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December 28, 2023

The Honorable Ronald D. Kouchi,
President and Members
of the Senate
Thirty-Second State Legislature
State Capitol, Room 409
Honolulu, Hawaii 96813

The Honorable Scott K. Saiki,
Speaker and Members of
the House of Representatives
Thirty-Second State Legislature
State Capitol, Room 431
Honolulu, Hawaii 96813

Dear President Kouchi, Speaker Saiki, and Members of the Legislature:

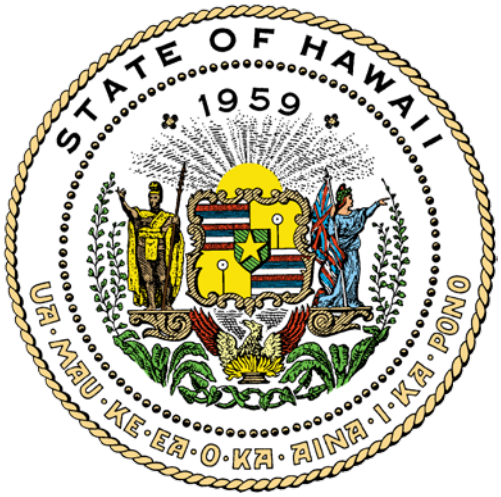
For your information and consideration, I am transmitting a copy of the **Renewable Portfolio Standards Legislative Report as required by section 269-95, Hawaii Revised Statutes (HRS).**

In accordance with Section 93-16, HRS, I am also informing you that the report may be viewed electronically at **https://puc.hawaii.gov/reports/.**

Sincerely,

Leodoloff R. Asuncion
Chair

Enclosures



STATE OF HAWAII

PUBLIC UTILITIES COMMISSION

Report to the 2024 Legislature
on
Hawaii's Renewable Portfolio Standards

Issued Pursuant to Section 269-95,
Hawaii Revised Statutes

December 2023

Report to the Hawaii Public Utilities Commission on Hawaii's Renewable Portfolio Standards

Report prepared by

Hawaii Natural Energy Institute
School of Ocean and Earth Science and Technology
University of Hawaii

Forward

The Hawaii Public Utilities Commission is required by HRS § 269-95(4) to evaluate Hawaii's RPS every five years and report its findings to the Legislature. As part of this process, HNEI is required to submit their assessment of the achievability and effectiveness of the RPS to the Commission. This report was prepared in collaboration with Telos Energy who participated under contract to HNEI.

HNEI
Hawai'i Natural Energy Institute
University of Hawai'i at Mānoa

Contents

List of Figures

List of Tables

Executive Summary

Hawaii has long-standing policies to reduce its imports of fossil fuels, increase the use of indigenous renewable resources, and maintain affordable energy services. The RPS was initially created by Act 272 (SLH 2001), which states:

> "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.... 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.)"

Thus, the State of Hawaii's ("State") energy policy is driven, in significant part, by the State's Renewable Portfolio Standards (RPS) that mandates the percentage of electricity that must be generated from renewable energy resources in different years until achieving 100% in 2045. The RPS targets have evolved through several legislative amendments since the RPS was first established in 2001. Prior to 2022, the RPS requirements were based on the amount of available renewable electricity as a percentage of utility sales. The current RPS, under Hawaii Revised Statutes (HRS) § 269- 92, was modified by Act 140, Session Laws of Hawai`i (2022), which requires electric utilities in the State to report electricity from renewable sources based on a percentage of electricity generation including distributed generation (the "2022 RPS"). The minimum percentages of renewable energy by year were not changed and remain as shown in Table 1.

Table 1. Hawaii's Renewable Portfolio Standards by year.

Compliance Year	RPS Requirement (% of Generation)
2010	10%
2015	15%
2020	30%
2030	40%
2040	70%
2045	100%

A side-by-side comparison of the impact of this change was an overall statewide reduction in RPS achievement of approximately 7.5% based on the 2022 generation mix. Hawaiian Electric's 2022 Renewable Portfolio Standard Status Report (Appendix B) provides an island by island comparison, which shows a reduction in achievement of 6% for Oahu and 12% for Hawaii Island, respectively compared to the old standard. In this assessment, the new RPS framework is considered.

The Hawaii Public Utilities Commission's ("Commission") evaluation of and reporting on the effectiveness and achievability of the current RPS is submitted to the Hawaii legislature pursuant to HRS § 269-95(5). Measuring the success of Hawaii's clean energy policies is an ongoing process. This report ("Report"), part of continuing analyses related to the impacts of RPS on the State, examines and presents findings regarding the achievability and effectiveness of the existing RPS requirements recognizing that there is uncertainty regarding RPS targets past 2030. Findings in this Report include:

- Achievement of the 2030 RPS requirement of 40% is likely for the Hawaiian Electric Company (HECO) service territory, which includes Oahu, Maui County, and the Hawaii Island ("Big Island"); and is essentially certain for the Kauai Island Utility Cooperative (KIUC). As of 2022, KIUC and Hawaii Island have already achieved the 2030 goal.
- Based on current plans for the PUC approved Stage 1 and Stage 2 solar + storage projects, the HECO territory is expected to reach the 40% by 2030. However, force majeure and related supply chain issues have created problems for Stage 1 and Stage 2 projects. If these issues continue, it could create problems in achieving the 40% mandated goal. Additionally, the recent Lahaina wildfires and cancellation of four out of five Stage 1 and Stage 2 projects (66% of proposed capacity on Maui) could potentially impact the pace of new renewable energy generation on Maui.
- The RPS has led to a substantial reduction of greenhouse gases (GHGs) being emitted by the electricity sector. However, GHGs have not diminished significantly in other sectors (transportation, buildings, etc.) as much as the Hawaii Clean Energy Initiative (HCEI) originally projected.
- Increasing electric loads from electric vehicle adoption will make it more difficult to achieve the RPS targets in the future, but will ultimately benefit statewide emissions.
- The costs of renewable energy projects under development and recently proposed in Hawaii are expected to remain comparative to or below costs of oil-fired generation – making renewable projects cost-competitive alternatives compared to continuing to utilize fossil fuel generation resources.

- Initial analysis by HNEI to explore the ability to integrate solar + storage or solar/wind and storage suggests that reaching the 70% RPS target by 2040 is feasible and likely cost effective with current technologies. However, land use restrictions, community acceptance, and transmission will pose challenges and need to be carefully managed.
- The RPS remains effective in helping the State achieve its policies and objectives with respect to developing renewable energy resources in Hawaii.

Historical RPS and 2030 RPS Achievability

By the end of 2022, statewide renewable generation totaled 33.2% of total generation, based on the new requirements imposed in the 2022 RPS. The new method for calculating RPS includes the total utility generation, both thermal and renewable, as well as the estimated behind the meter (BTM) renewable generation in the denominator to determine percent renewables. The reported combined generation for KIUC and HECO Companies at the end of 2022 was 10,813 GWh, of which 3,587 GWh was renewable, inclusive of BTM renewable energy generation. Figure 1 illustrates the RPS achievement for the consolidated State progress in meeting the RPS.

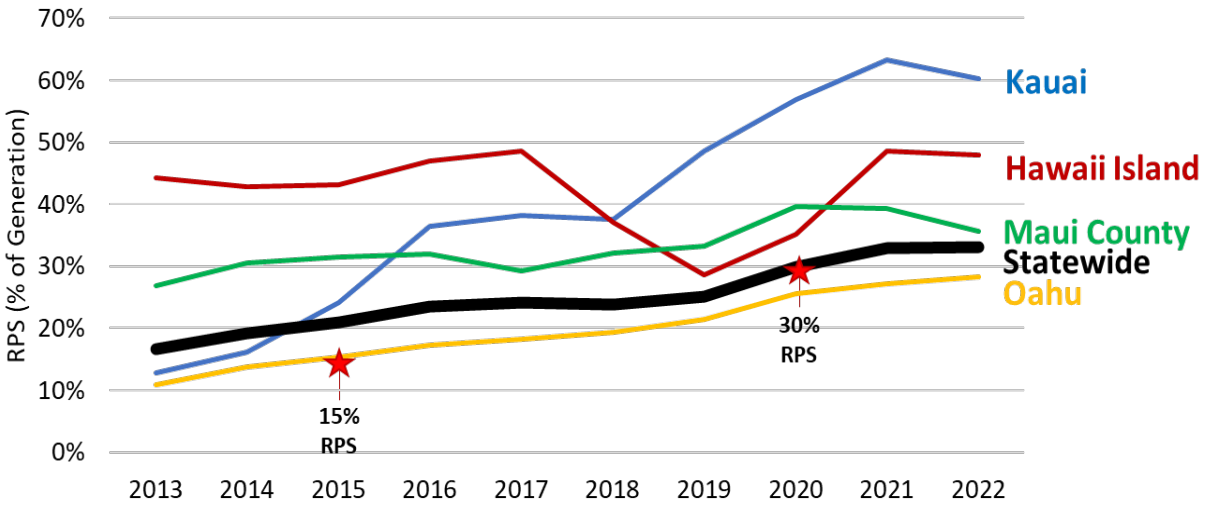


Figure 1. Consolidated progress in meeting RPS.

Given KIUC's and HECO's progress to date in acquiring renewable generation and reasonable expectations for additional renewable projects, it is likely that the 2030 RPS requirement of 40% is achievable for both the HECO Companies and KIUC. KIUC has already achieved the 2030 RPS requirement. Additional projects are planned or in construction that would further boost KIUC's RPS achievement above the 2030 requirement.

