energy sources.⁵ Thus, energy efficiency measures and energy off-set technologies no longer can be applied to meet the RPS requirements for 2015, 2020 or 2030.

Act 155 also established a separate EEPS target to require 4300 gigawatt-hours (“GWh”) of future energy savings by the year 2030 from energy efficiency and off-set technologies calculated to achieve a 30% reduction in forecasted 2030 energy consumption.

Act 10 (2011)

Act 10, Session Laws of Hawaii 2011, further amended the definition of “renewable electrical energy” to be applied towards achievement of the RPS by clarifying that, starting on January 1, 2015, electrical energy generated using renewable energy as the source would include customer-sited, grid-connected renewable energy generation.

Definitional Protocols for Measuring RPS Achievement

The current effective RPS statute provides two separate definitional protocols for determining achievement of the RPS:

- **Pre-2015 Protocol:** Prior to January 1, 2015, the RPS percentage requirements may be achieved by both renewable energy generation and by energy efficiency and energy off-set technologies, provided that at least 50% of the standard is met by renewable energy generation. This protocol applies to the 2010 RPS requirement.
- **2015 Protocol:** Starting on January 1, 2015, each of the RPS requirements must be achieved by renewable generation, and may not include energy efficiency and energy off-set technologies allowed under the Pre-2015 Protocol. Since the 2015 RPS requirement must be achieved by the end of year 2015, this protocol applies to the 2015 RPS requirement and all years thereafter.

⁵Prior to the creation of Act 272, an added provision under Act 162, Session Laws of Hawaii 2006 (“Act 162”), created the requirement that at least 50% of the renewable electrical energy that counts towards achieving the RPS must be provided by renewable generation. As noted, Act 272 clarified Act 162’s 50% requirement in line with the amended definition and calculation of “renewable electrical energy” beginning January 1, 2015.

As of the date of this Report, the definitional protocol that applied to the 2010 RPS is technically still in effect through 2014. Since the 2015 RPS requirement is the next target to be achieved, however, the most pertinent protocol for tracking probable future achievement is currently the 2015 Protocol. Comparing historical RPS achievement figures using the different definitional protocols can be useful, particularly when considering potential future RPS achievement of the 2015 RPS requirement in relation to past RPS numbers. This Report indicates which definitional protocol is used – either the Pre-2015 Protocol or the 2015 Protocol – where appropriate.

III. Historical RPS Achievement

Since the inception of RPS in Hawaii, the RPS has effectively applied to two utility entities – KIUC⁶ and the combined HECO Companies.⁷

Both KIUC and the HECO Companies met the 2010 RPS requirement of 10%. The historical achievement of the RPS for both KIUC and the combined HECO Companies according to the Pre-2015 Protocol (i.e., including energy efficiency and energy off-set technology) are shown in Chart 1 below.⁸ Consistent with the Pre-2015 Protocol, the definition for “renewable electrical energy” includes utility-owned and non-utility-owned renewable generation resources, as well as the impacts of energy efficiency programs, efficiency measures that include heat pump water heating, energy off-set technologies that include solar water heating and customer-sited, grid-connected renewable energy systems.⁹

Additional information showing the historical RPS achievement of each individual electric company in the State is presented in Appendix A.

⁶Prior to a change of provider completed in 2002, electric utility service had been provided to the Island of Kauai by Citizens Communications Company, Kauai Electric Division.

⁷The HECO Companies, being affiliated electric utility companies, are allowed under the current RPS statute to combine renewable resources to meet the RPS on an aggregated basis, and have elected to do so. See Haw. Rev. Stat. § 269-93(a).

⁸The data portrayed in Chart 1 and Chart 2 are provided by the RPS status reports and net energy metering status reports filed annually with the Commission by each utility company. For copies of the utilities’ annual reports submitted to the Commission, see the Commission’s website at <http://puc.hawaii.gov/reports/energy-reports/>.

⁹According to each utilities’ respective RPS and net energy metering status reports, both KIUC and the HECO Companies complied with the RPS requirement that at least half of the required energy was provided by renewable generation. See Haw. Rev. Stat. § 269-92(b).

Chart 1. Historical RPS Achievement; 2010 Requirement (Pre-2015 Protocol)

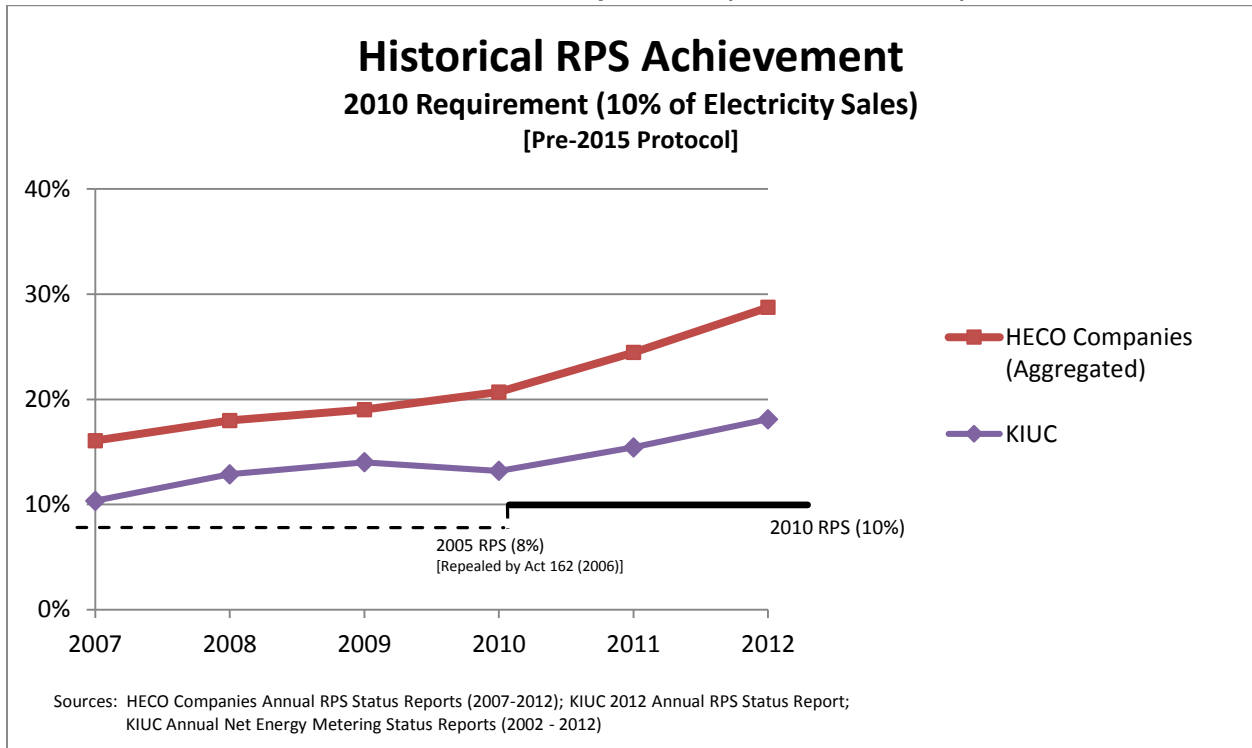


Chart 2. Historical RPS Achievement; 2015 Requirement (2015 Protocol)

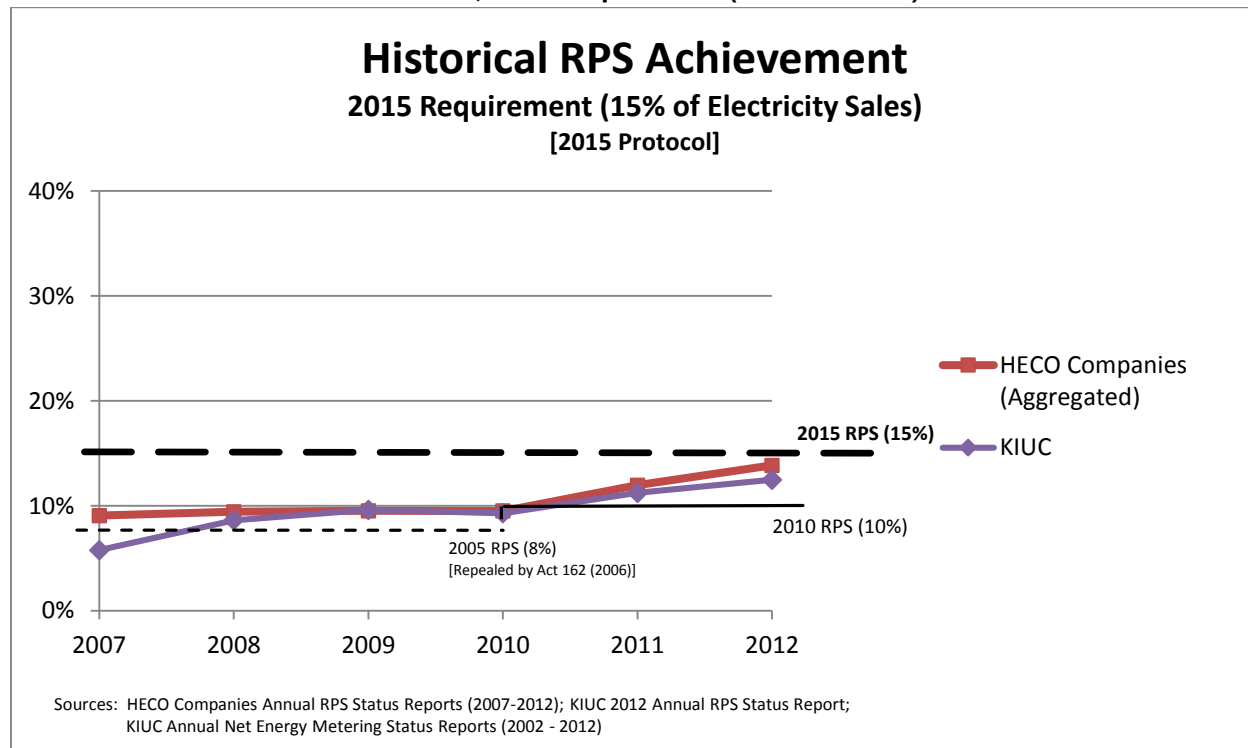


Chart 2 above shows the historical RPS achievement for KIUC and the combined HECO Companies according to the 2015 Protocol, which applies to the RPS requirements for 2015 and all years thereafter. Consistent with the 2015 Protocol, “renewable electrical energy” includes only energy generated from renewable sources including customer-sited, grid-connected renewable energy generation. Although this statutory definition does not take effect until January 1, 2015, the historical achievement of the RPS according to the 2015 Protocol is informative regarding the ability of the utilities to meet the next applicable RPS requirement in 2015.

The information portrayed in Chart 2 above utilizes data provided by KIUC and the HECO Companies in RPS and net energy metering reports, where applicable, provided to the Commission by each utility annually. The percentage achievement of the 2015 RPS requirement shown in Chart 2, however, is based on the Commission’s interpretation of the 2015 Protocol and differs in several respects from what is provided

in the utilities' reports. First, the utilities' respective RPS reports are filed consistent with the still-effective Pre-2015 Protocol definitions. Second, the Commission applies the full estimated output of customer-sited, grid-connected generation to the RPS, whereas the KIUC reports apply only to the portion of generation that off-sets electricity sales.¹⁰

¹⁰KIUC's RPS reports document and count only estimates of the portion of distributed generation resources that off-set customer loads towards achievement of the RPS. Consistent with the statutory definitions that will apply to the RPS starting on January 1, 2015, the Commission counts the full output from distributed generation in determining achievement of the RPS requirements. The distributed generation contribution for the KIUC system is derived from KIUC's annual net energy metering reports that provide more comprehensive documentation of distributed generation installed capacity and energy production.

IV. Effectiveness and Achievability of the RPS: Standards and Methodology

The RPS statutes require that the Commission periodically review whether the RPS remain effective and achievable. HRS § 269-95(4) requires the Commission to:

Evaluate the renewable portfolio standards every five years, beginning in 2013, and may revise the standards based on the best information available at the time to determine if the standards established by section 269-92 remain effective and achievable; (emphasis added)

The determination of the effectiveness and achievability of the RPS is a central focus of this Report. The Commission's interpretation and determination of effectiveness and achievability are discussed generally below. The achievability of the RPS is discussed in more detail individually regarding each of the 2015, 2020 and 2030 RPS requirements in several later sections of this Report.

Effectiveness of the RPS

Hawaii has long-standing policies to reduce imports of petroleum, increase the use of indigenous renewable resources and maintain affordable energy services.¹¹ The RPS was initially created by Act 272, stating:

It is the intent of the legislature to recognize the economic, environmental, and fuel diversity benefits of renewable energy resources and to encourage the establishment of a market for renewable energy in Hawaii using the State's renewable energy resources and to encourage the further development of those resources...

....

¹¹See, for example, Haw. Rev. Stat. § 226-18. In particular, Act 100, Session Laws of Hawaii 1978, which was codified as HRS § 226-18, identified the establishment of “[d]ependable, efficient, and economical statewide energy and communication systems” and “[i]ncreased energy self-sufficiency” as two primary energy/utility planning objectives of the State. See Section 2, Act 100, Session Laws of Hawaii 1978.

Accordingly, the legislature finds that it should establish goals for electric utilities to guide them in incorporating renewable resources into their resource portfolios to reduce the use of imported oil.

Part I, Section 1, Act 272, Session Laws of Hawaii 2001.

The Legislature has expressed similar intent in subsequent enactments amending Hawaii's RPS.¹² The assessment of the effectiveness of the RPS must therefore consider (1) whether the RPS are effective at increasing the amount of renewable energy generation resources implemented on Hawaii's utility systems, and (2) whether the increased utilization of renewable resources is effectively reducing the use of imported oil and, more generally, promoting Hawaii's policies to increase use of indigenous resources while maintaining affordable energy services. As explained in this Report, the RPS has been effective in both respects.

It is generally accepted that implementation of renewable energy generation promotes Hawaii's energy policies regarding fuel use. Generation using Hawaii sources of renewable energy increases the use of indigenous resources and decreases reliance on imported fuels. As noted above, the Legislature has recognized the economic, environmental and fuel diversity benefits of renewable energy resources. This Report does not attempt to further substantiate the nature of the benefits of increased utilization of renewable resources in achieving Hawaii's fuel use policies beyond those which are clear from legislative intent.

The economics of the cost-effectiveness of renewable resources has changed substantially in the past decade. In recent years, the price of petroleum fuels has far exceeded general expectations since the RPS was originally established.¹³ Indeed, the

¹²See Section 1, Act 95, Session Laws of Hawaii 2004. See also Part I, Section 1, Act 155, Session Laws of Hawaii 2009.

¹³For a comparison of general fuel price expectations during the period when the RPS statutes were established and subsequently amended, the HECO Companies' various IRP reports over the last decade provide a useful example of expectations. See, for example, In re Integrated Resource Planning, Docket No. 03-0253, Hawaiian Electric Company, Inc. IRP Plan, Appendix M Fuel Price Forecasts for LSFO, No. 2 Diesel and Coal, filed October 28, 2005; In re Integrated Resource Planning, Docket No. 2007-0084, Hawaiian Electric Company, Inc. IRP Plan, Appendix M Fuel Price Forecast, filed September 30, 2008; and In re Integrated Resource Planning, Docket No. 2012-0036,

high costs of petroleum fuels have become an economic driver for developing alternatives in electricity production rather than any kind of perceived roadblock.

At current and expected future petroleum prices, economic forces are working generally in conjunction with the RPS and other Hawaii policies and programs to promote the implementation of renewable energy generation resources.¹⁴ The increased use of renewable generation resources on Hawaii's utility systems is currently effectively reducing costs paid by utility customers. The price paid by utilities for the purchase of energy from renewable resources is less than the avoided operation costs of the utilities' fossil-fueled generation. Table 1 below shows an approximated estimate of the annual cost savings from purchases of renewable energy from independent power producers for each of the HECO Companies based on actual reported information from the 2012 calendar year.¹⁵ The average price paid for renewable generation purchases is less than the average costs of operating utility fossil-fueled generation on each utility system.¹⁶

2013 IRP Report, Appendix E: Quantifying the Scenarios, filed June 28, 2013. See also U.S. Energy Information Administration, *AEO Retrospective Review: Evaluation of 2012 and Prior Reference Case Projections*, March 15, 2013. http://www.eia.gov/forecasts/aeo/retrospective/excel/table_3a.xls.

¹⁴There are several uncertainties regarding future costs for operating Hawaii's existing fossil-fueled generation units. In addition to uncertainties regarding future world crude oil prices, new federal air quality regulations may require utilization of more expensive, lower sulfur fuels or substantial investments in emissions control equipment. It is also possible that liquefied natural gas could become available as a fuel for existing generation units, but the likelihood, timing and pricing of this possibility remain uncertain. Decreases in the costs associated with renewable energy generation are also a notable potential uncertainty.

¹⁵The analysis presented in Table 1 follows a basic and straightforward approach suitable for determining an approximation of the current economies of renewable generation. A more thorough analysis would require the inclusion of several additional factors, including, in particular, a more rigorous determination of the utility system costs avoided by operation of the renewable generation resources.