Since the end of 2022, HECO brought online 105 MW (estimated to produce approximately 230,000 MWh per year) of new solar projects across its service territory. This represents 13% of the HECO-procured and PUC approved Stage 1 and Stage 2 solar + storage projects on Oahu, Maui, and Hawaii island. When the remaining Stage 1 and Stage 2 projects are fully deployed by 2025 (after accounting for cancellations), these projects will total 339 MW of solar PV, approximately 740,000 MWh[1], and contribute 7% towards the RPS relative to expected total statewide generation. These projects, if developed, will contribute to the HECO Companies meeting the 2030 RPS goal.

In addition, newly proposed variable resources, (HECO "Stage 3"), for approximately an additional 1,000 GWh, have been selected for contract negotiations, future regulatory approval, and anticipated operations by 2030. Completion of the remaining Stage 1 and Stage 2 procurements and all of the Stage 3 variable renewable energy procurements would provide an estimated 1,800 GWh annually, or 17% of total expected HECO generation in 2025. Figure 2 illustrates the projected achievement of the 2030 goal. It should be noted that behind the meter distributed solar + storage is expected to continue to increase, but at a slower rate. Project details for Stage 1, 2, and 3 projects are provided in Appendix C.

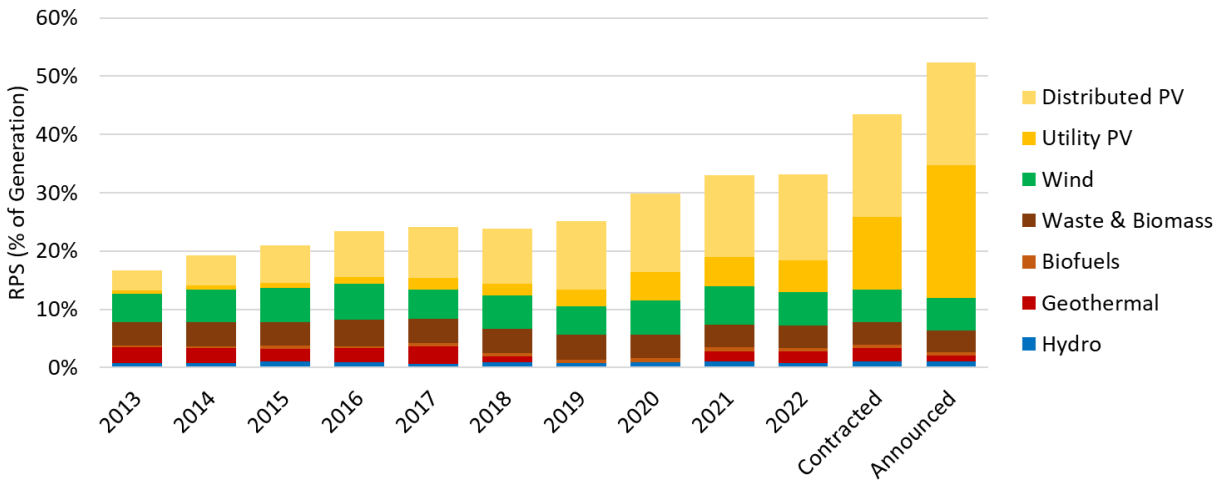


Figure 2. Projected achievement of state goals with contracted projects.
(Note: Contracted projects include under construction Stage 1 and Stage 2 projects not already online or cancelled as of December 2023 (HECO Companies) and the West Kauai Energy Project as originally proposed. Announced projects include Stage 3 variable renewable energy proposals that do not yet have regulatory approval. The total generation in these cases is based on an expected 2025 load, extrapolated based on recent growth rates. Additional discussion of the contracted and awarded projects is provided in Section 5.)

[1] This Report uses a 25% capacity factor to estimate energy from variable renewable projects.

Effectiveness of RPS Requirements

The RPS requirements continue to serve as an effective driver of renewable generation implementation. The establishment of the RPS by the Hawaii State Legislature ("Legislature") serves as a clear statement of standing policy and priority. The objective of achieving the RPS requirements has been embraced as a mandate by Hawaii's electric utilities and independent renewable power producers. The policy established by the Legislature in the RPS statute provides strong guidance for the Commission in reviewing utility applications and plans that are subject to Commission review and approval.

Section 1. Background

Hawaii's RPS, initially created in 2001 by Act 272 (Part I, Section 1, Act 272, Session Laws of Hawaii 2001), stated:

> "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.... 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."

The purpose of Hawaii's Renewable Portfolio Standards is to encourage the development and implementation of locally-sourced renewable energy generation, while displacing existing fossil fuel generation, thus reducing the State's historical dependence on imported oil. Initially established with voluntary targets, the Legislature subsequently set mandatory RPS provisions in Act 95, Session Laws of Hawaii 2004. Act 95 also increased the RPS percentage requirements and expanded the types of resources included in the definition of "renewable energy." The renewable energy requirements to be met or exceeded, as a percentage of electricity sales, were set to 10% by 2010, 15% by 2015, and 20% by 2020.

In 2006, HRS § 269-91, as amended by Act 162, Session Laws of Hawaii 2006, authorized the Commission to establish standards for each utility that prescribed what portion of the RPS shall be met by specific types of renewable electrical energy resources, provided that: (1) at least 50% of the RPS shall be met by electrical energy generated using renewable energy as the source; (2) where electrical energy is generated or displaced by a combination of renewable and nonrenewable means, the proportion attributable to the renewable means shall be credited as renewable energy; and (3) where fossil and renewable fuels are co-fired in the same generating unit, the unit shall be considered to generate renewable electrical energy (electricity) in direct proportion to the percentage of the total heat value represented by the heat value of the renewable fuels.

HRS § 269-91 also defined "renewable energy" as energy generated or produced utilizing the following sources: (1) wind; (2) sun; (3) falling water; (4) biogas (including landfill and sewage-based digester gas); (5) geothermal; (6) ocean water, currents and waves; (7) biomass (including

biomass crops, agricultural and animal residues and wastes, and municipal solid waste); (8) biofuels; and (9) hydrogen produced from renewable energy sources. A utility failing to meet the RPS is subject to penalties to be established by the Commission unless they determine that the utility is unable to meet the RPS due to reasons beyond the reasonable control of the utility.

In January 2008, the State executed a memorandum of understanding with the U.S. Department of Energy establishing the Hawaii Clean Energy Initiative (HCEI). The HCEI agenda featured energy efficiency measures and plans to replace fossil fuel use in both the transportation and electrical power sectors by 70% by the year 2030. Act 155, Session Laws of Hawaii 2009, increased the RPS goals as a percentage of electricity sales to meet or exceed 25% by 2020 and 40% by 2030. Act 155 also established a separate Energy Efficiency Portfolio Standard in which 4,300 gigawatt-hours (GWh) of future energy savings by the year 2030 must be met from energy efficiency and energy management technologies, roughly equivalent to achieving a 30% reduction in forecasted 2030 energy consumption at the time of the Act 155's passage.

Act 155 also specified that the RPS for 2015, 2020, and 2030 shall not include energy efficiency and energy offset technologies as previously permitted, and could only be met by electrical generation from renewable energy sources. In 2015, Act 155 was amended to increase the RPS target to 100% by 2045, including interim requirements of 30% by 2020, 40% by 2030, and 70% by 2040. Hawaii is one of many states to have adopted RPS goals, and was first, in 2015, to establish a 100% RPS.

Act 240 (HB 2089) was enacted in 2022 and amended the RPS calculation from renewable energy as a percentage of sales to renewable energy as a percentage of total system generation including for the first time, generation from private rooftop solar as part of the total generation (denominator), and total renewable generation (numerator). Prior to Act 240, only electric sales were included in the denominator, while renewable generation from private rooftop solar was counted only in the numerator, resulting in double counting of the contribution of distributed, behind-the-meter resources. The impacts of Act 240 are discussed in Section 2, "Notable Changes Since Last Report."

State law requires that the Commission evaluate Hawaii's RPS every five years and report its findings to the legislature as to whether the RPS remain effective and achievable. HRS § 269-95(4) states 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."

As part of this process, HNEI is required to submit their assessment of the achievability and effectiveness of the RPS to the Commission. The determination of the effectiveness and achievability of the RPS is the central focus of this Report. The objective is to determine if the standards established by HRS § 269-92 remain effective and achievable based on progress to date and to analyze options for meeting RPS targets in the future. This is the fourth RPS evaluation since Hawaii first adopted a legally binding RPS in 2004 and the third since HRS § 269-95(4).

Examination of the achievability of the RPS includes the consideration of several factors, such as existing and possible future renewable energy generation resources being identified and the expected or possible amount of energy generation quantified from these resources. Information regarding existing generation and projects that are under construction is more certain than information regarding possible future projects or general estimates of resource potential. For this report, sufficient verified information is available for projects that are existing and/or approved and under construction on a project-by-project basis with some consideration of uncertainties. Projections are based on the successful development of these near-term projects as well as information received from the utilities regarding future near term (proposed to come on-line by 2030) proposals.

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 resolve any uncertainties associated with these considerations.

In performing the analysis necessary for this Report, the HNEI 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. 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 indicate RPS achievement information for the calendar year 2022.