¹⁶The average price of purchased renewable energy for the HECO system shown in Table 1 does not include the energy production or the cost of biofuels used in utility-owned generation. The utilization of biofuels on the HECO system in 2012

Table 1. Estimated Annual Cost Savings From Renewable Energy Purchases

Estimated Annual Cost Savings From Purchases of Renewable Energy From Independent Power Producers (IPP) Hawaii Public Electric Utility Companies Calendar Year 2012							
Utility	Average IPP Renewable Generation Energy Price	Average Utility Fossil Fueled Generation Energy Cost	Renewable IPP Generation Energy Cost Margin	Renewable IPP Energy Generation	Renewable IPP Generation Savings	Renewable IPP Generation Savings	Renewable IPP Generation Energy
	Cents/kWh	Cents/kWh	Cents/kWh	GWh	\$ Millions	Percentage of Total System Energy Cost	Percentage of Total System Generation
HECO	19.5	22.6	3.0	383	11.7	0.9%	5.2%
HELCO	16.9	25.4	8.5	451	38.4	15.8%	38.5%
MECO	16.2	23.8	7.6	208	15.9	5.8%	17.1%
KIUC	20.9	22.9	2.1	41	0.8	0.8%	9.1%

The favorable economics of renewable generation are not without exception or limit, however, regarding the ultimate extent to which renewable generation can be feasibly and economically implemented on Hawaii's utility systems. A large fraction of the renewable generation resources used and planned for implementation in Hawaii are variable or intermittent¹⁷ and require support from "dispatchable" resources to assure grid stability and suitable power quality. Dispatchable resource support can be provided by fossil-fueled generation or some types of renewable generation resources, such as geothermal, waste-to-energy, biomass or biofueled generation resources, as well as by energy storage technologies or demand response resources. As substantially higher percentages of intermittent renewable generation are implemented, there are expected to be increased costs for the measures necessary to maintain system reliability.

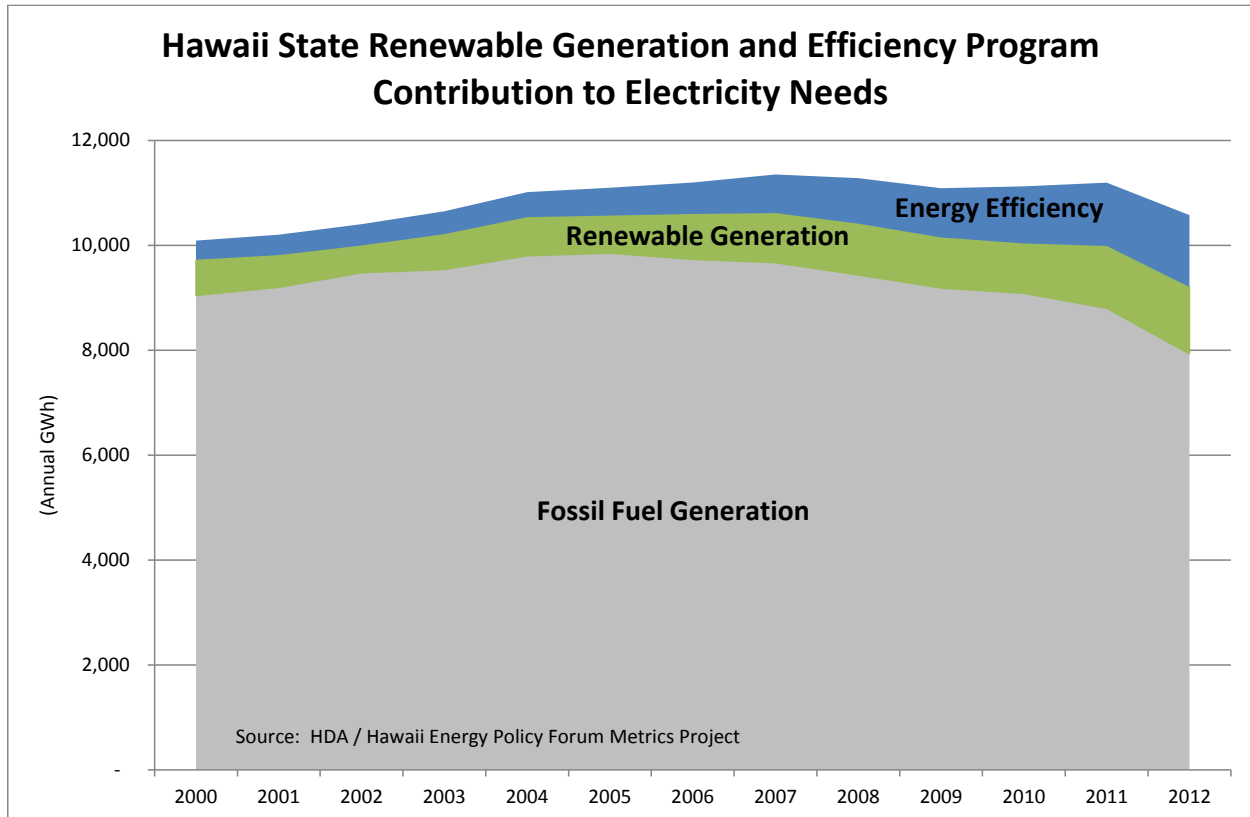
For the purposes of this Report, the implementation of renewable resources is presumed to promote Hawaii's energy policies to the extent that the RPS requirements promote cost-effective renewable energy generation. The effectiveness of the RPS is evaluated as to the extent to which the RPS is an effective driver of the implementation of renewable

increased energy costs by \$14.1 million above fossil fuel energy costs, more than offsetting the savings from utilization of purchased renewable energy.

¹⁷Variable or intermittent resources, such as wind and solar generation are available only when the source of energy (e.g., wind or sun) is available and may vary in output during the course of each day.

energy resources on Hawaii’s utility systems. In this respect, the RPS are clearly effective.

Chart 3. Contributions of Renewable Energy and Energy Efficiency to Electricity Generation



The RPS requirements serve as an effective driver of renewable generation implementation. The establishment of the RPS by the Legislature serves as a clear statement of standing policy and priority, and the objective of achieving the RPS requirements has been embraced as a mandate by Hawaii’s electric utilities and independent renewable power producers. The Commission concurs with and implements the clear policy enunciated by the Legislature in the RPS statute in establishing and implementing the Commission’s own policies and in reviewing the utility applications and plans that are subject to Commission review and approval. There is no doubt that Hawaii is further along the path to increased utilization of renewable and indigenous resources, reduction in use of imported petroleum fuels and diversifying its fuel portfolio due to the RPS in conjunction with Hawaii’s other energy policies and programs.

Achievability of the RPS

Achievability addresses whether the RPS requirements can be met by each of the utilities, or, as allowed under statute, by utilities on an aggregated basis. Two principal considerations are:

- Whether sufficient renewable energy resources currently exist or can be feasibly developed on each utility system to achieve the RPS requirements. This assessment includes consideration of whether sufficient renewable resources are reasonable in terms of cost and can be successfully sited, which considers factors such as land availability, site control and the ability to successfully permit projects.
- Whether the required amounts of renewable energy resources can be connected to and accommodated by the utility electric systems. On the system generation level, this assessment includes consideration of the extent to which each utility system can accommodate assumed levels of variable renewable generation resources. On the distribution circuit level, this assessment includes whether assumed levels of distributed generation resources can be accommodated on distribution circuits economically, safely and reliably.

The achievability of the 2015 RPS is clearly determinable based on existing information. For both of the considerations above, there are some uncertainties regarding the achievability of the 2020 RPS and considerable uncertainty for the 2030 RPS regarding both of the considerations above.

The achievability of the 2020 RPS is substantially informed by a number of currently-proposed, specifically-defined utility-scale projects at identified sites. Uncertainty remains regarding whether many of the proposed projects will ultimately be implemented, each being subject to several contingencies, including obtaining necessary permits and approvals, including approvals by the Commission and successful financing and project implementation.

Achievability of the 2030 RPS is not possible to determine with certainty at this time for several reasons including:

- The long timeframe presents uncertainties regarding the amount of growth in electricity demand. Since the RPS requirements are expressed in terms of percentages of electricity sales, the amount of required renewable resources depends on uncertain future economic trends.
- Since the RPS percentage requirements are higher, the ability of the utility systems to accommodate increasing proportions of variable utility-scale generation and distributed generation becomes an increasingly important consideration.
- Achievement of the RPS depends, in part, upon development of renewable resources that are not currently proposed, known or sited.
- Community acceptance regarding the siting of renewable energy resources and the potential impacts of unforeseen technological advancements are also key uncertainties in determining 2030 RPS achievability.

In order to address the uncertainty in the longer-term timeframes, a number of scenarios are examined to consider a range of future possibilities. Several focused studies are underway to inform the Commission and utilities regarding the ability of the utility systems to accommodate challenging proportions of variable renewable generation resources and distributed renewable resources. An effort is made in this Report to make reasonable considerations regarding incorporation of renewable generation on each utility system. This Report does not, however, attempt to definitively resolve these uncertainties. Several scenarios are provided and known uncertainties are identified for each scenario. Several significant challenges in achieving the 2020 and 2030 RPS requirements are discussed in a later section of this Report in Section VIII discussing challenges in achieving the RPS.

Although not explicitly identified, technological factors are considered subjectively in assessing the achievability of the RPS. It is possible that some renewable generation or energy storage technologies may be developed or become commercially available or substantially less expensive in the next decades, which would make the RPS more achievable. The possibility of technological advances is considered generally, but is not relied upon or quantified in determining the achievability of the RPS in this Report.

Similarly, economic factors are considered but are not quantified in determining the achievability of the RPS requirements. For example, large amounts of biofuels could be imported to replace fossil fuels in existing utility generation units to achieve and even far exceed the RPS requirements. At current and expected future prices, however, this would not be an affordable option and would continue Hawaii's predominant reliance on imported fuels.¹⁸

Methodology: Effectiveness and Achievability

This section outlines the methodology and considerations involved in the Commission's evaluation of the RPS, both in terms of effectiveness and achievability. First, examination of the achievability of the RPS includes consideration of several factors:

- Existing and possible future renewable energy generation resources are identified and the expected or possible amount of energy generation is quantified. Categories of renewable generation considered include existing generation resources, projects approved by the Commission, (whether under construction or not), proposed projects and potential unidentified future projects.
- Projections of future utility sales are identified in order to determine the amount of renewable generation necessary to meet future RPS targets. As noted, RPS generation requirements are stated as percentages of utility electricity sales.
- Uncertainties regarding future estimates are considered. Several scenarios are examined to account for uncertain assumptions regarding different levels of implementation of planned/potential renewable energy generation, different assumed levels of future utility system sales and alternate assumptions regarding inter-island transmission connectivity.¹⁹

¹⁸Existing biofuel use is included and currently proposed biofuel projects are considered in the quantifications of expected amounts of future renewable energy production, but extensive use of biofuels is not considered as a primary means of achieving the RPS requirements in this Report.

¹⁹Inter-island transmission connectivity is considered for purposes of evaluating the 2030 RPS requirement as it applies to the HECO Companies.

In performing the analysis necessary for this Report, the Commission relied on several sources of information including:

- Annual Utility RPS Status Reports – Each of Hawaii’s electric utilities provides annual reports identifying the amount of energy generated by renewable sources and the achievement of the RPS requirements.²⁰ These reports identify renewable generation resources that are operating as of the dates of the reporting periods. The Commission relies on these reports to quantify historical and existing renewable energy generation. The most recent reports by each utility, provided in Appendix C of this Report, indicate RPS achievement information for the calendar year 2012.
- New Renewable Generation Projects – This includes new renewable generation projects that provide electrical power to the utility, either by power purchase contract or by utility ownership, and which require review and approval by the Commission. The Commission relies in this Report on approved applications to quantify expected renewable energy generation from projects that are under construction or substantially in progress. In addition, applications for specific renewable projects or competitively-bid proposals that are currently under review provide information regarding the possible scope of new renewable resources in the near- to-mid-term.²¹
- Mid- and Long-Range Utility Planning Estimates – Hawaii’s electric utilities also provide the Commission with mid-term and long-range planning information and projections of expected and possible capital expenditures in filed reports and periodic briefings. Planning information includes identification of possible specific future renewable generation projects,

²⁰For copies of the utilities’ annual RPS reports submitted to the Commission, see Commission Docket No. 2007-0008 or the Commission’s website at <http://puc.hawaii.gov/reports/energy-reports/renewable-portfolio-standards-rps-annual-reports/>.

²¹Information from applications and proceedings that are currently under review by the Commission is used to inform estimates or ranges of possible generation potential, but no specific assumptions regarding the outcomes of specific matters currently under review are presumed in the quantifications used in this Report.

possible requests for proposals and general estimates of possible resource potential.²²

- HECO Companies' Integrated Resource Planning Report – Anticipating the need for reliable information regarding several pertinent matters, the Commission explicitly ordered the HECO Companies to provide meaningful analysis and responses to several principal issues in the HECO Companies' 2013 IRP Report.²³ These issues included analysis of the cost impacts that would result from fully achieving, partially achieving and exceeding the RPS requirements; the merits and costs of various strategies to meet the RPS requirements, including assessment of inter-island and inter-utility transmission; and the feasibility, merits and cost of various strategies to incorporate large amounts of variable and distributed generation resources on the utility systems. The HECO Companies' IRP Report was filed on June 28, 2013 and is currently under review by the Commission. The "Independent Entity" ("IE") retained by the Commission to oversee and review the HECO Companies' implementation of the IRP process was not able to certify the merits of the IRP Report due to several noted insufficiencies, including substantial flaws in the analyses of the principal issues listed above.²⁴ In this RPS Report, the Commission relies on some of the sales demand forecast assumptions used in the Companies' IRP Report. Given the concerns raised in the IE's Certification Report, and the fact that the Commission is still in the process of reviewing the IRP, the Commission cannot rely on the analyses in the IRP Report for purposes of this Report (although this Report does reference data included in the IRP). Thus, the Commission has initiated several independent investigations and

²²As used in this Report, renewable energy generation projects include all resources that count towards achievement of the RPS, including contracts or provisions for using renewable fuels in existing generation resources.

²³See In re Integrated Resource Planning, Docket No. 2012-0036, Order No. 30534 Identifying Issues and Questions for the Hawaiian Electric Companies' Integrated Resource Planning Process, filed July 19, 2012.

²⁴See In re Integrated Resource Planning, Docket No. 2012-0036, Final Certification of the HECO/MECO/HELCO Integrated Resource Planning Process: Certification of Key Phases III, IV, and V, filed July 29, 2013.

studies to provide necessary information regarding the feasibility and costs associated with incorporating renewable generation resources on the HECO Companies' systems, with and without inter-island or inter-utility transmission systems.

Information regarding existing generation and projects that are under construction is substantially more certain than information regarding possible future projects or general estimates of resource potential. The methods used to assess the effectiveness and achievability of the RPS address the uncertainties in future projections for each of the RPS requirements as appropriate. For the 2015 RPS requirement, sufficient verified information is available for projects that are existing and/or approved and under construction on a project-by-project basis without need for methodical consideration of uncertainties. For the 2020 RPS requirement, uncertainty regarding the magnitude of expected renewable energy generation is accounted for by considering possible ranges of renewable generation implementation and levels of utility electricity sales. For the 2030 RPS requirement, projections are substantially more uncertain compared to previous years' benchmarks. Several scenarios are analyzed in order to consider major uncertainties and several substantial challenges are identified.

V. Achievability of the 2015 RPS

Both KIUC and the HECO Companies are very likely to achieve the 2015 RPS requirement of 15% of electricity sales from renewable energy generation.

The HECO Companies' existing installed renewable resources in 2013 already exceed the 2015 RPS when projected on an annualized basis that considers the full annual energy production expected from installed renewable generation resources. KIUC's annualized renewable energy generation from existing resources is very close to the 2015 RPS requirement. Two substantial renewable generation resources on the KIUC system are under construction and are expected to be online prior to 2015, pushing KIUC's renewable energy generation well in excess of the 2015 RPS requirement.

Charts 4 and 5 below show estimated RPS achievement figures for the combined HECO Companies and KIUC, respectively. Both Charts 4 and 5 present 2013 figures encompassing 2012 RPS achievement levels and including annualized expected energy generation for existing resources in 2012 and 2013. In addition, the Charts show estimated 2015 RPS achievement for the different utility companies based on estimates of added distributed generation resources through 2015, as well as anticipated additional renewable energy generation resources that are approved and under construction and should contribute to 2015 RPS achievement.²⁵

²⁵For the combined HECO Companies, added renewable energy generation resources for 2015 RPS achievement is estimated to total 152 GWh of new renewable energy generation and 78 GWh of new distributed generation resources. For KIUC, new renewable energy generation resources for 2015 RPS achievement is projected to total an estimated 73 GWh of new renewable energy generation and 4 GWh of new distributed generation resources.