- ***Future Renewable Generation Projects***: This includes new renewable generation projects that provide electrical power to each utility. Expected renewable generation for these projects is provided by the utilities, based on current estimates. 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, for the HECO Companies, the ongoing competitive-bid process for new renewable generation includes information regarding the possible scope of new renewable resources in the near-to-mid-term. For HECO, more than 500 MW of renewable projects are expected to come online in the next few years.
- ***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, periodic briefings, and the Integrated Grid Planning (IGP) process. Planning information includes identification of possible specific future renewable generation projects, possible requests for proposals and general estimates of grid needs and possible resource potential.
- ***Additional Expert Opinion***: External expert opinion was also factored into the analysis and commentary. A number of anonymized state-based experts were interviewed to obtain their views on the future achievement of RPS goals. These experts including those from non-governmental organizations (NGOs), independent power producers, the utilities, academia, and state agencies.

Section 2. Notable Changes Since the Last Report

Modification of Calculation Method for RPS

In July 2022, Act 240 (HB 2089) was signed into law that amended the RPS calculation to include rooftop solar as part of the total generation, not just part of the renewable generation as had been the case previously. The amended definition results in lower RPS percentages due to the use of a larger denominator, changing it from sales to overall system generation. Given the high levels of adoption for rooftop solar in Hawaii, this legislative change had a significant impact on the statewide RPS, decreasing attainment by approximately 7.5% based on the 2022 end-of-year generation mix. The estimated change in the calculated 2022 RPS is shown in Figure 3 for each jurisdiction and for the statewide values.

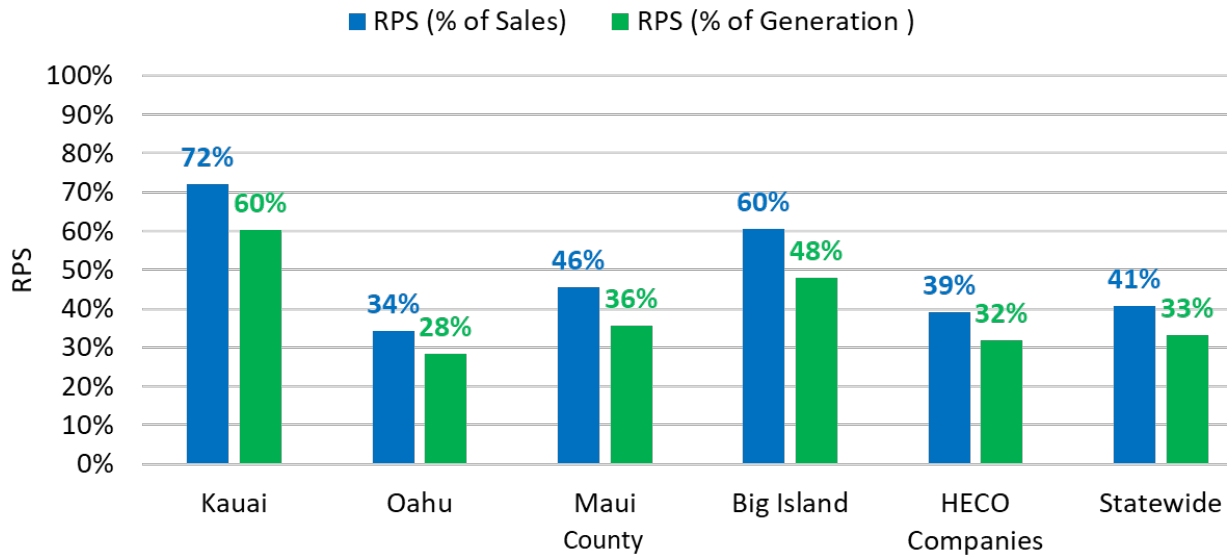


Figure 3. Change in RPS for 2022, based on amended method for calculation.

Inflation Reduction Act

Under the Biden administration, several bipartisan laws have been enacted that promote the deployment of renewable energy technology and the reduction of greenhouse gas (GHG) emissions. Most notably, the Inflation Reduction Act extended and expanded federal clean energy tax credits for clean energy technologies, clean fuels, electric vehicles, and other climate policies. It also changed tax rules on transferability of tax credits, increasing the number of

entities able to invest in, and benefit from tax credits associated with renewable energy. This has resulted in a considerable amount of federal funding being available to states and utilities to increase percentages of renewable technologies and resources in the energy sector. While it is difficult to quantify the impact of this new legislation now, it is reasonable to assume that it will catalyze funding to states such as Hawaii to increase the development of these resources.

New Utility Procurements and RFP

Since the publication of the last five-year analysis, there have been significant efforts on the part of both utilities (KIUC and HECO) to procure more renewable energy resources for electricity production. For HECO, this has included a marked shift to utility scale solar plus storage and the development of three major solicitations – called Stage 1, Stage 2, and Stage 3.

As of the writing of this report, three of the new facilities under HECO's Stage 1 or 2 solicitation have come online (105 MW, ~230 GWh), seven more (234 MW, ~510 GWh) are currently under construction, and 11 (443 MW, ~970 GWh) were canceled. Collectively, the remaining Stage 1 and Stage 2 projects are anticipated to increase statewide RPS by up to 7%, a major contribution to HECO meeting the 2030 RPS.

In addition to the Stage 1 and 2 projects currently operating or under construction, HECO announced Stage 3 projects expected to provide 1,067 GWh of new generation by 2030 across Oahu, Maui, and Hawaii Island, excluding contributions from firm renewable (i.e. biodiesel) resources also being proposed.[2] Collectively, the Stage 1-3 variable renewable energy solicitations could increase RPS contributions by 17% across the HECO service territory (Table 2).

Table 2. HECO Stage 1-3 procurement summary.

	Oahu	Maui County	Big Island	HECO Total
Stage 1 & 2 (GWh)*	479	131	131	741
Stage 3 (GWh)**	451	175	440	1,067
Total Stage 1-3 (GWh)	**930**	**307**	**572**	**1,808**
Stage 1-3 RPS (% of expected 2025 Generation)***	12%	21%	41%	17%

[2] Due to the recency of the announcement, there is currently limited information on the expected RPS contributions from selected firm resources, so they are not included in calculations in this Report.

**Excludes canceled projects.*
*** Based on December 2023 announced projects, excludes firm renewable projects and PPA extensions.*
****2025 generation is estimated based on extrapolation of recent historical growth rates.*

KIUC has also increased the development of renewable energy resources considerably since the last report. Since 2019, KIUC added two hybrid solar and storage projects (20 MW and 14 MW) increasing Kauai's RPS to 60%. KIUC has also proposed the West Kauai Energy Project, which combines solar, battery storage, hydro, and pumped storage, and would increase Kauai's renewable energy by another 60 MW, contributing up to 17% to Kauai's RPS as originally planned.[3]

Collectively, if the Stage 1, 2, and 3 variable renewable energy procurements and the KIUC West Kauai Energy Project (as organically proposed) are fully developed, the statewide total RPS would increase by approximately 18%. Details of the potential increases for individual islands are discussed in more detail in Section 5. However, there have been issues with some of the projects, leading to significant delays and cancelations. These issues are discussed further later in this report.

Fossil Retirements and Reliability Concerns

The utilities have been aware for some time that their aging oil- and diesel- fired power plants are becoming less reliable and more difficult to maintain, as shown in Figure 4. Forced outage factor is a measure of the fraction of time in which a generating unit is not available due to forced outages and forced deratings. The weighted forced outage factor is a measure of the cumulative outages of the fleet, weighted by the capacity of the individual generators.[4] Forced outages (unplanned failures) in the HECO fleet are increasing as a percentage of operation time. Further, new federal regulations passed in the 2015 for control of fine particulates and trace metals have increased the time necessary for planned outages.

[3] On December 13, 2023, KIUC announced that it is discontinuing active development of the flowthrough hydroelectric portion of this project and is considering the feasibility of a scaled-back design to this project due to litigation-caused delays, project uncertainty, and cost increases.
[4] See Hawaiian Electric Company, *Key Performance Metrics, Key Performance Metrics,* https://www.hawaiianelectric.com/about-us/performance-scorecards-and-metrics/power-supply-and-generation.

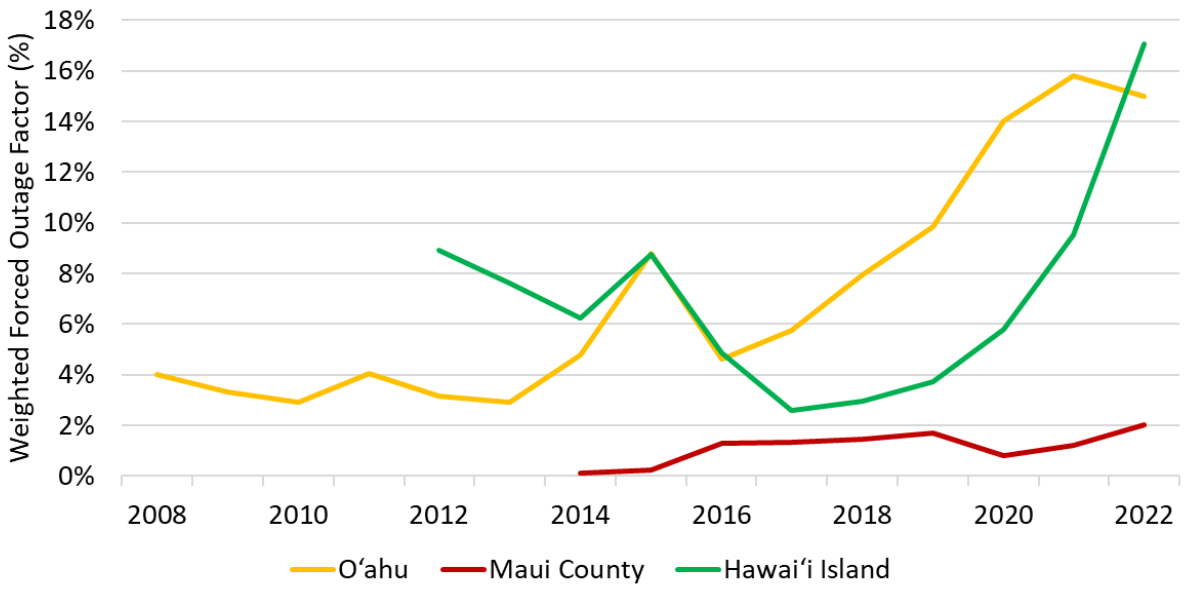


Figure 4. Weighted equivalent forced outage factor.
(Note: KIUC does not publicly report forced outage rates.)