Chart 4. HECO Companies 2015 RPS Achievement (Estimated)

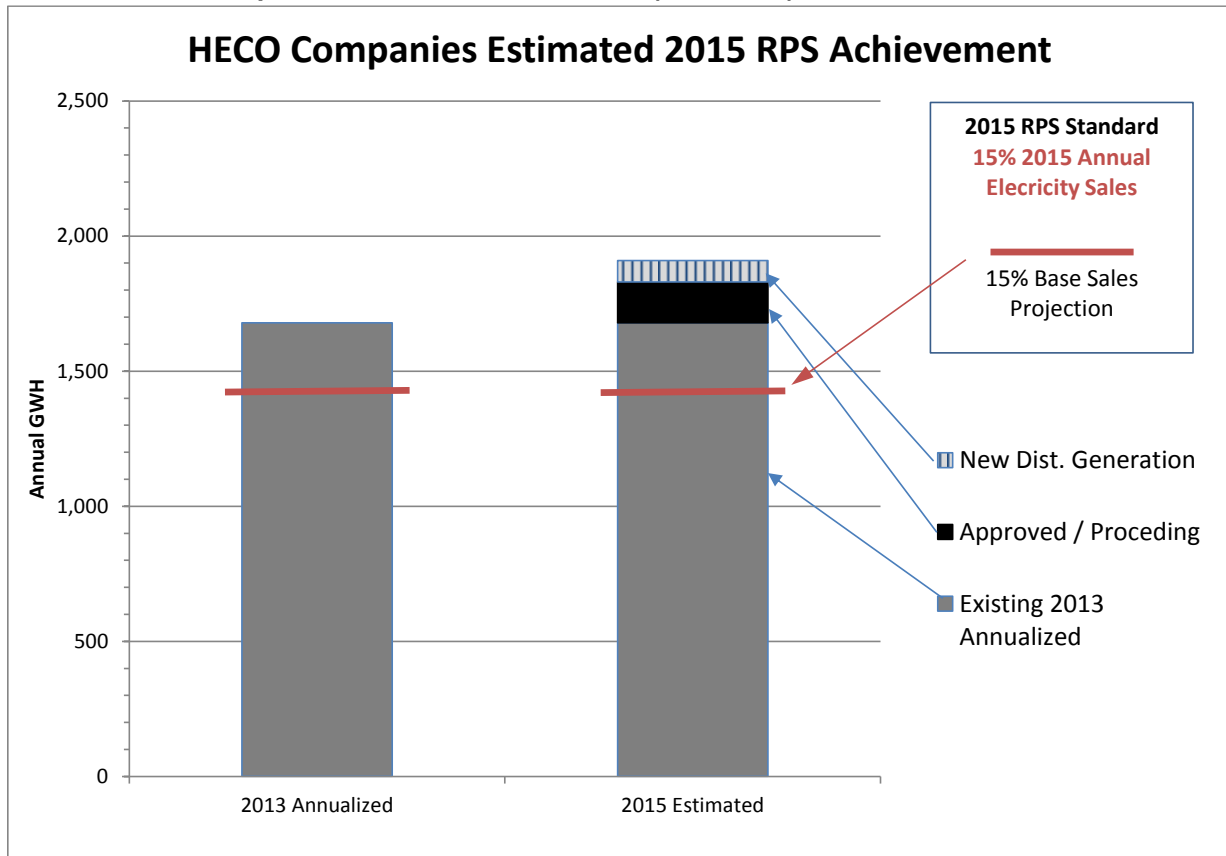
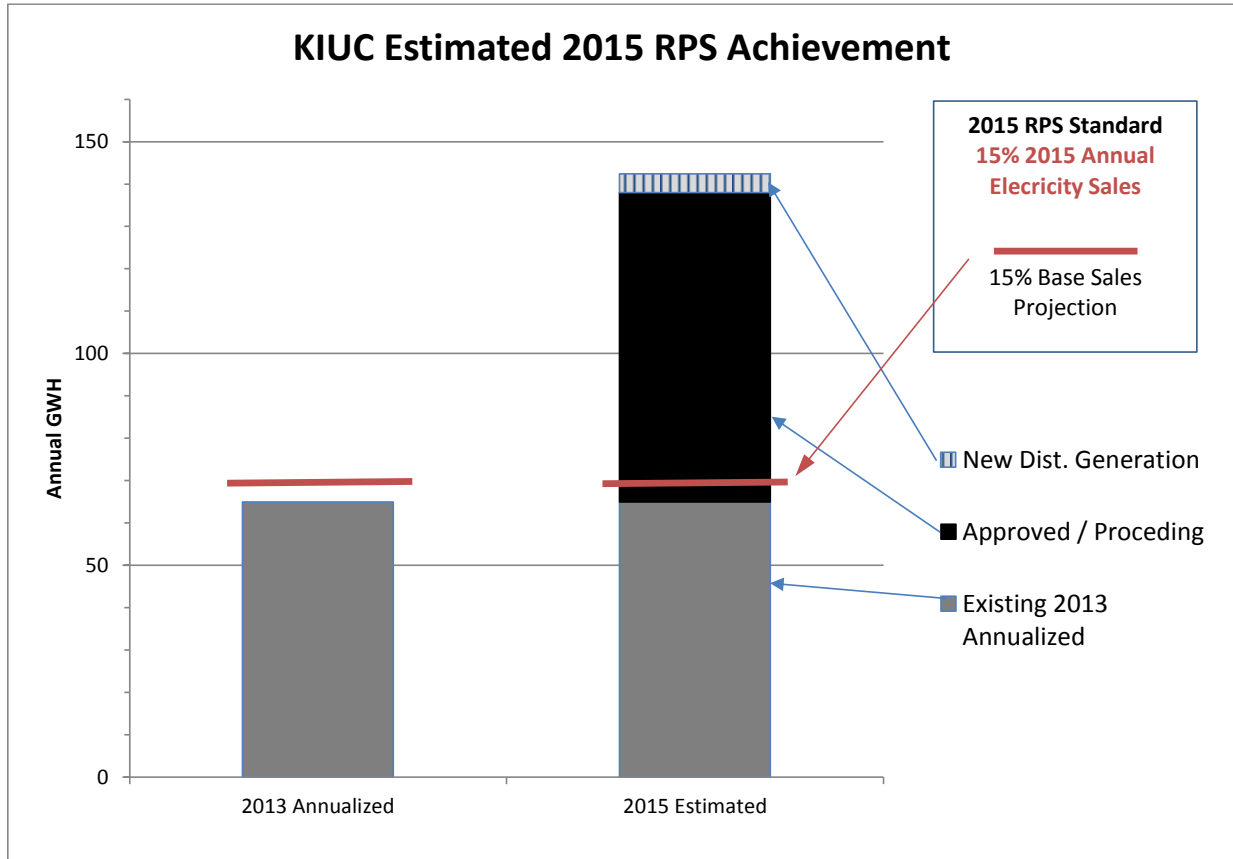


Chart 5. KIUC 2015 RPS Achievement (Estimated)



VI. Achievability of the 2020 RPS

Both the HECO Companies and KIUC are likely to achieve the 2020 RPS requirement of 25% net renewable energy generation as a fraction of electricity sales, provided that reasonably expected amounts of currently-proposed utility-scale renewable energy projects and distributed renewable generation are successfully developed and integrated on the utility systems.

The HECO Companies

In addition to existing renewable generation resources and projects that are under construction, there are several proposed projects for the HECO Companies' systems that are currently in various stages of consideration, negotiation and/or regulatory approvals. In addition, renewable generation RFPs are currently pending and under review.

It is not yet known which or how many of the proposed projects or projects responding to the RFP's will ultimately be implemented. Several specific projects and estimates of new distributed generation are identified and quantified in Table 2 and Chart 6 below. Three scenarios are analyzed to gain a better understanding of the potential for achievement of the 2020 RPS requirement. These scenarios are:

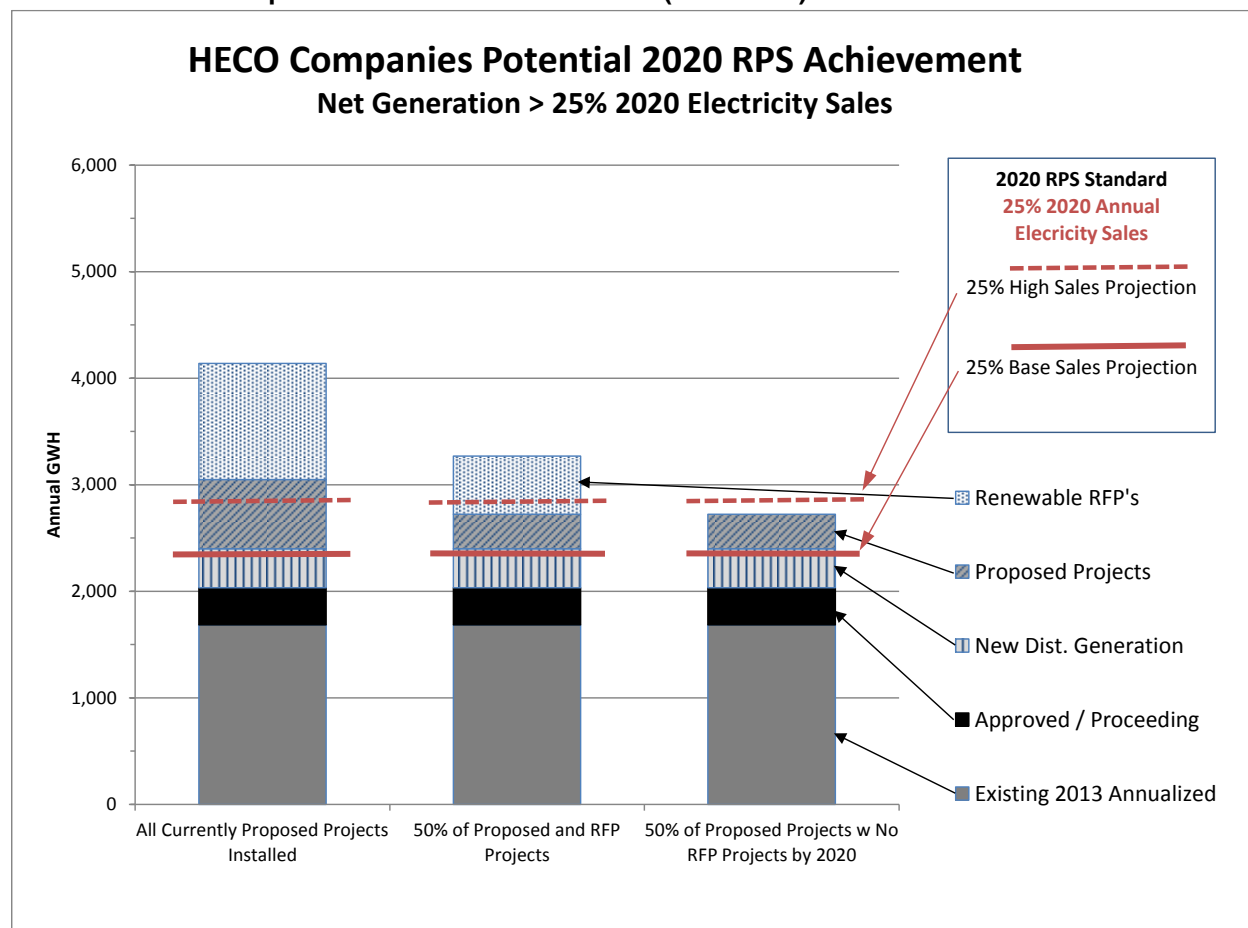
1. All Currently Proposed Projects Installed (2020) – The first scenario considers the full implementation of all the listed currently-proposed projects, full subscription and implementation of resources sought by the listed RFPs currently-pending and the base case projection of additional distributed energy resources assumed in the HECO Companies' 2013 IRP Report.²⁶ This scenario is presented for reference to indicate the magnitude of the listed currently-proposed projects. Although it is hypothetically possible that all of these projects could be implemented by 2020, this scenario is not relied upon as a basis for determining that the 2020 RPS requirement is likely achievable.
2. 50% Implementation of Proposed and RFP Projects (2020) – The second scenario considers the implementation of 50% of the proposed generation projects and RFP projects in the All Currently Proposed Projects Installed (2020) scenario. Implementation of 50% of the currently proposed projects provides a more conservative and reasonable estimate of the proportion of

²⁶In particular, the base case projection for added distributed energy resources in the "Stuck in the Middle" IRP scenario is used in this part of the Report.

the listed projects likely to ultimately be completed when compared to the All Currently Proposed Projects Installed (2020) scenario.

3. 50% Implementation of Proposed Projects With No RFP Projects Completed by 2020 (2020) – The third scenario represents the reasonably expected possibility that generation projects procured through the currently pending listed RFP’s may not be completed by the end of 2019.²⁷

Chart 6. HECO Companies 2020 RPS Achievement (Estimated)



The HECO Companies’ 2020 scenarios are assessed with respect to the 25% RPS requirement based on two projections of 2020 electricity sales for the combined HECO

²⁷In order to contribute to achievement of the 2020 RPS requirement, generation resources would need to be installed and operational early enough to provide renewable energy generation during the year 2020.

Companies' utility systems. The base sales and high sales projections are based on the medium case and high case underlying economic sales forecasts used in developing scenarios in the 2013 IRP Report, adjusted for the impacts of energy efficiency programs²⁸ and the sales impacts of the customer-sited distributed energy resources assumed in the scenarios.

As shown in the second scenario, 50% Implementation of Proposed and RFP Projects (2020), with successful implementation of the assumed amounts of renewable generation, the HECO Companies would achieve the 2020 RPS requirement based on either the base or high electricity sales projections assuming that 50% of the listed proposed projects and 50% of the currently pending RFPs are fulfilled. The total amount of additional renewable generation beyond existing, under construction and expected distributed generation required to meet the 2020 RPS for the base case RPS target would be 48 GWh annually. As an example to provide scale, this is roughly the amount of generation that would be produced by 14 megawatts ("MW") of medium capacity factor generation (e.g., wind generation) or 27 MW of low capacity factor generation (e.g., solar generation).

As shown in the third scenario, 50% Implementation of Proposed Projects With No RFP Projects Completed by 2020 (2020), with successful implementation of half of the listed proposed projects, but without completion of projects procured through the RFP's by 2020, the HECO Companies would be able to achieve the 2020 RPS requirement for the base case scenario. This amount of renewable generation, though not without presenting some challenges, appears to be reasonably achievable.²⁹

Achieving the 2020 RPS target for the high sales case would be more challenging. The total amount of additional renewable generation beyond existing, under construction and expected distributed generation required to meet the 2020 RPS requirement for the high case RPS target would be 460 GWh annually. As an example to provide scale, this is roughly the amount of generation that would be produced by 58 MW of high capacity factor generation (e.g., geothermal or biomass generation), 131 MW of medium capacity factor generation (e.g., wind generation) or 263 MW of low capacity factor generation (e.g., solar generation). Implementing this amount of renewable generation would be more challenging and less certain than meeting the RPS requirement for the base sales

²⁸The amount of energy efficiency impacts is calculated to be consistent with the HECO Companies' share of achievement of the State EEPS targets.

²⁹See the discussion of challenges in Section VIII of this Report.

case and could present more substantial system integration challenges, but it would be possibly more achievable.

The HECO Companies should be able to achieve the 2020 RPS requirement for the base sales case and could possibly achieve the requirement for the high sales case, provided that reasonably expected amounts of currently-proposed utility-scale renewable energy projects and distributed renewable generation are successfully developed and integrated on the utility systems.

Table 2. HECO Companies Renewable Energy Generation through 2020 (Existing and Potential)

<u>HECO Companies Combined</u> <u>Renewable Energy Generation</u> <u>(2020 Annual GWH)</u>	All Currently Proposed and RFP Projects Installed		50% Implementation of Proposed and RFP Projects		50% Implementation of Proposed Projects w No RFP Projects by 2020	
	GWH	% Base Case RPS	GWH	% Base Case RPS	GWH	% Base Case RPS
Existing 2013 (Mid-Year Annualized)	1,685	17.9%	1,685	17.9%	1,685	17.9%
Projects Approved and Proceeding	349	3.7%	349	3.7%	349	3.7%
Honolulu International Airport (HECO)						
HBE Biomass (HECO)						
Hu Honua Biomass (HELCO)						
Honua Power (HECO)						
New Distributed Generation (Est. 210 MW Solar PV)	366	3.9%	366	3.9%	366	3.9%
Proposed Projects	650	6.9%	325	3.5%	325	3.5%
"Waivered" Projects Applications (HECO)						
Negotiated PV Projects (HECO)						
HECO Kahe PV Application (HECO)						
Renewable RFP's	1,089	11.6%	545	5.8%	0	0.0%
Oahu 200 MW RE RFP (HECO)						
Geothermal RFP (HELCO)						
Total Renewable Energy Generation	4,139	44.0%	3,269	34.7%	2,725	29.0%
2020 Projected Combined Electricity Sales						
Base Sales Projection	9,410		9,410		9,410	
High Sales Projection	11,437		11,437		11,604	
2020 RPS Requirement						
Base Sales Projection	2,352		2,352		2,352	
High Sales Projection	2,859		2,859		2,901	
Renewable Generation as Percentage of Sales						
Base Sales Projection	44.0%		34.7%		29.0%	
High Sales Projection	36.2%		28.6%		23.5%	

KIUC

KIUC is expected to meet and substantially exceed the 2020 RPS requirement. In addition to existing renewable generation resources, there is a substantial amount of renewable generation that is under construction that will serve KIUC's system. In addition, there are several proposed projects that are currently in various stages of consideration, negotiation and/or regulatory approvals. Several specific projects and estimates of new distributed generation are identified and quantified in Chart 7 and Table 3 below.