With increasing age of the plants and the increased cycling of the existing thermal units to accommodate the variable renewables, challenges related to reliability and resiliency will likely continue to increase. HNEI has conducted analysis using over 20 years of solar data that shows that as the older oil-fired facilities are retired, the HECO systems will require additional firm resources to maintain reliability and provide grid services. The HNEI analysis is consistent with analysis conducted by HECO using other methodologies (see HECO's IGP, Section 8, Resource Adequacy). Assuming these firm resources are renewable, they would provide an increase to the RPS. Dispatchable firm-renewable resources are currently being solicited in the Stage 3 Firm Capacity solicitation, with the potential to support grid services and RPS goals.

Section 3. Status as of December 31, 2022

The RPS is applied to KIUC and the HECO Companies. The 2018 Report from the Commission to the legislature projected that each utility would exceed the 2020 requirement of 30%. Both utilities successfully achieved this goal, which was based on the prior method for calculating the RPS percentage. While the advances in the development of utility-scale renewable generation have been significant in both service areas since the 2018 report, it should be noted that customer-based generation also continued to increase during this period, accounting for 46.6% of renewable energy generation across the state in 2022, with this value being 49.9% on Oahu. Figure 5 is a pie chart showing the relative percentages of resources providing electricity from renewables across the state for 2022.

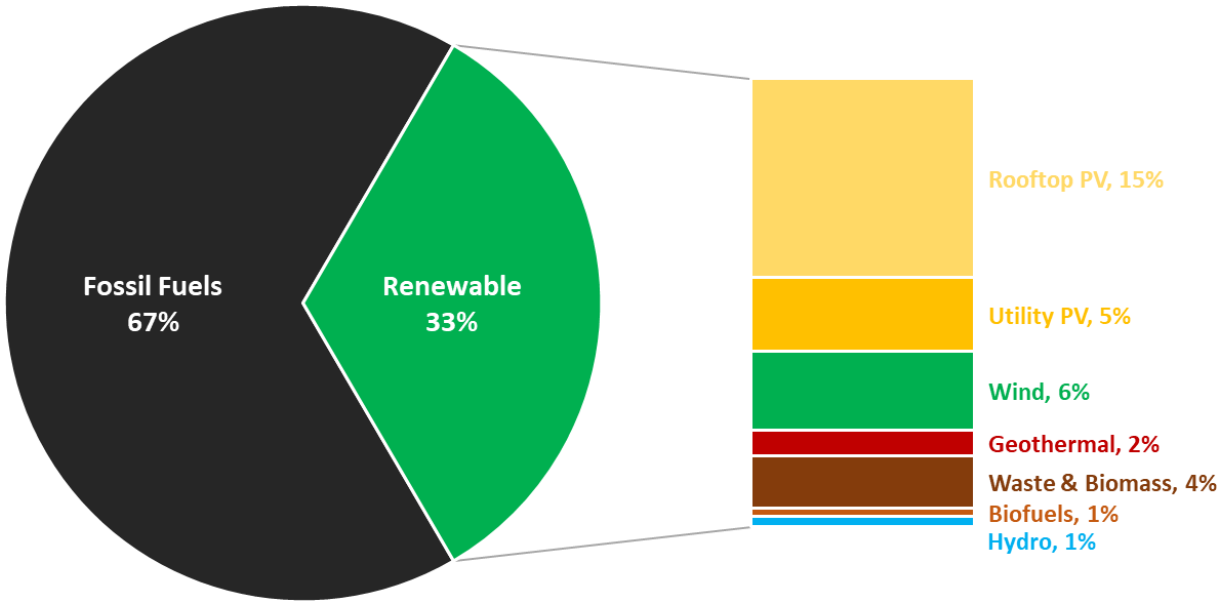


Figure 5. 2022 Percentages of renewable energy sources (statewide).

KIUC

KIUC's letter to the Commission on May 4, 2023, describes the utility's achievements through the end of 2022 (Appendix A). KIUC meets electricity needs of its customers by using its own fossil fueled and renewable resource generation, renewable power purchases from independent power producers, and a modest amount of behind the meter (BTM) PV generation. Even with the legislatively-mandated change in the definition and calculation of RPS, which reduced KIUC's RPS by approximately 6%, renewable energy resources supplied 60% of KIUC's net electricity

generation during the 2022 calendar year. This is substantially higher than the requirement of 40% by 2030. The KIUC RPS values for 2022 with the new definition, and for 2021 using both the new and older definitions are shown in Table 3. Also shown in Table 3 are the amounts of renewable generation (GWh) from the different renewable sources. The generation from the customer-sited grid-connected PV represents approximately 40.6 MW of BTM systems.

Table 3. KIUC renewable generation in 2022.

Kauai Island Utility Cooperative
Renewable Portfolio Standard (RPS) Status Report
Year Ending December 31, 2022
EXHIBIT A

Electrical Energy Generated Using Renewable Energy Sources	**2022**	**2021 post-HB2089***	**2021 pre-HB 2089***
Biomass	51,555	48,479	46,019
Hydro	56,421	64,807	61,518
Photovoltaic (PV)	141,770	138,251	131,235
Customer-Sited, Grid-Connected PV	68,131	64,649	63,444
Total Renewable Electrical Energy	317,877	316,186	302,217
Total Electrical Energy Generation (Sales for 2021 pre-HB 2089)	527,924	499,413	435,156
RPS Percentage	60.2%	63.3%	69.5%

* H.B. 2089 of 2022 amended the RPS to be based on net electricity generation rather than sales. Prior to HB2089, net electricity generation was reduced by system losses in order to correlate to net electricity sales.

"Renewable portfolio standard" means the percentage of electrical energy generation that is represented by renewable electrical energy, excluding customer-sited, grid connected generation that does not produce renewable energy

Figure 6 shows the historical trends for renewable development for KIUC since 2013 with all percentages shown using the new method to calculate RPS.

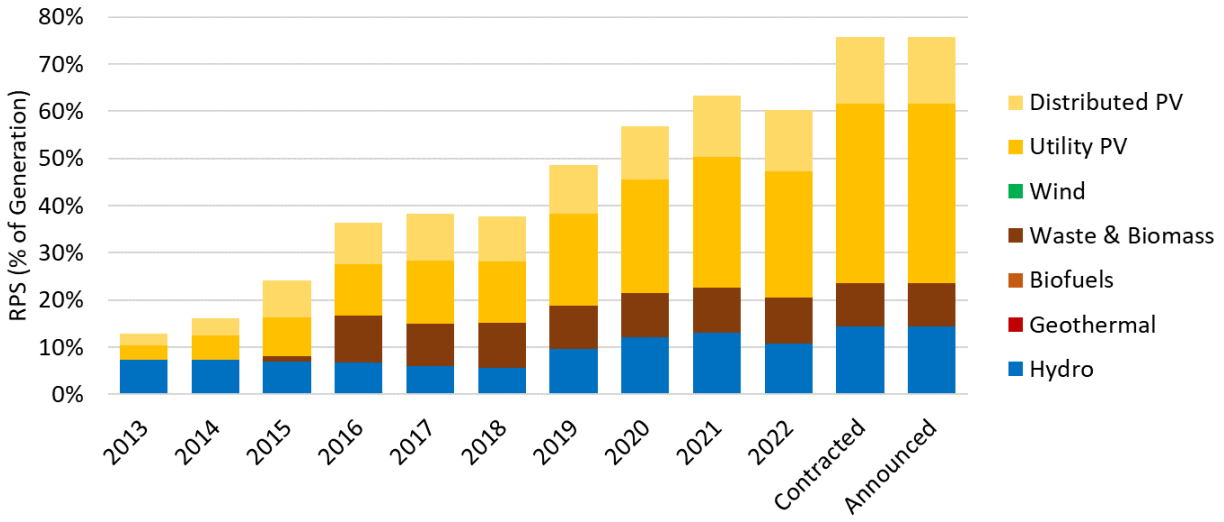


Figure 6. KIUC historical RPS by renewable fuel type (all values based on new method for calculating RPS).

HECO Companies

HECO's Renewable Portfolio Standard Status Report for 2022, submitted on February 17, 2023 (Appendix B), covers utility operations on the islands of Oahu, Molokai, Lānai, Maui, and Hawaii. The report shows that by the end of 2022, HECO had achieved a RPS of 31.8%, within 8.2% percent of the 2030 target without projects currently under construction or proposed. The Oahu, Hawaii Island, and Maui County systems achieved 28%, 48%, and 36% RPS, respectively. Table 4 summarizes the amounts of renewable generation (GWh) from the different renewable sources for each county.

Wind production was lower by approximately 11%, compared to 2021, within the range of historical wind production variability over the past decade. This reduction was more than compensated for by increases in solar generation, with most of that from customer sited systems. Geothermal production also increased slightly as the Puna Geothermal Venture plant continues to return to full service following the 2018 eruptions.

Table 4. HECO Companies renewable generation in 2022.

Hawaiian Electric
For the Year Ended December 31, 2022
(In Net Megawatt Hours)

	2022				2021
	O'ahu	Hawai'i	Maui County	TOTAL	TOTAL
Electrical Energy Generated Using Renewable Energy Sources					
Biomass (including municipal solid waste)[1]	370,668			**370,668**	**366,365**
Geothermal[1]		208,346		**208,346**	**183,391**
Photovoltaic and Solar Thermal[1]	433,875	4,050	12,844	**450,769**	**390,353**
Hydro[1]		27,409		**27,409**	**43,050**
Wind[1]	249,766	141,301	234,849	**625,916**	**701,124**
Biofuels	16,256	46,292	566	**63,114**	**71,780**
Customer-Sited, Grid-Connected[2]	1,064,021	209,629	248,794	**1,522,444**	**1,418,036**
TOTAL	2,134,587	637,027	497,052	**3,268,667**	**3,174,100**
TOTAL GENERATION	7,559,608	1,330,718	1,394,862	**10,285,189**	**10,072,948**
RPS PERCENTAGE (% of Generation)	**28.2%**	**47.9%**	**35.6%**	**31.8%**	**31.5%**
TOTAL SALES	6,210,797	1,053,833	1,089,324	**8,353,955**	**8,261,103**
RPS PERCENTAGE (% of Sales)	**34.4%**	**60.4%**	**45.6%**	**39.1%**	**38.4%**

Figure 7 shows the historical trends for renewable development for HECO since 2013 with all percentages shown using the new method to calculate RPS. Figure 8 similarly shows the development of BTM distributed solar over this same period.

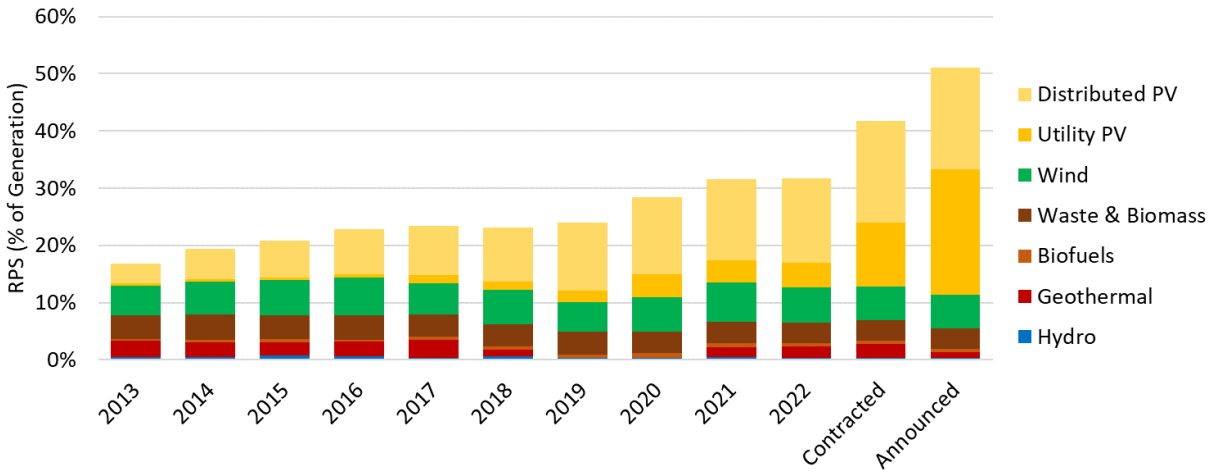


Figure 7. Renewable generation percentages by resource for HECO Companies.

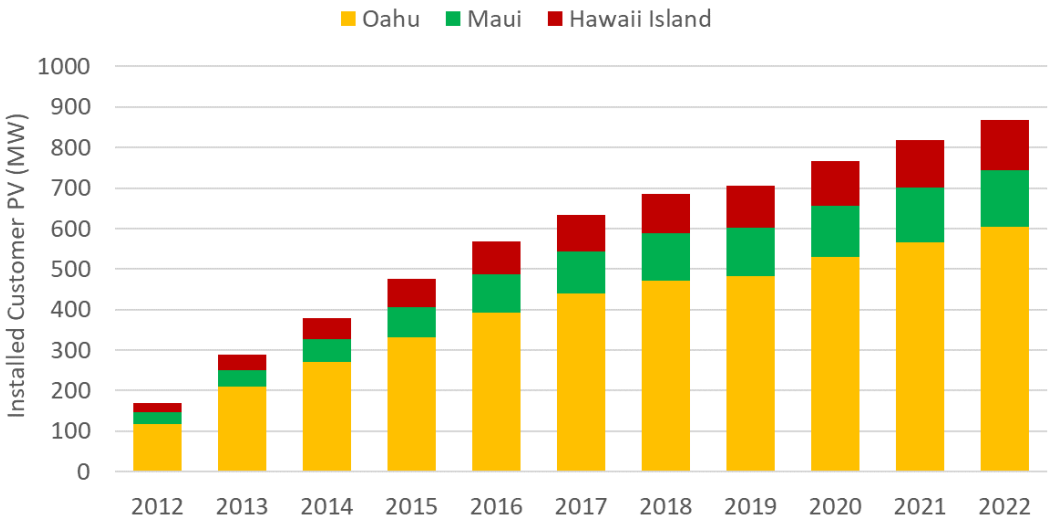


Figure 8. Growth of behind the meter renewable energy (HECO Companies).

As shown in Table 4 and Figures 7 and 8, wind, utility-scale solar, geothermal, and biomass (including municipal solid waste [MSW]) are all significant renewable resources that provide electricity to the HECO Companies' grids. However, as of 2022, customer-sited distributed PV continues to be the single largest source of renewable energy. Generation from customer-sited, grid-connected resources increased by approximately 7% from 2021 and 2022.

Generation from grid-scale solar increased by 15% across the HECO companies due, in large part, to the start-up of the 39 MW Mililani I solar + storage project on Oahu in July 2022.

Statewide

In 2022, renewables provided approximately 33% of the state's electrical energy. Figure 9 illustrates the variability from county to county across both the KIUC and HECO service areas.

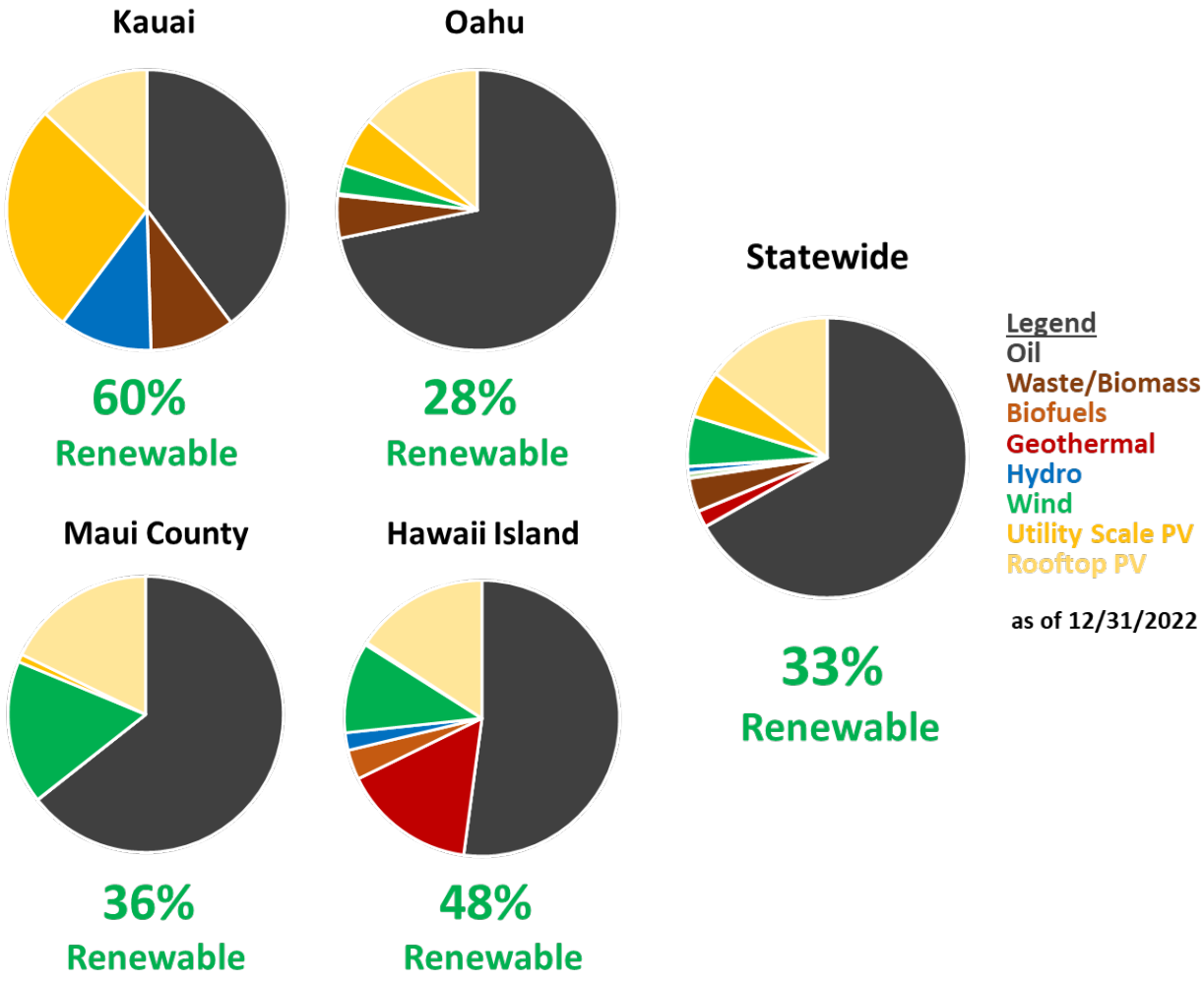


Figure 9. 2022 Energy generation mix by island and statewide.