To address potential uncertainties in generation availability, three renewable generation scenarios for KIUC are analyzed. These KIUC-specific scenarios are:

1. Existing and Under Construction (2020) – This scenario, which includes all existing generation with all projects currently under construction and anticipated new distributed renewable energy generation, shows that KIUC could meet the 25% 2020 RPS requirement for both the base case and high case projections of electricity sales without implementation of further proposed renewable generation projects.
2. 25% Proposed Projects (2020) – Renewable energy generation equal to 25% of proposed projects is added in this scenario to the Existing and Under Construction (2020) scenario resource total.
3. 50% Proposed Projects (2020) – This scenario projects the addition of renewable energy generation equal to 50% of proposed projects to the Existing and Under Construction (2020) scenario generation total.

Under each scenario, the RPS targets are achieved for the base case and high case projections of utility system electricity sales.³⁰

As noted above, KIUC is expected to meet and exceed achievement of the 2020 RPS requirements with existing generation and projects that are approved and currently under construction.

³⁰Projections of electricity sales for the 2015, 2020 and 2030 RPS standards are based on KIUC's response to CA-IR-14 in Docket No. 2012-0383. A high case was generated for use in this Report, as needed, by increasing the base case projections by 10%.

Chart 7. KIUC 2020 RPS Achievement (Estimated)

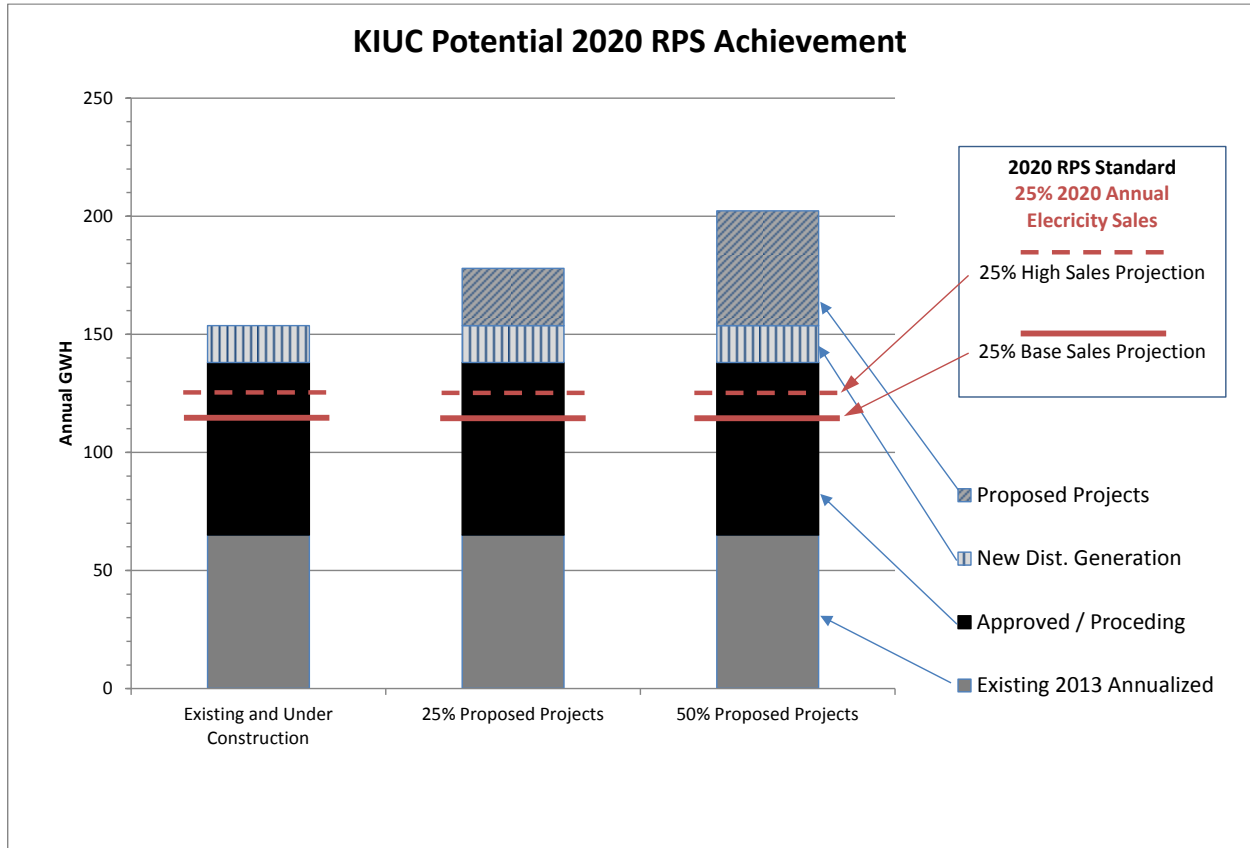


Table 3. KIUC Renewable Energy Generation through 2020 (Existing and Potential)

<u>2020 RPS</u> <u>KIUC Renewable Energy Generation</u> <u>(2020 Annual GWH)</u>	Existing and Under Construction		25% Implementation of Proposed Projects		50% Implementation of Proposed Projects	
	GWH	% Base Case RPS	GWH	% Base Case RPS	GWH	% Base Case RPS
Existing 2013 (Annualized)	65	14.3%	65	14.3%	65	14.3%
Projects Under Construction	73	16.0%	73	16.0%	73	16.0%
Green Energy Biomass						
Grove Farm, Koloa Solar						
New Distributed Generation (Est. 9 MW Solar PV)	16	3.4%	16	3.4%	16	3.4%
Planned Projects			24	5.3%	49	10.7%
KIUC-HCDC, Anahola Solar						
Puu Opae, Kekaha Hydro						
Kekaha Ditch Hydro						
Kalepa Hydro						
Hanalei River Hydro						
Total Renewable Energy Generation	154	33.7%	178	39.0%	202	44.4%
2020 Projected KIUC Electricity Sales						
Base Sales Projection	456		456		456	
High Sales Projection (+10%)	501		501		501	
2020 RPS Requirement						
Base Sales Projection	114		114		114	
High Sales Projection (+10%)	125		125		125	
Renewable Generation as Percentage of Sales						
Base Sales Projection	33.7%		39.0%		44.4%	
High Sales Projection	30.6%		35.5%		40.3%	

VII. Achievability of the 2030 RPS

The achievability of the 2030 RPS requirement of 40% is not possible to determine with confidence at this time due to uncertainties regarding the magnitude of future utility sales and several substantial outstanding project development challenges regarding the successful and economical siting, implementing and integrating requisite amounts of renewable energy generation resources on the utility systems. This Report identifies critical challenges to future RPS achievability and it considers the current resource potential for achieving the 2030 RPS requirement by considering several possible future scenarios that estimate future RPS achievement with respect to principal uncertainties and challenges.

HECO Companies

The achievability of the 2030 RPS for the HECO Companies' systems is subject to several substantial uncertainties that include:

- Economic Demand for Electricity – The amount of underlying economic demand for electricity in the year 2030 is substantially uncertain. The wide range between the high and low bounds of forecasted demand results in a wide range of possible RPS requirements. If demand develops according to low projections, the HECO Companies face far less difficult challenges than under base case demand circumstances.³¹ If demand develops according to high projections, for example, achievement of the 2030 RPS requirement will be very challenging in several respects. The achievability of the RPS is, therefore, generally subject to uncertainty regarding future economic conditions and electricity demand.
- On-island Resources versus Inter-island Transmission – Depending on the amount of electrical demand and resulting RPS targets, it is not known whether sufficient renewable resources can be developed on each individual island or whether it would be necessary to provide inter-island electrical transmission to meet the RPS requirements.

³¹If electricity sales decrease substantially, however, there may be resulting challenges in managing generation unit minimum operating levels and avoiding curtailment of renewable resource generation during minimum load conditions.

- Renewable Energy Integration Feasibility and Costs – The feasibility and costs of several aspects of alternate strategies to meet the RPS requirements are currently substantially uncertain, including uncertainty regarding the costs to accommodate large amounts of variable renewable energy on the existing utility systems and unknown costs for inter-island transmission system options.³² Although several strategies to meet the 2030 RPS requirements are presented in this Report, the feasibility of these strategies, including the reasonableness of costs, remains uncertain.

In order to address these uncertainties, several renewable generation scenarios were analyzed. Chart 8 and Table 4 below depict three generation scenarios and several RPS targets associated with a base case, high case and low case projection of 2030 electrical energy sales. All of the scenarios assume that the HECO Companies will combine their RPS achievement amounts for the 2030 RPS requirements on an aggregated basis. The scenarios, as illustrated by the information in Chart 8 and Table 4 show the renewable generation and RPS targets for the combined HECO Companies' systems.

Each of the 2030 RPS scenarios includes the following renewable generation resources:

- Existing installed renewable generation³³
- Projects currently approved and proceeding
- Distributed generation included in the 2020 scenarios based on the base case projection used in the HECO IRP Report³⁴

The three scenarios used to analyze potential 2030 RPS achievement by the HECO Companies are described below and are depicted in Chart 8 and Table 4. Chart 8 shows renewable generation sufficient to meet the RPS requirements according to the base case

³²Results of several studies and processes that are currently underway should help to address some of the identified uncertainties following this Report.

³³Existing installed renewable generation is based on calculation of the expected annualized energy generation of mid-year 2013 installed capacity.

³⁴Distributed generation beyond what is assumed to be installed by the year 2020 in the 2020 scenarios is considered conjunctively with other new required on-island generation in the 2030 scenarios.

sales projection. Table 4 shows renewable generation sufficient to meet both the base sales and high sales RPS requirements. The three scenarios are defined as follows:

1. On-Island RE Generation (2030) – This scenario shows renewable energy generation sufficient to meet the 2030 RPS requirement with all energy generated “on-island” (i.e., no inter-island transmission). On-island generation includes total generation on each island on which the HECO Companies’ system loads are located.
2. Inter-island Generation (2030) – This scenario assumes installation of a 200 MW net capacity inter-island transmission system with 750 GWh annually of associated inter-island renewable energy resources.³⁵
3. Intensive Energy Efficiency (2030) – The third HECO 2030 RPS scenario shows the amount of generation needed assuming intensive implementation of energy efficiency measures, exceeding the current EEPS, to obtain full economic energy efficiency potential. The reduction of utility sales by energy efficiency measures would result in reduction of the RPS requirements based on 40% of electricity sales. Required generation is depicted as on-island renewable generation.

³⁵The amount of off-island generation that could be accommodated or facilitated by a 200 MW inter-island transmission system depends on several factors, including the type and mix of off-island renewable resources and the composition and operation protocols of the utility systems. This matter is currently the focus of several analyses being conducted and/or under review by the Commission. 750 GWh is a provisional estimate roughly consistent with several published estimates.

Chart 8. HECO Companies 2030 RPS Achievement (Estimated)

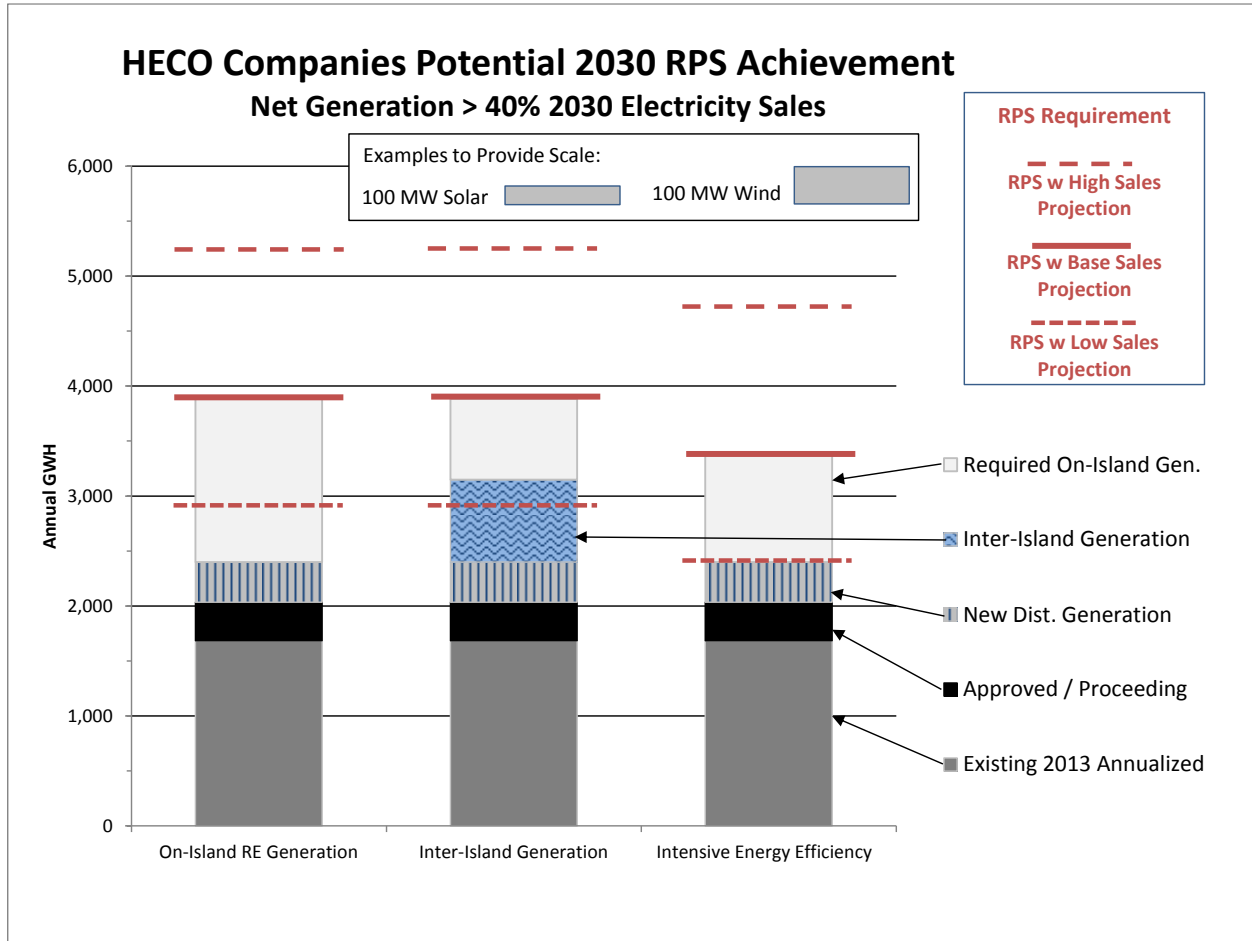


Table 4. HECO Companies Renewable Energy Generation through 2030 (Existing and Potential)

HECO Companies Combined Renewable Energy Generation (2030 Annual GWH)	On-Island RE Generation				Inter-Island Generation				Intensive Energy Efficiency			
	RE to Meet Base Sales		RE to Meet High Sales		RE to Meet Base Sales		RE to Meet High Sales		RE to Meet Base Sales		RE to Meet High Sales	
	GWH	% RPS	GWH	% RPS	GWH	% RPS	GWH	% RPS	GWH	% RPS	GWH	% RPS
Existing 2013 (Mid-Year Annualized)	1,685	17.4%	1,685	12.9%	1,685	17.4%	1,685	12.9%	1,685	19.9%	1,685	14.3%
Projects Approved and Proceeding	349	3.6%	349	2.7%	349	3.6%	349	2.7%	349	4.1%	349	2.9%
Honolulu International Airport (HECO)												
HBE Biomass (HECO)												
Hu Honua Biomass (HELCO)												
Honua Power (HECO)												
New Distributed Generation (Est. 210 MW Solar PV)	366	3.8%	366	2.8%	366	3.8%	366	2.8%	366	4.3%	366	3.1%
Inter-Island Generation via Undersea Transmission					750	7.7%	750	5.7%				
Oahu-Maui Grid-Tie or Gen-Tie (w 200 MW Wind)												
Required On-Island Utility-Scale Generation	1,483	15.3%	2,833	21.7%	733	7.6%	2,083	15.9%	979	11.6%	2,329	19.7%
Future Currently Unspecified Projects												
Total Renewable Energy Generation	3,883	40.0%	5,232	40.0%	3,883	40.0%	5,232	40.0%	3,379	40.0%	4,728	40.0%
Total New On-Island Generation Required (GWH) (Excluding Existing and Approved/Proceeding)	1,849		3,199		1,099		2,449		1,345		2,695	
Approximate Equivalent Capacity Required (MW)	(MW)		(MW)		(MW)		(MW)		(MW)		(MW)	
Low Capacity Factor Resources (PV)	1,055		1,826		627		1,398		768		1,538	
Medium Capacity Factor (Wind)	528		913		314		699		384		769	
High Capacity Factor (Geothermal/Biomass)	235		406		139		311		171		342	
2030 Projected Combined Electricity Sales (GWH)												
Base Sales Projection	9,706		9,706		9,706		9,706		8,447		8,447	
High Sales Projection	13,081		13,081		13,081		13,081		11,821		11,821	
Low Sales Projection	7,192		7,192		7,192		7,192		5,932		5,932	
2030 RPS Requirement (GWH)												
40% Base Sales Projection	3,883		3,883		3,883		3,883		3,379		3,379	
40% High Sales Projection	5,232		5,232		5,232		5,232		4,728		4,728	
40% Low Sales Projection	2,877		2,877		2,877		2,877		2,373		2,373	
Renewable Generation as Percentage of Sales												
Base Sales Projection	40.0%		53.9%		40.0%		53.9%		40.0%		56.0%	
High Sales Projection	29.7%		40.0%		29.7%		40.0%		28.6%		40.0%	
Low Sales Projection	54.0%		72.8%		54.0%		72.8%		57.0%		79.7%	

The 2030 RPS requirement for the base sales projection (assuming attainment of current EEPS targets) in each of the scenarios appears to be significantly challenging, but possibly achievable by the HECO Companies. The amount of additional renewable energy generation required beyond existing generation and projects currently approved and proceeding, is 1,849 GWh annually. To provide an example of scale, this is roughly the amount of generation that would be produced by 235 MW of high capacity factor generation (e.g., geothermal or biomass generation), or 528 MW of medium capacity factor generation (e.g., wind generation) or 1,055 MW of low capacity factor generation (e.g., solar generation). This additional amount of generation could be provided, for example, by the combined sum of 35 MW of geothermal, 200 MW of wind and 500 MW of solar generation.³⁶ Focused studies are currently underway to determine the feasibility

³⁶This breakdown of types of generation and all such examples provided in this Report are provided solely as examples. Renewable energy to meet the RPS could be

of incorporating this amount of new generation into the existing utility systems with appropriate changes to utility system operations and possible necessary adjustments to the utility system's dispatchable generation unit mix.

Significant challenges associated with meeting the 2030 RPS requirements include:³⁷

- Successfully siting sufficient economical renewable generation resources may be difficult, especially if large amounts of generation must be sited on Oahu without inter-island transmission.
- Substantial amounts of variable renewable generation resources must be integrated on each utility system economically and reliably. Curtailment of utility-scale renewable resources is occurring currently on each of the major HECO Companies' island grids. This situation will likely be exacerbated with additions of more variable renewable energy resources, potentially creating project financing challenges. In addition, in order to provide sufficient support for large amounts of variable renewable generation, substantial changes may be necessary to utility system operation protocols, perhaps requiring retirement of some existing generation units and provision of appropriate new system resources to provide necessary ancillary services.
- Incorporation of extensive amounts of distributed generation resources on utility distribution circuits safely and reliably presents challenges and will incur yet-undetermined costs.
- The amounts of different types of renewable generation resources on each utility system must be maintained at appropriate levels. For example, meeting the RPS predominantly using solar generation resources – which have a low capacity factor – would require substantially more installed capacity than other resource types. Capacity-related system constraints, such as minimum daytime loads coincident with solar generation output,

provided by contributions from various types of renewable generation in various proportions, distributed in various ways between the individual island utility systems.

³⁷See the discussion of challenges in Section VIII of this Report.

may limit economically-feasible penetrations of solar generation to effectively meet the RPS.

- The economics of providing affordable electricity services must be considered in determining the most appropriate mix of generation resources. The RPS requirements promote the implementation of renewable generation resources, but may not produce the most acceptable resulting utility system resource mix without proper planning and regulation.

If the amount of electricity sales increases substantially beyond what is assumed in the base case sales projections for each of the scenarios above, the achievability of the RPS becomes more difficult. With the electricity demand predicted in the high case economic forecast, achievement of the RPS would require 3,199 GWh annually beyond existing generation and projects currently approved and proceeding. To provide an example of scale, this is roughly the amount of generation that would be produced by 406 MW of high capacity factor generation (e.g., geothermal or biomass generation), 913 MW of medium capacity factor generation (e.g., wind generation) or 1,826 MW of low capacity factor generation (e.g., solar generation). This amount of generation could be provided, for example, by an additional combined sum of 50 MW of geothermal or biomass generation, 400 MW of wind generation and 800 MW of solar generation. Siting this amount of new renewable generation could be very challenging, even with installation of an undersea cable transmission system, and would present substantial challenges to generation system operations.

The Intensive Energy Efficiency (2030) scenario, depicted in the right-most column of Table 4 and in the right-most scenario shown in Chart 8 above, examines the extent to which extensive energy efficiency implementation, beyond achievement of the State EEPS, could mitigate challenges to meet the 2030 RPS requirement. Implementation of the full potential of cost-effective energy efficiency programs and measures, as based on preliminary results of ongoing study, could reduce the HECO Companies' combined sales by 1,260 GWh annually. This would lower the 2030 RPS requirements by approximately 504 GWh. Resulting requirements are depicted in Table 4.

The high case projections of electricity sales appear to represent a fairly extreme upper bound to possible expected circumstances, especially in light of recent downward trends

in the HECO Companies' electricity sales.³⁸ For purposes of determining the achievability of the RPS requirements, this Report notes the potential extremity of possible future electricity sales, but it places more weight on more moderate and probable levels of possible electricity sales in determining the achievability of the 2030 RPS. If electricity sales do trend upward commensurate with the high case forecast predictions, this will become apparent over a period of years in which the ongoing effectiveness and achievability of the RPS requirements can be reassessed.

If trends in electricity demand follow the low case forecast predictions, the achievability of the 2030 RPS is less challenging.³⁹

The achievability of the 2030 RPS requirement by the HECO Companies depends upon several uncertainties regarding future economic growth, the availability of renewable generation potential and the feasibility and cost of integrating renewable resources on its utility systems. Assuming base case electricity sales growth projections, it appears that the HECO Companies could possibly achieve the 2030 RPS requirement, provided that several substantial challenges are successfully met.

KIUC

KIUC may be able to achieve the 2030 RPS requirement, assuming electricity sales grow according to forecast predictions with a moderate amount of additional renewable generation beyond existing generation, projects approved and under construction and expected amounts of renewable distributed generation. However, KIUC's achievement of the 2030 RPS requirement cannot be determined with certainty at this time, and is subject to many of the same uncertainties and challenges the HECO Companies face in reaching the 40% renewable energy generation requirement. The scenarios used to analyze KIUC's 2030 RPS achievability include:

1. Existing and Under Construction (2030) – This scenario shows all existing generation with all projects currently under construction and anticipated new distributed renewable energy generation through 2030.

³⁸HECO Companies' electricity sales in 2012 were below the low case sales forecast for 2012, even after adjustment for the higher-than-expected amount of distributed renewable generation sales offset.

³⁹In some respects, however, lower electricity sales could present potential technical difficulties in managing minimum generation constraints and in accommodating large capacities of renewable generation resources without curtailment.

2. 50% Proposed Projects or Equivalent (2030) – This second scenario for KIUC 2030 RPS achievement presents renewable energy generation equal to 50% of proposed projects, while maintaining the estimated new distributed renewable energy generation for 2030.
3. 100% Proposed Projects or Equivalent (2030) – This third scenario projects the addition of renewable energy generation equal to 100% of proposed projects to the Existing and Under Construction (2030) scenario generation total, but with no added distributed generation resources beyond Existing and Under Construction (2030) scenario amount.

As indicated in Chart 9 and Table 5 below, KIUC could meet the base sales case 2030 RPS requirement if 50% of currently-proposed projects (49 GWh annually) or an equivalent amount of generation is implemented. As a general example to serve as an indicator of scale, this additional amount of generation is roughly equivalent to the production of 30 MW of solar generation.

In order to meet the RPS requirement resulting from the high projection of electricity sales,⁴⁰ an amount of additional generation would be required equal to 100% of currently proposed projects – 97 GWh annually. As a general example to serve as an indicator of scale, this additional amount of generation is roughly equivalent to the production of 60 MW of solar generation.

The projects currently proposed for KIUC's system are predominately hydroelectric projects that may be subject to permitting challenges. For purposes of determining the achievability of the 2030 RPS, it is not presumed in this Report that the specific identified proposed – or any – hydroelectric projects are implemented successfully. The magnitude of the currently-proposed projects is used as a metric to indicate the amount of necessary additional generation that would be necessary to meet the 2030 RPS requirement. Achieving the 2030 RPS without the implementation of the identified hydroelectric

⁴⁰Projections of electricity sales for the 2015, 2020 and 2030 RPS are based on KIUC response to CA-IR-14 in Docket No. 2012-0383. A high case was generated for 2030 for use in this Report, as needed, by increasing the 2030 base case projections by 20%.

projects would require implementation of an equivalent amount of yet-unidentified renewable generation resources.

Chart 9. KIUC 2030 RPS Achievement (Estimated)

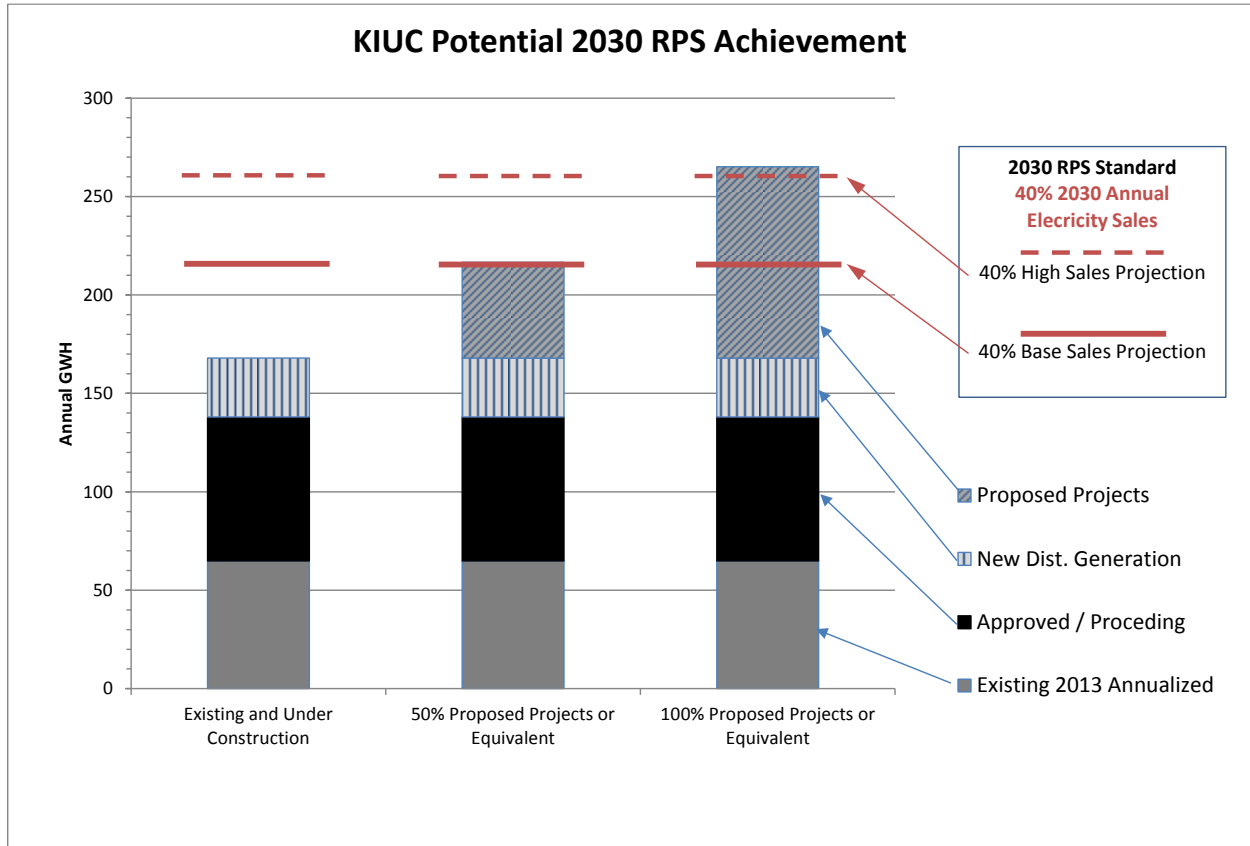


Table 5. KIUC Renewable Energy Generation through 2030 (Existing and Potential)

<u>2030 RPS</u> <u>KIUC Renewable Energy Generation</u> <u>(2030 Annual GWH)</u>	Existing and Under Construction		50% Implementation of Current Proposed Projects or Equivalent New RE Generation		100% Implementation of Current Proposed Projects or Equivalent New RE Generation	
	GWH	% Base Case RPS	GWH	% Base Case RPS	GWH	% Base Case RPS
Existing 2013 (Annualized)	65	12.0%	65	12.0%	65	12.0%
Projects Under Construction	73	13.5%	73	13.5%	73	13.5%
Green Energy Biomass						
Grove Farm, Koloa Solar						
New Distributed Generation (Est. 17 MW Solar PV)	30	5.5%	30	5.5%	30	5.5%
Planned Projects			49	9.0%	97	18.0%
KIUC-HCDC, Anahola Solar						
Puu Opaе, Kekaha Hydro						
Kekaha Ditch Hydro						
Kalepa Hydro						
Hanalei River Hydro						
Total Renewable Energy Generation	168	31.1%	217	40.1%	265	49.0%
2030 Projected KIUC Electricity Sales						
Base Sales Projection	541		541		541	
High Sales Projection (+20%)	649		649		649	
2030 RPS Requirement						
Base Sales Projection	216		216		216	
High Sales Projection	260		260		260	
Renewable Generation as Percentage of Sales						
Base Sales Projection	31.1%		40.1%		49.0%	
High Sales Projection	25.9%		33.4%		40.9%	

VIII. Challenges and Considerations in Achieving Future RPS Targets

This section discusses several uncertainties and challenges in determining the achievability of the 2020 and 2030 RPS requirements. Conclusions regarding the achievability of the RPS requirements are predicated on assumptions that expected amounts of renewable generation resources will ultimately be successfully and economically sited, constructed and integrated on the utility systems. It is important to clearly recognize that implementation of the necessary amounts of renewable generation will depend on successful resolution of several substantial challenges. These challenges discussed in further detail below must be carefully considered when evaluating the achievability of the current RPS targets.

Siting and Permitting of Renewable Generation Resources – The State has abundant natural renewable energy sources. However, the availability of sites for the construction of renewable generation that are not subject to environmental, community or cultural concerns is more limited. The achievability of the 2020 and 2030 RPS requirements depends on public acceptance and successful permitting of sufficient renewable generation projects.

Without inter-island transmission, sufficient renewable generation resources would have to be implemented on each island in proximity to the loads that are served. On the Island of Oahu, successfully siting and permitting sufficient renewable resources to meet the 2030 RPS requirement could be a difficult challenge, especially with any substantial growth in electricity demand.⁴¹

⁴¹The Island of Oahu is much more urbanized and has substantially higher electricity needs than other Hawaiian islands. Oahu uses six times as much electricity as any other individual Hawaiian island, but it has less available renewable resource potential than either the Island of Maui or the Island of Hawaii. The HECO Companies, serving the Island of Oahu and the Neighbor Islands (Maui, Molokai, Lanai and Hawaii Island) are permitted to aggregate renewable energy generation in order to comply with RPS requirements. The relatively limited amount of energy demand on the combined Neighbor Islands, however, limits the amount of renewable energy that can be generated on each island independently to contribute towards achieving the RPS on an aggregated basis for the combined HECO Companies. Also, Oahu does not have the same “world-class” level of renewable energy resources that the Neighbor Islands have and would, therefore, have to develop more extensive renewable energy projects to produce the same level of renewable energy output.

Table 6. New On-Island Generation Requirements for 2030 RPS Scenarios

HECO Companies Combined Renewable Energy Generation 2030 40% RPS Requirement	On-Island RE Generation		Inter-Island Generation		Intensive Energy Efficiency	
	RE to Meet Base Sales	RE to Meet High Sales	RE to Meet Base Sales	RE to Meet High Sales	RE to Meet Base Sales	RE to Meet High Sales
Total New On-Island Generation Required (GWH) (Excluding Existing and Approved/Proceeding)	(GWH) 1,849	(GWH) 3,199	(GWH) 1,099	(GWH) 2,449	(GWH) 1,345	(GWH) 2,695
Approximate Equivalent Capacity Required (MW)	(MW)	(MW)	(MW)	(MW)	(MW)	(MW)
Low Capacity Factor Resources (PV)	1,055	1,826	627	1,398	768	1,538
Medium Capacity Factor (Wind)	528	913	314	699	384	769
High Capacity Factor (Geothermal/Biomass)	235	406	139	311	171	342

Providing inter-island transmission capability could alleviate constraints on the amount of required renewable generation construction on Oahu, but this would pose its own community acceptance and permitting challenges⁴² and would not avoid siting and permitting challenges on the connected Neighbor Islands.

Ultimately, the achievability of the RPS requirements will depend, in essential part, on community acceptance and permissibility of sufficient renewable generation and associated transmission projects. This is not a certainty.

Integration of Variable Renewable Generation on Utility Systems – Many of the most economical existing and proposed renewable generation projects are variable generation resources, producing energy only when the energy source (e.g., wind or sun) is available. Variable resources require accommodation and support provided by “dispatchable” generation resources in order to maintain reliable energy services. This ancillary support is currently provided primarily by existing fossil-fueled generation units. The existing utility systems can accommodate some, but not an unlimited amount of variable renewable generation without substantial mitigation measures or costs.