Section 4. Effectiveness of Renewable Performance Standards

The determination of the effectiveness and achievability of the RPS is the focus of this and the next section of this report.

As discussed in Section 2 of this report, state law (HRS § 269-95(4)) requires that the Commission:

> "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."

The Legislature has expressed similar intent in subsequent enactments amending Hawaii's RPS. As such, the Commission's assessment of the effectiveness of the RPS considers: (1) whether the RPS is effective for increasing the amount of renewable energy generation resources deployed on Hawaii's utility systems and (2) whether the increased utilization of renewable resources is effectively reducing the use of imported oil and promoting Hawaii's policies to increase use of indigenous resources while maintaining affordable energy services. The RPS has been effective in both respects.

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. 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 (such as a performance incentive for achieving RPS targets before their mandated timelines) and in reviewing the utility applications and plans that are subject to Commission review and approval. 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 being part of Hawaii's overall energy policies and programs.

The cost-effectiveness of renewable resources has changed substantially over the past decade. In recent years, the price of petroleum fuels has varied considerably, particularly following the COVID pandemic and the onset of Russia's invasion of Ukraine. This invasion necessitated the Par Refinery dropping its imports from Russia (approximately 27% of its supply prior to the war) to other international sources. While this invasion caused a spike in oil prices for Hawaii, the overall costs for oil tends to track mainland costs. This geopolitical reality, coupled with lower solar technology costs, make the new projects cost competitive with existing fossil-fired facilities.

The proposed projects from the HECO Companies' ongoing competitive solicitations, as well as experience of other recent renewable projects, shows that renewable energy can be developed in Hawaii at prices below the cost of fossil fueled generation. The HECO Companies' avoided energy costs have ranged between 12 and 28 cents/kWh over the last year (depending on which island) and have recently trended upwards. In contrast, recent Stage 1 and Stage 2 procurements are estimated in the range of 9 to 14 cents/kWh, inclusive of battery energy storage capacity and subsequent amendments.

Going forward, new renewable energy projects, with long-term fixed prices, are expected to continue to offer savings to ratepayers as the projects are integrated into the energy resource mix. However, ongoing supply chain problems, more limited land availability, more expensive interconnections, and volatility in technology costs may impact the amount of savings from future renewable projects going forward.

Section 5. Anticipated Achievement of 2030 RPS Requirements

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 includes consideration of whether sufficient renewable resources are reasonable in terms of cost and can be successfully sited. Factors to be considered include, but may not be limited to, land availability, site control, community acceptance, and the ability to successfully obtain project permits.
- 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 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 includes whether assumed levels of distributed generation resources can be accommodated on distribution circuits economically, safely, and reliably.

KIUC

KIUC has already exceeded the 2030 RPS requirement of 40%, with over 60% RPS achieved at the end of 2022. As such, assuming existing projects continue to produce at average historical levels, KIUC will exceed the 2030 RPS requirement even if load growth continues.

Additional projects planned for Kauai, such as the approved West Kauai Energy Project (a combination of solar, storage, and hydro resources), would further boost KIUC's RPS achievement. However, as a result of litigation and ongoing community engagement, a new COD has not been reported and KIUC recently announced that it is discontinuing active development of the flowthrough hydroelectric portion of this project and is considering the feasibility of a scaled-back design to the project. If a new hydro project nearing completion and the larger West Kauai Energy Project are completed as originally planned, KIUC's 2022 RPS would be expected to increase up to approximately 75%, as shown by the last bar in Figure 10. The KIUC projection in Figure 10 does not include CBRE projects or additional growth in customer-sited distributed PV, which could further boost KIUC's RPS achievement, although we have no knowledge of such plans.

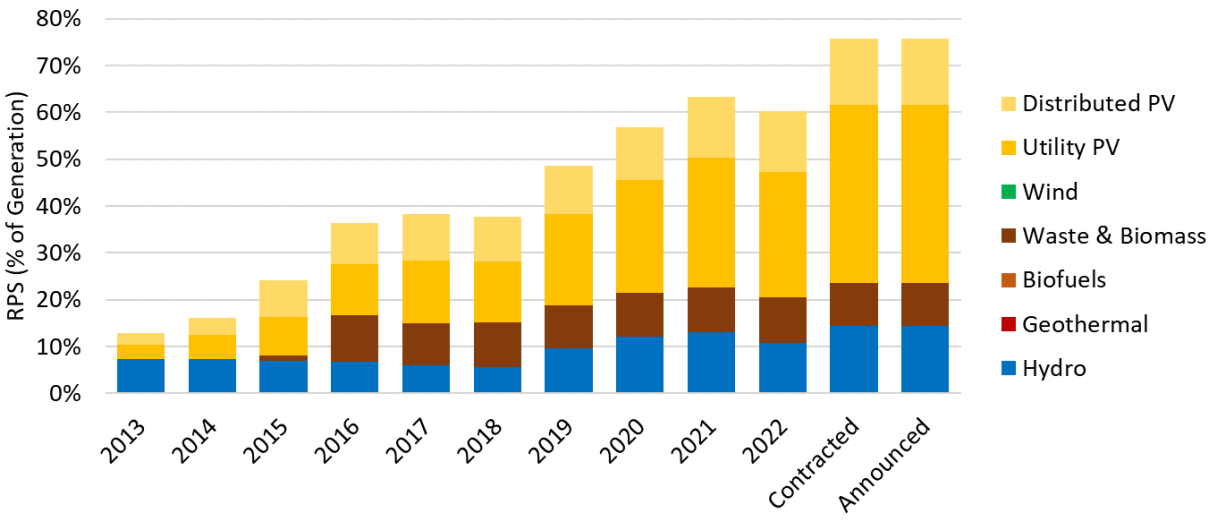


Figure 10. KIUC historical RPS by renewable fuel type.

HECO

Figure 11, shown previously, summarizes the history of the HECO companies renewable generation percentages by resources from 2013 through 2022, and presents a projection of future RPS based on currently contracted agreements. This projection includes awarded Stage 1 and Stage 2 projects that have not been canceled as of December 2023. It does not include the Hu Honua biodiesel project on the Big Island. Variable renewable resources currently being tendered in the Stage 3 procurement are shown in the "announced" column. While it does not explicitly include a year, it is based on a projected load growth out to 2025 based on continuation of recent trends. The figure shows that the expected growth is primarily from contracted utility-scale solar PV + storage projects and continued growth in distributed, rooftop PV.

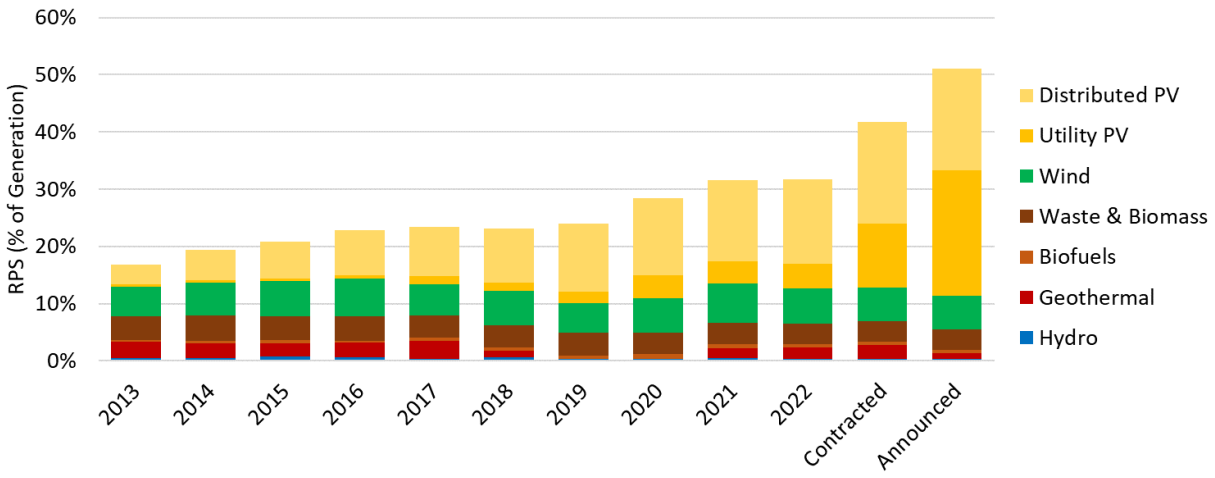


Figure 11. Renewable generation percentages by resource for HECO Companies.