There are several types of utility system operation constraints that limit penetrations of particular types of generation additions unless mitigating measures are implemented. Variable generating resources, such as solar photovoltaic (“PV”) and wind turbines,

⁴²The Commission is also currently investigating whether an inter-island electric transmission cable system potentially connecting the electrical grids of Oahu and Maui is in the public interest under Docket No. 2013-0169. The Commission’s investigation in this proceeding will include consideration of the cost-effectiveness of an inter-island cable system. In addition, the Commission currently has open an investigative proceeding on the status of the proposed 200 megawatt (“MW”) wind project on Lanai in Docket No. 2013-0168.

require utility system resources to “ramp” in order to balance total instant generation with loads. This ancillary support is currently provided primarily by existing fossil-fueled generation units. Utilizing renewable energy generation that is available during times of low system demand may require operation of existing utility generating units at more-than-minimum-cost levels and sub-optimal configurations of operation. As the penetration of specific types of variable renewable generation increases, the costs of the necessary mitigation measures can be expected to progressively increase. As the penetration of variable generation further increases, it may become necessary to replace existing, inflexible fossil-fueled generation units with new, flexible, fast-start generation technology.

Accommodating the amounts of variable renewable generation necessary to achieve the RPS requirements reliably and economically is currently providing technical engineering challenges and may ultimately present substantial economic challenges. The full costs of accommodating extensive amounts of variable generation resources have yet to be determined.

Integrating Distributed Generation Resources – Hawaii’s electric utilities are currently addressing the technical challenges associated with the unprecedented exponential increase in the amount of distributed photovoltaic generation resources seeking connection to the State’s utility grids. The nature of the appropriate necessary measures and the full associated costs of adequately identifying and addressing these technical challenges have yet to be determined.

Optimal Resource Mix (Economics/Value) – The RPS provides mandates for the installation and use of required amounts of renewable generation by specific dates in order to reduce the State’s reliance on imported petroleum fuels and increase the use of indigenous resources. This must be accomplished while maintaining reliable and economical delivery of electricity services. Achieving the RPS requirements, providing reliable electric service and affordable electric service all require careful planning and optimization of a viable mix of resources on each utility system.

Excessive focus on the most easily sited or earliest permissible resources may not result in an optimal or viable resource mix. For example, distributed photovoltaic generation resources – which are encouraged by favorable financing, tax credits, contract provisions, and nonrestrictive permitting requirements – are being installed on the State’s utility systems at an exponential pace. Because solar generation resources have a much lower capacity factor (i.e., the actual energy output of a system versus the system’s potential energy output) than other resources, meeting the RPS requirements predominantly with

solar generation resources would require substantially more installed solar relative to other resources to attain equal energy production. This can exacerbate capacity-related system constraints.⁴³ While capacity-related system integration challenges may ultimately limit the total amount of variable renewable generation in general, an inadvertent outcome of favoring extensive penetrations of solar resources, as opposed to maintaining a balanced resource portfolio, may preclude the most economical sources of renewable generation through the displacement of higher capacity factor resources that may be less expensive and ultimately allow higher feasible amounts of renewable generation output and greater reduction in imported oil.

A challenge for the State is providing the necessary sound analysis, planning and regulatory guidance to provide an optimal resource mix that best meets State energy objectives, particularly the provision of reliable and economical energy services. The “market,” currently driven by economic factors, tax policies and constrained by generation resource siting and permitting challenges, may not ultimately result in an optimal resource mix.

Appendix B shows the mix of resources used historically to achieve the RPS requirements by Hawaii’s electric utilities. Appendix C provides both the HECO Companies’ 2012 Annual RPS Report and the KIUC 2012 Annual RPS Report filed with the Commission.

Changes in Renewable Energy and Storage Technology and Costs – The potential for changes in renewable energy generation and storage technology over time may result in lower costs of energy for the State from both existing and future renewable energy resources. The real potential for these kinds of changes should be considered when evaluating the RPS targets.

⁴³One example of a capacity-related system constraint is the need for extensive system generation ramping where firm (i.e., non-variable and primarily fossil-fueled) electricity generation is used to provide quick-response support of power supply levels in response to fluctuating variable power generation levels on the system, such as fluctuations from solar PV systems where energy output is directly affected by the sun and the clouds. Another potential system constraint could include bimodal daily unit cycling where extensive installed solar generation capacity may reduce daytime operating levels of supporting system generation to levels comparable to or below nighttime levels, requiring some utility generation units (that are not originally designed to provide cycling service) to cycle two times per day. This kind of extensive ramping activity and associated operational adjustments can significantly affect system operating costs.

IX. Summary, Findings and Recommendations

The existing RPS targets remain appropriate and effective at promoting the implementation and operation of renewable generation resources and are sufficiently achievable based on best currently available information.

- Both KIUC and the HECO Companies are likely to achieve the 2015 RPS requirement of 15% when renewable energy generation resources that are currently-installed or under construction are accounted for.
- It appears likely that the 2020 RPS requirement of 25% is achievable for both the HECO Companies and KIUC, provided that reasonably expected amounts of currently-proposed utility-scale renewable energy projects and distributed renewable generation are successfully developed and integrated on the utility systems.
- The 2030 RPS requirement of 40% may possibly be achievable, but this cannot be determined with confidence at this time due to uncertainties regarding the magnitude of future utility sales and several substantial outstanding challenges regarding siting, as well as the economic and technical challenges in incorporating requisite renewable energy generation resources.

The Commission is currently taking steps to investigate several uncertainties and will monitor the progress of each utility's efforts and achievement of the RPS. As provided by the RPS statutes, the Commission will consider, on an ongoing basis, whether the RPS remain effective and achievable and whether the RPS requirements need to be amended, reporting findings to the Legislature every five years.

Although the 2015 and 2020 RPS appear to be achievable, the RPS requirements are high enough to remain effective in promoting the pace of renewable energy generation implementation. The 2030 RPS target is sufficiently aggressive to effectively focus efforts to address several challenges to the extensive incorporation of renewable resources on the Hawaii utility systems.

Several factors should be considered carefully prior to revising⁴⁴ the RPS requirements:

- The current RPS requirements, in conjunction with other State energy policies and programs, are effectively promoting increased use of renewable generation on the State's utility systems at a challenging pace.
- It is not certain that the existing 2030 RPS requirement is achievable, subject to several uncertainties regarding future electricity demand and availability of renewable resources that can be incorporated on the State's utility systems cost-effectively.
- The feasibility and costs of incorporating large and unprecedented amounts of variable renewable generation on the State's utility systems remain uncertain. It is expected that more will be known as the results of current studies become available in the months following this Report is provided to the Legislature.
- It should be recognized that implementing renewable resource generation projects requires substantial lead times for project design, financing, siting, regulatory approvals and construction.
- It appears that both KIUC and the HECO Companies will be able to meet the 2020 RPS requirement with some technical challenges. Increasing the 2020 RPS requirement, however, may not encourage the most optimal mix of generation resources. The most challenging RPS requirement appears to be the 40% 2030 RPS requirement. Considerable planning and analysis is underway to determine the most effective ways to meet this long-range target. Achievement of the 2030 RPS requirement may require substantial investments in large projects, such as grid modifications, an inter-island transmission system and associated optimal Neighbor Island generation resources. These resources would not be available until after 2020. Therefore, increasing the 2020 RPS requirement may encourage

⁴⁴Haw. Rev. Stat. § 269-95(4). The Commission is required to evaluate the RPS requirements "every five years, beginning in 2013, and may revise the [RPS] based on the best information available at the time to determine if [RPS] remain effective and achievable." (emphasis added)

installation of sub-optimal generation resources in advance of a decision on inter-island transmission availability.

The Commission recommends careful deliberations and a cautious approach before adopting any revisions to the RPS requirements at this time. The Commission is monitoring and proceeding with several investigations and studies to address significant challenges and uncertainties, and will continue to examine the effectiveness and achievability of the RPS requirements on an ongoing basis.

Appendix A

Historical RPS Achievement
Individual Utilities

(As of Calendar Year 2012)

Historical RPS achievement by each individual electric utility, according to the Pre-2015 Protocol (including energy efficiency and off-set technology impacts), is shown below:

Table A-1: Historical RPS Achievement; 2010 Standard (Pre-2015 Protocol) [All Utilities]

	2007	2008	2009	2010	2011	2012
Kauai Island Utility Cooperative (KIUC)	10.6%	12.9%	13.9%	13.1%	15.4%	18.1%
HECO Companies (Aggregated)	16.1%	18%	19%	20.7%	24.5%	28.7%
Hawaiian Electric Company, Inc. (HECO)	11%	13.8%	15.1%	16.6%	19.8%	23.2%
Hawaii Electric Light Company, Inc. (HELCO)	39.8%	40.7%	39.5%	41.9%	49.9%	57.7%
Maui Electric Company, Limited (MECO)	24.7%	22.5%	23.7%	26.1%	29.1%	34.8%

Sources: HECO Companies Annual RPS Reports (2007 - 2012); KIUC 2012 Annual RPS Report; KIUC Annual Net Energy Metering Reports (2002 - 2012)

Chart A-1: Historical RPS Achievement; 2010 Requirement (Pre-2015 Protocol) [HECO Companies Disaggregated]

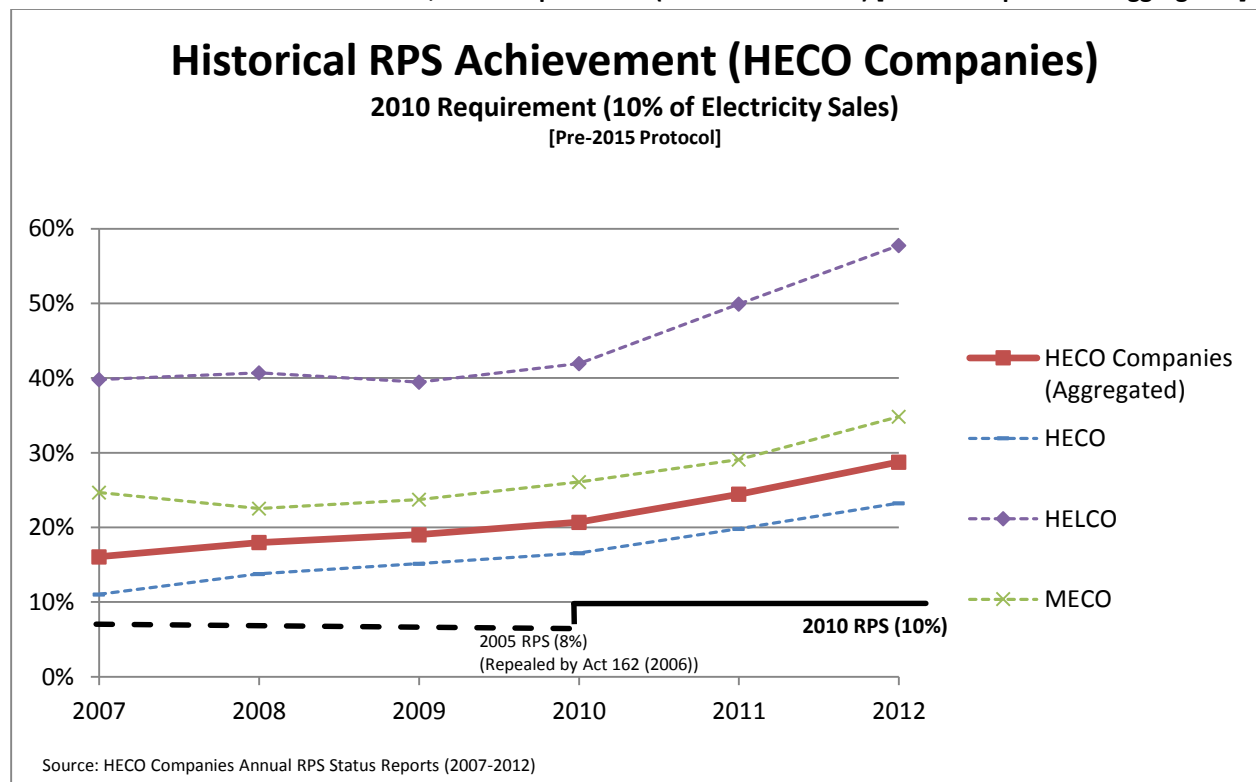
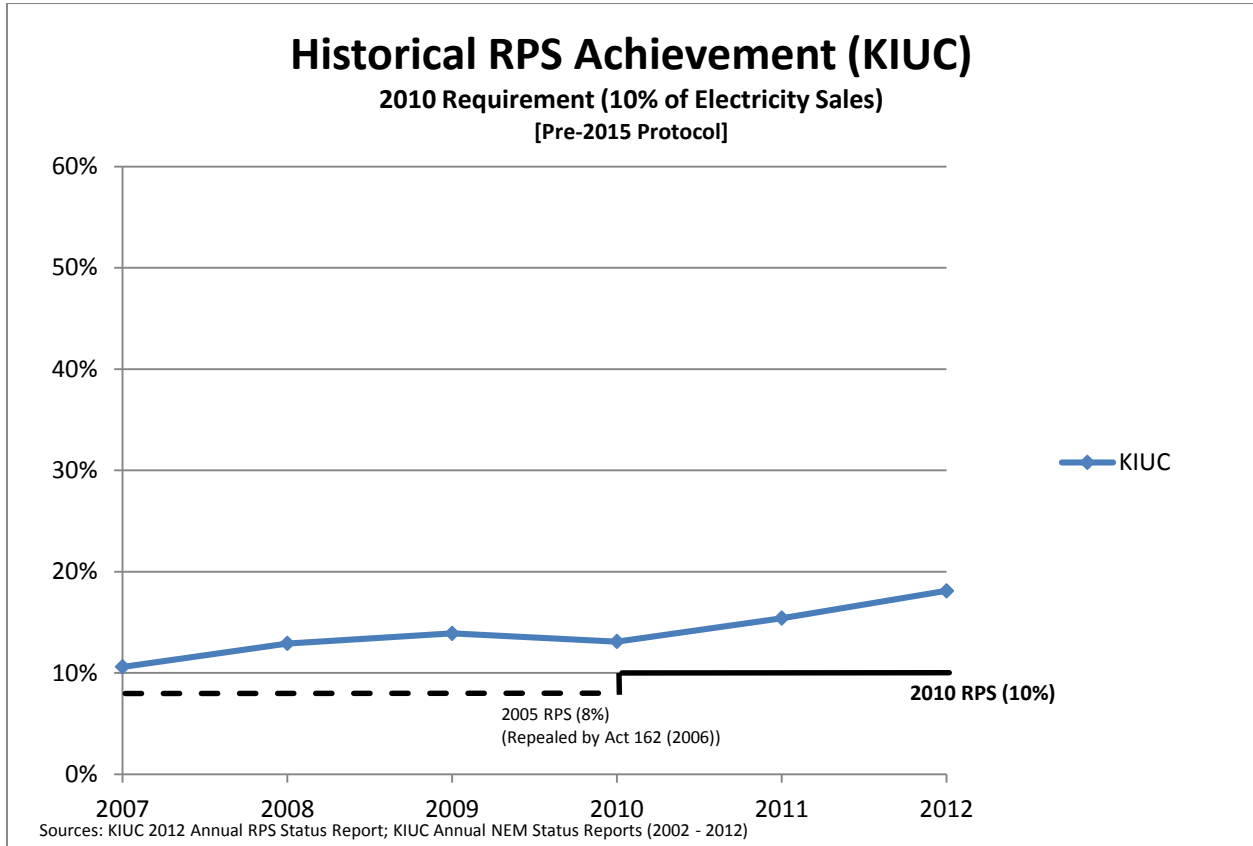


Chart A-2: Historical RPS Achievement; 2010 Requirement (Pre-2015 Protocol) [KIUC]



Appendix B

Historical RPS Achievement
By Resource

(As of Calendar Year 2012)

Historical RPS achievement by each of the individual electric utilities in Hawaii according to the 2015 Protocol (i.e., excluding energy efficiency contributions) is shown below according to the mix of resources each utility uses to achieve RPS requirements in each year.

While this Appendix illustrates the relative mixes of renewable generation resources used to meet RPS requirements over the last several years, these charts do not indicate the installed capacities of each type of resource. Some resources, such as solar PV systems, produce less energy for each MW of installed capacity (i.e., lower capacity factor) than other renewable energy resources like wind, geothermal or biomass generation. The charts show amounts of energy produced by each resource, not the amount of installed capacity.

Chart B-1: KIUC Historical RPS Achievement [Kauai]; By Resource (MWh)

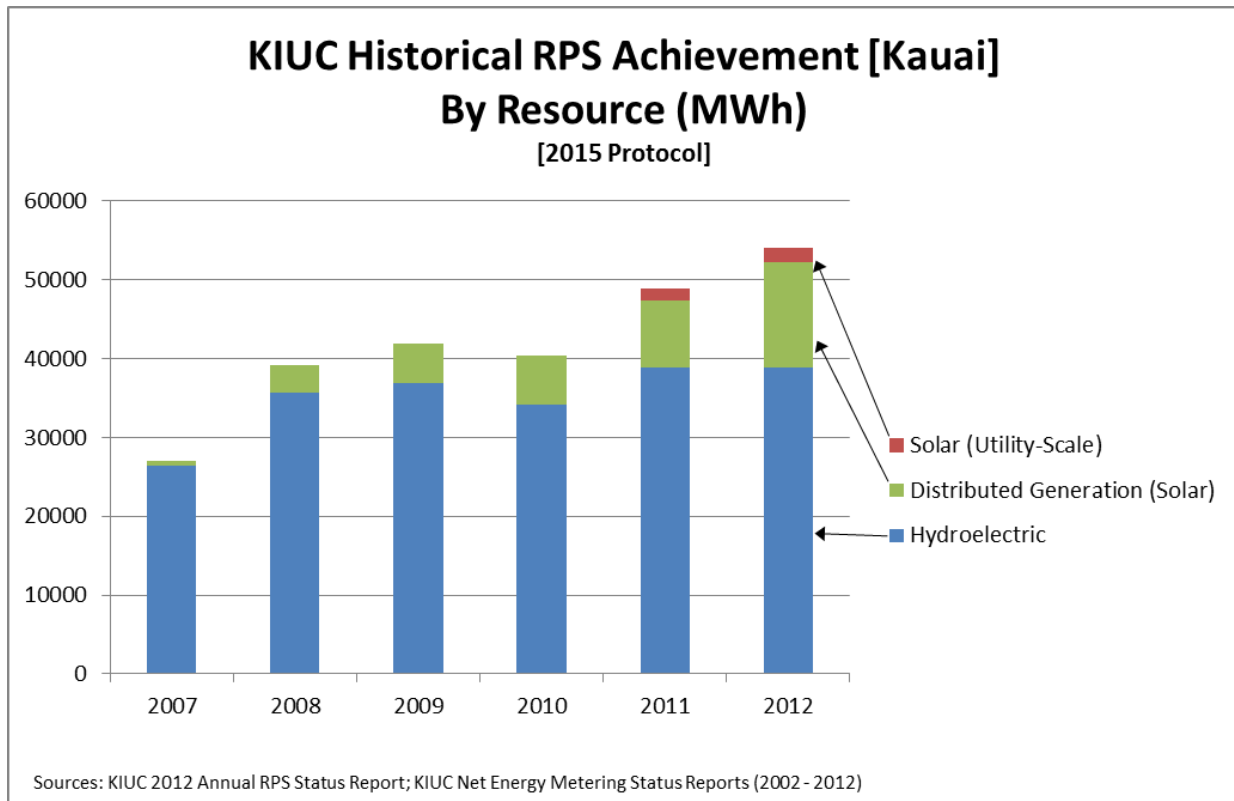


Chart B-2: HECO Companies (Consolidated) Historical RPS Achievement; By Resource (MWh)

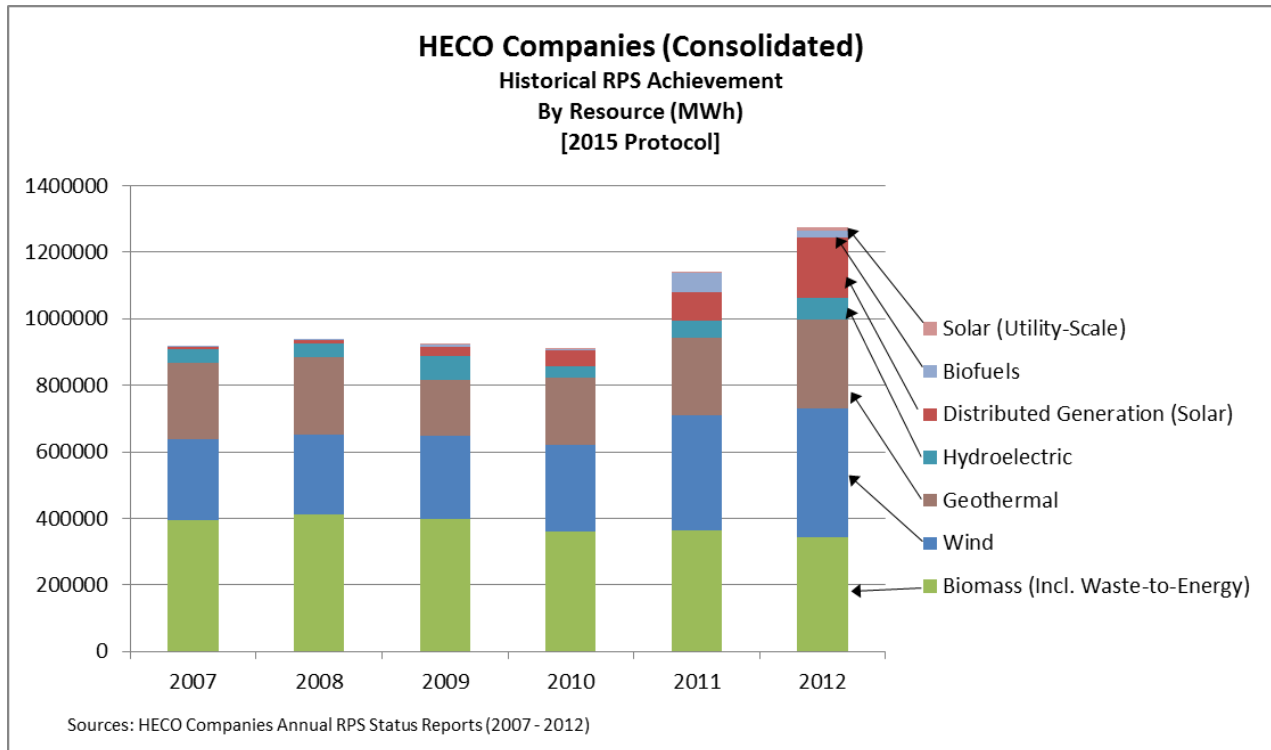


Chart B-3: HECO Historical RPS Achievement [Oahu]; By Resource (MWh)

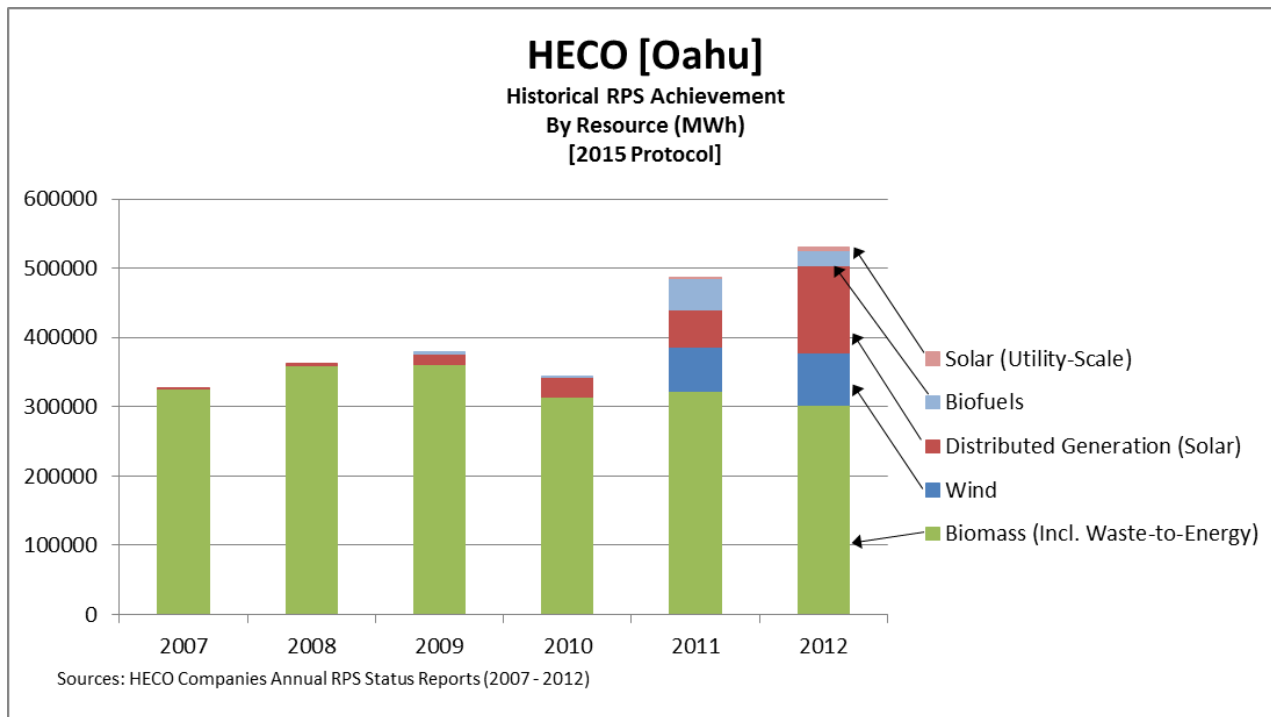


Chart B-4: HELCO Historical RPS Achievement [Hawaii Island]; By Resource (MWh)

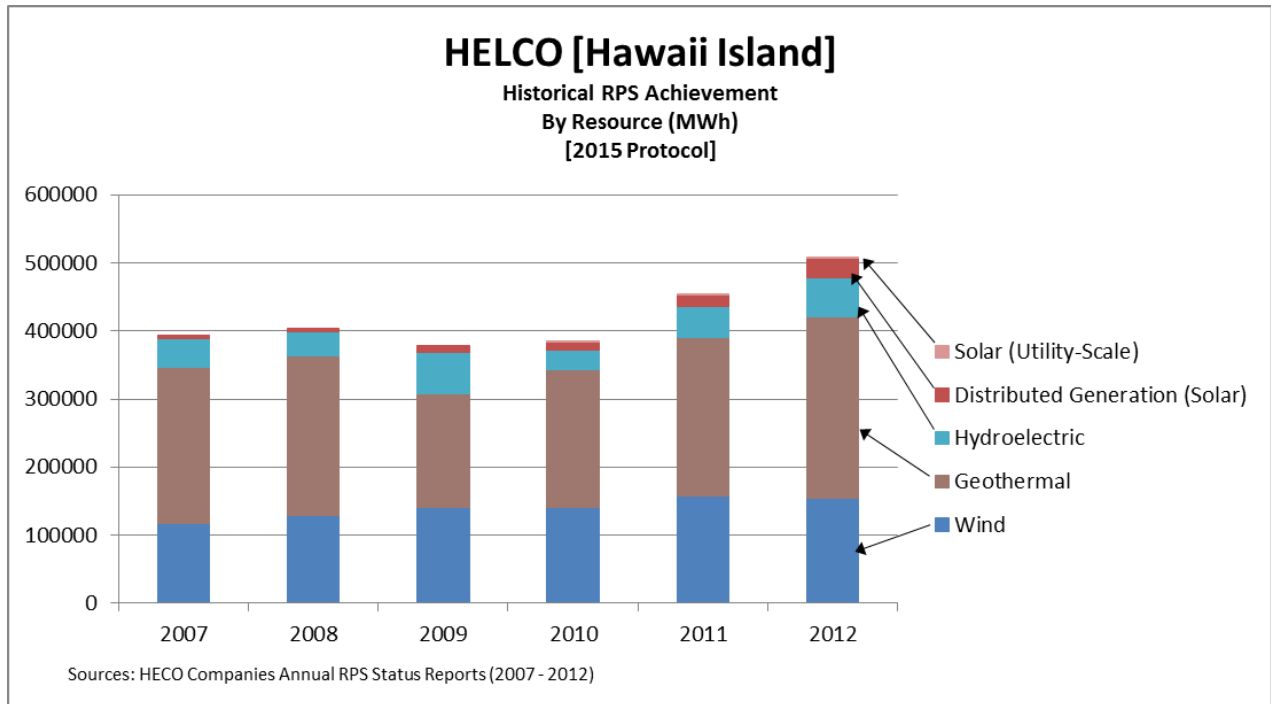
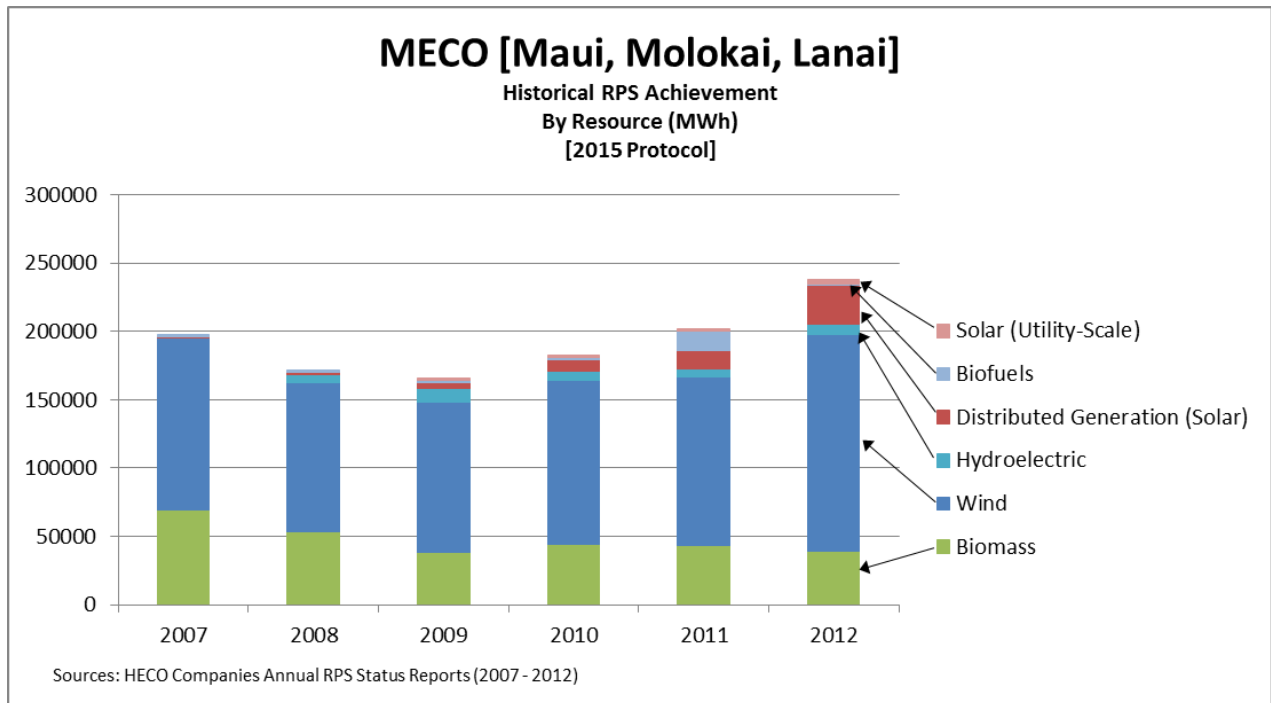


Chart B-5: MECO Historical RPS Achievement [Maui, Molokai, Lanai]; By Resource (MWh)



Appendix C

The following annual RPS status reports are included in this Appendix:

1. HECO Companies (Consolidated)
2012 Renewable Portfolio Standard Status Report
Filed April 24, 2013
Docket No. 2007-0008

2. Kauai Island Utility Cooperative
Renewable Portfolio Standards (RPS) Status Report
Year Ending December 31, 2012
Filed May 6, 2013
Docket No. 2007-0008

2012 Renewable Portfolio Standard Status Report

**Hawaiian Electric Company, Inc.
Hawaii Electric Light Company, Inc.
Maui Electric Company, Limited**

For the Year Ended December 31, 2012

This report was prepared pursuant to the Framework for Renewable Portfolio Standards, which was adopted by the Hawaii Public Utilities Commission (“Commission”) in Docket No. 2007-0008.¹

Hawaiian Electric Company and its subsidiaries, Hawaii Electric Light Company and Maui Electric Company (collectively, the “Hawaiian Electric Companies”), have achieved a consolidated Renewable Portfolio Standard (“RPS”) of 28.7% in 2012, including the electrical energy savings from energy efficiency and solar water heating technologies. This is an increase from the 24.5% achieved in 2011 and is primarily the result of the increased energy from renewable energy sources (biomass, geothermal, photovoltaic, hydro, wind, and biofuels), additional energy from customer-sited grid-connected technologies (primarily photovoltaic systems), additional energy efficiency demand-side management (“DSM”) implemented in 2012, and increased installations of solar water heating systems.

New DSM program participants in 2012 contributed approximately 175,950 megawatt-hours of additional electrical energy savings.² Also, approximately 1,009,310 megawatt-hours of electrical energy savings in 2012 came from participants in the Hawaiian Electric Companies’ and Public Benefits Fee Administrator’s (“PBFA’s”) energy efficiency DSM programs from previous years that continue to save electricity. DSM continues to achieve significant energy conservation benefits.

The current RPS law, which became effective on July 1, 2009, will not allow the electrical energy savings from energy efficiency and solar water heating technologies to count towards the RPS from January 1, 2015 (the 2015 RPS target is 15%, the 2020 RPS target is 25% and the 2030 RPS target is 40%). Excluding electrical energy savings from energy efficiency and solar water heating technologies, the 2012 renewable generation percentage for the Hawaiian Electric Companies is 13.9%. This renewable generation figure approximates how the RPS will be calculated in 2015 when the RPS calculation will be based only on renewable energy generation and customer-sited, grid-connected renewable energy.³

¹ The Framework for Renewable Portfolio Standards was adopted by Decision and Order No. 23912, issued December 20, 2007, and revised by the Commission on December 19, 2008 (Order Relating to RPS Penalties).