Table 5 summarizes the current status of the Stage 1 and Stage 2 projects, which shows that a number of projects have been cancelled. Projects have been subject to several contingencies, including obtaining necessary permits, supply-chain issues, successful financing, and project implementation. Assuming that the current under construction (non-cancelled) projects come online, HECO will very likely achieve 40% RPS requirement early. However, the attainment of 40% RPS by 2030 is contingent on the potential for additional project cancellations and to a lesser extent on the amount of load growth between now and 2030 (driven in part by EV adoption).

Table 5. Recent status of approved Stage 1 and 2 (as of December 2023, shown in MW).

	Oahu	Maui	Big Island	Total
Operating	75	0	30	**105**
Construction	144	60	30	**234**
Canceled	208	115	120	**443**
Total	**426**	**175**	**180**	**781**
Standalone Batteries**	185	40*	12*	**237**

**Awaiting PUC approval*

***Standalone batteries are largely for grid services and will not significantly impact RPS*

While load growth could negatively impact HECO's ability to achieve 40%, several factors are in favor of it being met. These include continued growth of rooftop solar PV additions and CBRE solar. The recently announced Phase 2, Tranche 1 CBRE Final Award Group projects include another 52 MW of solar PV across the five islands of the HECO service territory[5]. However, there

[5] HECO Renewable Project Status Board, https://www.hawaiianelectric.com/clean-energy-hawaii/our-clean-energy-portfolio/renewable-project-status-board, accessed December 2023.

has been concern raised by technology providers that that the tariff-based approach that is being used for CBRE projects is not working well. One comment focused on the fact that the majority of CBRE projects currently under development were led by one developer.

Additionally, while the loss of the PGV facility on Hawaii island reduced HECO's near-term RPS by more than 3%, this facility is now back online. A proposal to increase its capacity to 60 MW requires an Environmental Impact Statement (EIS), which is now undergoing review and comment. Responses to all substantive public comments to the Draft EIS are being reviewed by PGV. PGV's review of the Final EIS is anticipated to be completed by around the end of December.

The largest potential addition of renewable energy is expected to come from the Stage 3 competitive solicitation currently underway by HECO. Selected projects were announced in December 2023 and proposed to be in service by 2030. As shown in Table 6, the proposed Stage 3 is larger than Stage 1 and Stage 2 combined. This request also includes specifics on the need for firm power renewable resources. Uncertainty in load growth could reduce the percentages some, but assuming a portion of these projects come online by 2030, HECO will easily meet or exceed its 40% RPS requirement, even with increasing load.

Table 6. HECO Stage 1-3 procurement summary.

	Oahu	Maui County	Big Island	HECO Total
Stage 1 & 2 (GWh)*	479	131	131	741
Stage 3 (GWh)**	451	175	440	1,067
Total Stage 1-3 (GWh)	**930**	**307**	**572**	**1,808**
Stage 1-3 RPS (% of expected 2025 Generation)***	12%	21%	41%	17%

**Excludes canceled projects.*

*** Based on December 2023 announced projects, excludes firm renewable projects and PPA extensions.*

****2025 generation is estimated based on extrapolation of recent historical growth rates.*

Statewide Summary for 2030

KIUC and HECO have both outlined their plans for future development over the next few years. Given these plans and as illustrated in Figures 12 and 13, it appears reasonable that the state will achieve its RPS goal of 40% by 2030. This assumption must be caveated by the concern that recent events have demonstrated that there can be significant delays and cancellations that were unanticipated when plans were developed and contracts were awarded.

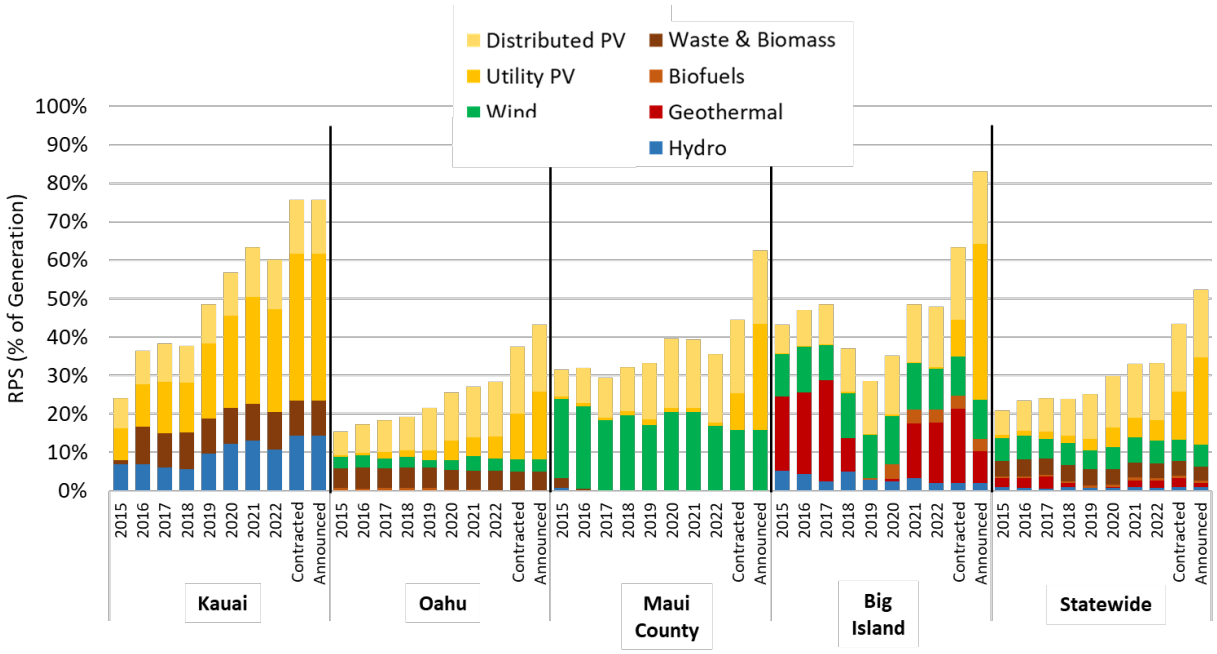


Figure 12. Projected RPS attainment, assuming completion of contracted projects. (Note: the "announced" column includes proposed Stage 3 variable renewable projects which do not yet have regulatory approval)

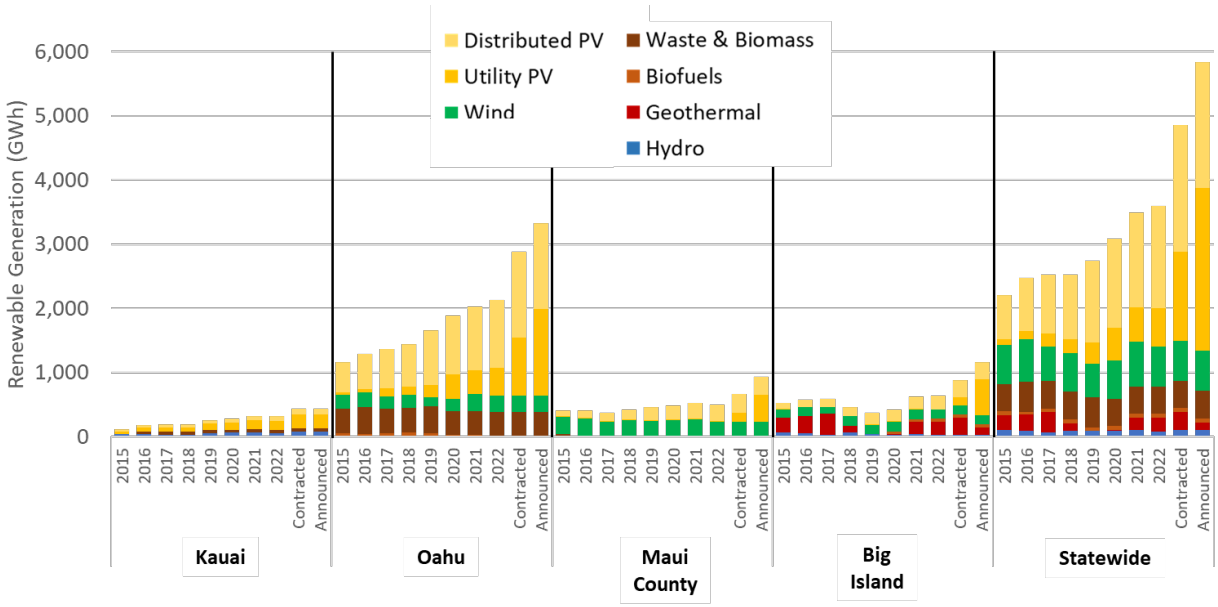


Figure 13. Projected RPS generation, assuming completion of contracted projects. (Note: the "announced" column includes proposed Stage 3 variable renewable projects which do not yet have regulatory approval)

Section 6. Challenges and Considerations in Achieving Future RPS

The findings of this report indicate that 40% RPS target for 2030 is achievable for Hawaii's electric utilities. However, there are technical, regulatory, economic, and societal challenges that will need to be monitored, evaluated, and addressed leading up to and beyond 2030. If unmitigated, these challenges could limit the ability to achieve RPS targets, especially at higher load levels and with increased electrification of transportation.