² Energy efficiency program impacts claimed in 2012 are based on the combination of the Hawaiian Electric Companies’ records for customers who participated in the Hawaiian Electric Companies’ programs prior to July 1, 2009 and impact estimates provided by Hawaii Energy (R. W. Beck / SAIC) following the transition. Hawaii Energy provided data for customer level energy efficiency impacts by program category reported during calendar year 2012 on March 6, 2013. This data was used to calculate electrical energy savings for new 2012 PBFA participants.

³ On April 25, 2011, Act 010 (S.B. No. 1346 SD2) Relating to Renewable Portfolio Standards was signed into law. Act 010 amends the definition of “renewable electrical energy” to include, beginning January 1, 2015, customer-sited, grid-connected renewable energy generation (currently represented on the attached 2012 RPS Summary Report as “Customer-Sited, Grid-Connected” under Renewable Displacement Technologies). The RPS value of 13.9% represents the electrical energy generated from Renewable Energy Sources and Customer-Sited, Grid-Connected renewable energy as a percentage of Total Sales.



In 2012, the Hawaiian Electric Companies continued to position themselves to increase their renewable energy portfolio. New Net Energy Metering installations for the Hawaiian Electric Companies totaled 73.4 MW in calendar year 2012 (more than double the 29.7 MW added in 2011). The Hawaiian Electric Companies' feed-in tariffs for Tier 1 and Tier 2 ("Schedule FIT Tier 1 and 2") became effective October 22, 2010, and their feed-in tariffs for Tier 3 ("Schedule FIT Tier 3") became effective November 22, 2011, which will help to encourage the addition of more renewable energy projects in Hawaii. On Oahu, a new 5 MW PV plant and 69 MW wind project began commercial operation in late 2012. On Maui, two new wind projects (both 21 MW) also began commercial operation in 2012. On the Big Island of Hawaii, an 8 MW geothermal expansion plant began commercial operation in 2012. In addition to these new resources being placed in service, two 5 MW PV plants received Commission approval in 2012 for the Oahu system.

Integrating additional amounts of renewable generation, while preserving stable electric grids and converting existing fossil fuel generating units to biofuels, are essential elements of the Hawaiian Electric Companies' plans to meet future RPS requirements. Siting renewable energy facilities continues to be a challenge in many communities, and federal and state tax credits and incentives remain important in the development of renewable projects. Timely approvals and implementation of renewable energy requests for proposals, power purchase agreements, biofuel contracts, and other mechanisms for renewable energy projects such as a renewable energy surcharge will also play key roles. It will take a concerted effort by all stakeholders to meet the State's RPS requirements and achieve a clean energy future. The Hawaiian Electric Companies look forward to working together to help Hawaii achieve these important objectives.



2012 Renewable Portfolio Standard Status Report

**Hawaiian Electric Company, Inc. ("Hawaiian Electric")
Hawaii Electric Light Company, Inc. ("HELCO")
Maui Electric Company, Limited ("MECO")**

**For the Year Ended December 31, 2012
(In Net Megawatt Hours)**

2012 RPS Status Report (Net Megawatt Hours)

	2012				2011
	Hawaiian Electric	HELCO	MECO	TOTAL	TOTAL
Electrical Energy Generated Using Renewable Energy Sources					
Biomass (including municipal solid waste)	302,398		39,392	341,790	365,266
Geothermal		266,234		266,234	232,906
Photovoltaic ¹	5,904	245	3,494	9,643	2,169
Hydro ¹		57,613	7,453	65,066	51,506
Wind ¹	75,410	154,688	158,158	388,256	344,376
Biofuels	21,259		1,348	22,607	59,254
Subtotal	404,971	478,780	209,845	1,093,596	1,055,477
Electrical Energy Savings Using Renewable Displacement Technologies					
Customer-Sited, Grid-Connected ²	125,882	28,282	28,474	182,638	84,968
Solar Water Heating ³					
Utility	113,541	17,919	28,341	159,801	161,824
PBFA ⁴	18,471	3,934	2,505	24,910	18,349
Subtotal	257,894	50,135	59,320	367,349	265,141
Electrical Energy Savings Using Energy Efficiency Technologies⁵					
Pre-2012 Participants					
Utility	641,869	48,948	86,823	777,640	777,483
PBFA	179,267	27,920	24,483	231,670	118,661
2012 Participants (PBFA)	137,019	20,897	18,034	175,950	112,920
Subtotal	958,155	97,765	129,340	1,185,260	1,009,064
TOTAL	1,621,020	626,680	398,505	2,646,205	2,329,682
TOTAL SALES	6,975,996	1,085,171	1,144,832	9,205,998	9,526,908
RPS PERCENTAGE	23.2%	57.7%	34.8%	28.7%	24.5%
RENEWABLE GENERATION					
(RPS Not Counting Energy Efficiency and Solar Water Heating)⁶					
Energy	530,853	507,062	238,319	1,276,234	1,140,445
Percentage	7.6%	46.7%	20.8%	13.9%	12.0%



¹ Renewable electrical energy generated is based on recorded data from FIT contracts and Independent Power Producers with PPAs.

² Savings from photovoltaic, wind, and hydro systems are based on known system installations for 2012 including Net Energy Metering ("NEM") installations, non-NEM systems, and Sun Power for Schools installations. Recorded generation data was used when available. For systems where recorded data was not available, estimates were made based on reasonable performance assumptions for typical photovoltaic systems.

³ Savings from solar water heating systems were based upon the number of rebates paid through the program and an estimated savings per system based on the periodic evaluation of the program. Utility Data is through June 2009, and PBFA Data is from July 2009 through 2012.

⁴ Public Benefits Fee Administrator ("PBFA") in 2009 through 2012 is Hawaii Energy (SAIC).

⁵ Savings from the energy efficiency technologies are based upon the annualized system energy savings for all participants in the utility's demand-side management ("DSM") programs excluding solar water heating, which is listed under the Renewable Displacement Technologies. Utility Data is through June 2009, and PBFA Data is from July 2009 through 2012. The energy savings from the utility DSM programs were reported to the Public Utilities Commission ("Commission") and the Consumer Advocate and were verified by an independent consultant whose evaluation reports are also filed with the Commission and the Consumer Advocate. The energy savings from the PBFA (Public Benefits Fee Administrator) was based on data provided by Hawaii Energy (SAIC).

⁶ Beginning January 1, 2015, electrical energy savings from Energy Efficiency and Solar Water Heating technologies shall not count toward RPS standards.



Kauai Island Utility Cooperative Renewable Portfolio Standards (RPS) Status Report Year Ending December 31, 2012

KIUC RPS Results for 2012

Kauai Island Utility Cooperative (KIUC or Company) achieved a Renewable Portfolio Standard (RPS) percentage of 16.64% for calendar year 2012. This exceeds the State of Hawaii's 2010 RPS requirement of meeting 10% of KIUC's net electricity sales with electrical energy generated and/or displaced by renewable resources.¹ In addition to meeting the 2010 required RPS percentage of net electricity sales, KIUC has also met the requirement that at least 50% of its RPS be met by electrical energy generated using renewable energy as the source.²

KIUC met the electrical energy needs of its customers with a combination of Company-owned fossil fueled generation, Company-owned renewable generation, and non-firm (100% renewable) power purchases³. In addition to this generated electricity, Photovoltaic (PV) systems and Demand Side Management (DSM) measures, including Solar Water Heating (SWH), also supplied some of KIUC consumers' energy needs, while at the same time, displacing fossil-fuel generated power. The portion of the RPS met by electrical energy generated using renewable energy as the source was 40,793 megawatt-hours, which is greater than 50% of the total 2012 10% RPS requirement of 43,315 megawatt-hours (MWh).⁴ Exhibit A, attached hereto, illustrates how KIUC met the energy needs of its approximately 36,000 accounts.

In 2012, KIUC achieved an RPS percentage of 16.64%, which is 1.95% more than KIUC's 2011 RPS percentage of 14.69%. This is due to the following:

1. A full year of solar production from Kapaa Solar, which began operation in February 2011.

¹ Hawaii Revised Statutes (HRS) § 269-92(a)(1).

² HRS § 269-92(b).

³ KIUC has nine non-firm power purchase contracts to purchase excess electrical power from Gay & Robinson (G&R) (hydro), Kauai Coffee (hydro), Kekaha Agriculture Association (KAA) (hydro), Green Energy Team (hydro), Green Energy Team (biomass), Pioneer (solar), Kapaa Solar (solar), McBryde Resources (solar), and MP2 Kaneshiro (solar). G&R shutdown its sugar operation in 2009 and as such has not generated any biomass-fueled energy since then. Green Energy Team's 6.7 megawatt (MW) biomass project is currently under development and as such KIUC will not receive any energy from it unless and until the plant is completed and commissioned. If built, KIUC anticipates that energy from that plant will not be available until 2014. Both McBryde Resources and MP2 Kaneshiro solar were interconnected in late 2012 and energy sales were not billed until January 2013.

⁴ 43,315 MWh is 10% of KIUC's annual MWh sales of 433,159.

2. Significant addition of customer-sited photovoltaic systems.
3. Continued success integrating DSM technologies.

KIUC Future RPS Activities

While KIUC exceeded the 2010 RPS goal of 10%, the Company is committed to even further increasing the growth of renewable energy and energy savings. To accomplish this, KIUC is undertaking the following:

1. On July 18, 2011, KIUC signed a Purchase Power Agreement (PPA) for purchase of electricity generated from the 6 MW McBryde Resources PV facility. The Hawaii Public Utilities Commission (Commission) approved the PPA on March 16, 2012, and the project began operation in late December 2012. This facility will provide approximately 2-3% of KIUC's current annual energy requirements.
2. Two 1.5 MW battery energy storage systems have been purchased to support the integration of the McBryde Resources 6 MW PV facility, the continued integration of customer generation, and to provide additional system support.
3. On September 29, 2011 the Commission approved KIUC's expenditures for the Smart Grid Project. KIUC has installed about 28,600 smart meters to date, and expects to complete the installation portion of the project by May 2013.
4. On November 29, 2012, the Commission approved KIUC's application to develop a 12 MW PV facility to be located in Anahola. KIUC expects to start construction of this facility in late 2013, and begin operation in mid-2014. This facility will provide approximately 5% of KIUC's current annual energy requirements.
5. On December 19, 2012, KIUC filed an application with the Commission to develop a second 12 MW PV project, to be located in Koloa. If approved, this facility will provide approximately 5% of KIUC's current annual energy requirements.
6. On January 12, 2011, KIUC announced a hydro development partnership with Free Flow Power to permit and investigate island wide hydro electric projects that, if successful, could provide greater than 20% of the island's annual electricity requirements. At this time, it is KIUC's intention to finance and own hydro electric facilities, as such structure will facilitate the lowest possible generation cost to the people of Kauai.
7. On January 25, 2011, KIUC signed a PPA for the purchase of electricity generated from the 6.7 MW Green Energy Biomass-To-Energy facility. The

Commission approved the PPA on October 31, 2011. The project began construction in early 2013 and is expected to begin operation in mid-2014. This facility will provide approximately 10-12% of KIUC's current annual energy requirements.

8. KIUC continues its efforts in securing a long-term water lease from the Department of Land and Natural Resources for the Waiahi hydro-electric facilities.
9. In addition to large utility-scale renewable energy projects, KIUC also recognizes the importance of small-scale PV, SWH, and DSM systems in meeting future RPS goals. To this end, KIUC is also continuing its residential energy efficiency programs, commercial retrofit program, and its SWH programs.

Conclusion

KIUC achieved an RPS percentage of 16.64% in 2012, which currently surpasses the 10% by 2010 RPS requirement by 6.64%. With the future activities identified above, KIUC is on target to meet the 2015 RPS requirement of 15%. KIUC recognizes the benefits that renewable energy and energy savings provide to the visitors, residents, and commercial sectors of Kauai, as well as the positive impacts on global environmental, societal, and economic issues. As such, KIUC will continue to evaluate, promote, and incorporate renewable energy and energy savings to meet the needs of its members, the Kauai community, and the State.

Exhibit A

KIUC RPS Status Report

	2005	2006	2007	2008	2009	2010	2011	2012
	MWh	MWh	MWh	MWh	MWh	MWh	MWh	MWh
1. Net Fossil Generation	413,355	419,451	441,154	417,986	399,325	400,307	392,689	389,180
2. Net Renewable Generation / Electrical Energy Generated Using Renewable Energy As Source ¹								
KIUC Hydro	4,232	4,561	926	7,968	7,454	7,896	6,974	7,591
Gay & Robinson Hydro	3,501	3,921	2,845	2,385	3,574	3,450	4,871	4,142
Kauai Coffee Hydro	26,292	25,613	20,612	22,149	21,756	18,296	21,208	23,038
KAA Hydro	3,466	3,024	2,079	3,106	4,141	4,374	5,457	3,775
Green Energy Hydro					5	189	407	366
Pioneer Solar							21	23
Kapaa Solar							1,468	1,858
Total	37,491	37,120	26,462	35,607	36,930	34,205	40,407	40,793

3. Electrical Energy Savings²

From Renewable Displacement or Off-Set Technologies ³								
Customer Renewable Generation (own use)	121	153	268	1,712	3,316	4,499	5,176	6,925
From Use of Energy Efficiency Technologies ⁴								
Demand Side Management (DSM)	20,855	21,349	21,361	19,233	19,217	16,911	18,264	24,368
Total	20,977	21,502	21,629	20,945	22,533	21,410	23,440	31,293
4 Total Sales / Total Electrical Energy Sales / Net Electricity Sales ⁵	448,611	452,080	466,896	453,791	436,273	434,533	434,745	433,159
5. Total Renewable Electrical Energy (Item 2 Total + Item 3 Total)	58,468	58,622	48,091	56,552	59,462	55,615	63,847	72,086

Total / RPS Percentage (Item 5 / Item 4)

	13.03%	12.97%	10.30%	12.46%	13.63%	12.80%	14.69%	16.64%
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Percent of Net Electricity Sales supplied by Item 2 Above

	8.36%	8.21%	5.67%	7.85%	8.46%	7.87%	9.29%	9.42%
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Percent of Net Electricity Sales supplied by Item 3 Above

	4.68%	4.76%	4.63%	4.62%	5.16%	4.93%	5.39%	7.22%
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1 Renewable electrical energy generated via power purchase agreements with independent power producers is based on recorded data of the energy generated from the power producer facility, which is typically the net electricity energy sold to the utility. Pursuant to the definition of "renewable electrical energy" under HRS Section 269-91, this will not include customer-sited, grid-connected renewable energy generation (i.e., net energy metering, Schedule Q) until January 1, 2015.

2 Pursuant to HRS Section 269-92(b)(2), beginning January 1, 2015, electrical energy savings shall not count toward the RPS.

3 Pursuant to HRS Section 269-91, under the definition of "Renewable electrical energy," these types of technologies include solar water heating, sea-water air-conditioning district cooling systems, solar air-conditioning, and customer-sited, grid-connected renewable energy systems. Beginning January 1, 2015, this shall not include electrical energy savings brought about by customer-sited, grid-connected renewable energy systems.

4 Pursuant to Section III.A.3. of the RPS Framework: "Electrical energy savings brought about by the use of renewable displacement or off-set technologies shall be determined using actual recorded energy produced by the displacement or off-set technologies, if that information is available to the utility, and the corresponding estimated electrical savings. Where the recorded energy produced by the displacement or off-set technologies is not available to the utility, as in the case of customer-sited renewable energy systems, the utility may make reasonable estimates of the energy produced by such systems, and provide an explanation of the calculation of the estimates. The electrical energy savings shall be expressed at a comparable level to the electrical energy generated using renewable energy sources (i.e., at the net generation level)."

5 Pursuant to HRS Section 269-91, under the definition of "Renewable electrical energy," energy efficiency technologies include heat pump water heating, ice storage, ratepayer-funded energy efficiency programs, and use of rejected heat from co-generation and combined heat and power systems, excluding fossil-fueled qualifying facilities that sell electricity to electric utility companies and central station power projects.

Pursuant to Section III.A.4. of the RPS Framework: "Electrical energy savings brought about by the use of energy efficiency technologies shall be determined using the actual gross energy savings (i.e., gross of (including) free-riders) reported by the utility or third-party DSM administrator in its annual DSM program report to the Commission excluding any electrical energy savings brought about by the use of renewable displacement or off-set technologies. The electrical energy savings shall be expressed at a comparable level to the electrical energy generated using renewable energy sources (i.e., at the net generation level)."

5 Pursuant to Section I of the RPS Framework "total electrical energy sales" or "net electricity sales" means the total MWhs of electrical energy sold by a utility to its customers during a given year. KIUC notes that Item 1 (Net Fossil Generation) plus Item 2 (Net Renewable Generation) does not equal Item 4 (Net Electricity Sales). This is because currently and until January 1, 2015, and as required by HRS § 269-91, Item 2 (Net Renewable Generation) does not include customer-sited, grid-connected renewable energy generation (e.g., energy generated and exported to KIUC by NEM, NEM Pilot, and Schedule Q customers). However, KIUC's sales of such customer-sited, grid-connected renewable energy generation are included in Item 4 (Net Electricity Sales).