Since there is no specific goal for the upcoming five-year mark (2025), this report has included some observations on the ability of the state and its utilities to reach goals beyond 2030. Due to substantially greater uncertainty, this report does not make a determination on the achievability of the 2040 and 2045 RPS requirements of 70% and 100%, respectively. Research conducted by HNEI and HECO's Integrated Grid Plan (IGP) process show that reaching the 70% RPS by 2040 is technically feasible and likely cost effective using current commercially available technologies. However, non-technical challenges like land use, community acceptance, and the pace of development will likely determine success or failure to meet the 70% RPS. As a result, it is appropriate to highlight several challenges described below in order to illustrate key considerations for further legislative, regulatory, research, and development activities.

The longer timeframe beyond 2030 presents uncertainties regarding the amount of growth in electricity demand. The amount of required renewable resources depends on future economic, legislative, and technology trends. These higher percentage goals are further exacerbated by the desire to "electrify everything" as the most effective way to achieve cross-sector, statewide emissions reductions. With proposed conversion of ground transportation from gasoline internal combustion engines to electric vehicles, further electrification of buildings and industries, and electrification of industrial processes, it is estimated that electricity load on Oahu could be between 30 and 60% greater in 2045 than the 2022 levels,[6] although there is considerable uncertainty in that forecast. Additionally, there will be continued efforts to improve energy efficiency that will lead to reduced electricity needs, thus increasing the percentage of renewable energy towards the RPS. Lastly, increased utilization of demand response, primarily in the form of better utilization of customer-owned storage systems will change the profile of electricity use.

[6] Hawaiian Electric Company, *Integrated Grid Plan, Appendix B, Forecasts, Assumptions and Modeling Methods* pg. B-25, https://hawaiipowered.com/igpreport/05_IGP-AppendixB_ForecastsandAssumptions.pdf.

Better utilization of demand response and load flexibility may be assisted by the HECO Companies' battery bonus and distributed energy resource programs.

Grid Integration Challenges

Managing Weather Variability

Most of the economic existing and proposed renewable generation projects are variable generation resources – producing energy only when the energy source (e.g., wind or sun) is available and susceptible to both ramping and extended periods of unavailability. Hawaii's grid operators must manage variability of both electricity demand as well as supply from variable resources. The grid must balance generation and load at all times, and grid operators must ensure that the grid is carrying adequate reserves to cover anticipated and/or unexpected drops of wind and solar generation.

The decreasing cost and technical maturity of battery energy storage resources have mitigated much of the variability concern. New battery storage can mitigate short-term fluctuations in wind and solar output and help shift surplus renewable energy to high load periods. However, current 4-hour duration battery storage is insufficient to cover multi-day low wind and solar events. There is growing concern over longer-term variability and unavailability that cannot be mitigated by current short-duration battery technology. For example, longer term weather patterns – such as "40 days of rain in 2006," and/or extended periods of Kona winds – may require continued use of firm power supplies. This is illustrated in Figure 14.

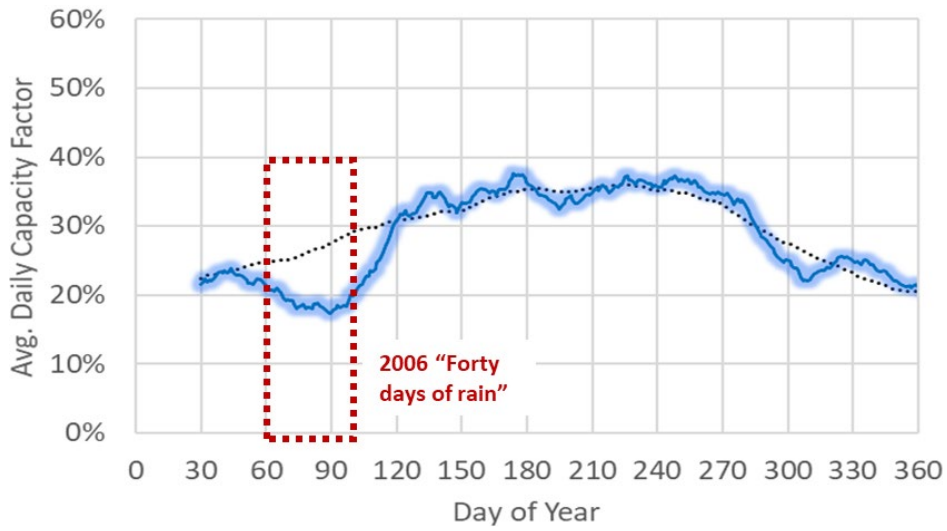


Figure 14. Average daily capacity factor during 2006 – year of "40 days of rain." (Note: The dotted line represents a 21-year average. Blue line represents two-week rolling average in 2006, with the "40 days of rain" occurring approximately between days 60 - 100.)

Other potential reliability events, such as the Kona low in December 2008 (Figure 15), suggest that research and development of grid integration technologies must continue as the management of grid operations becomes more complex as the percentage of variable renewable generation increases. Enabling technologies, such as energy storage and demand response, coupled with system operational experience will be increasingly important as the State develops additional mechanisms to better integrate more variable renewable resources.

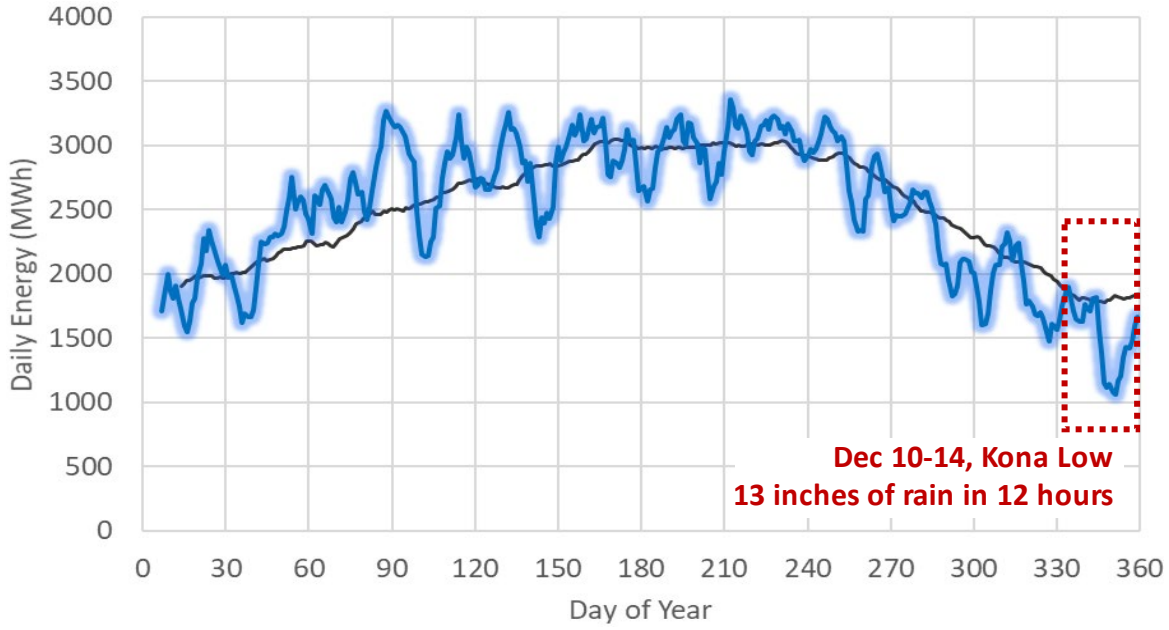


Figure 15. Historical low solar event (December 2008) on a future Oahu power system. (Note: The black line represents a 21-year average. Blue line represents one-week rolling average in 2008.)

Low Inertia and Inverter Based Resources

Wind, solar PV, and battery energy storage technologies are all inverter-based resources (IBRs). IBRs interact differently with the grid as compared to conventional technologies. IBRs utilize inverters to interface with the grid and the dynamics of that interaction are determined by the inverter controls software. In contrast, oil-fired generation and other thermal technologies (biomass, biodiesel, etc.) are synchronous generation and the interaction is based on the physics of the rotating generator and turbine.

The shift to increasing penetration of inverter-based generation changes the way the power grid is managed, particularly related to grid stability during and after grid disturbances. These disturbances can be caused by generator trips (supply dropping offline unexpectedly), load trips, or transmission faults. If inverter controls are not designed and implemented properly, grid

stability can be jeopardized. In order to maintain system frequency and voltage, avoid load shedding, and potential grid collapse, the grid needs to quickly respond to restore balance between generation and load. These challenges are a top concern and area of research for the international power system community, but its effects are more pronounced in Hawaii. The Hawaii power grid is made up of six isolated, low inertia power grids. The share of IBR generation and the disproportionate impacts of disturbances make grid stability a more discernible, near-term concern.

Mitigating risks to grid stability is done through several mechanisms that vary in time of response and in duration of response. With increased wind and solar penetration, fossil generation is being displaced and as a result, synchronous inertia is reduced. This subsequently causes the speed at which the system becomes unbalanced (rate of change of frequency) to increase. In order to maintain system stability, a faster response (fast frequency response) will be required either via additional synchronous inertia, frequency responsive wind, solar PV, and loads, or battery energy storage.

Currently HECO is advancing, and requiring, the use of Grid Forming Inverters (GFM) for all new solar and battery storage projects. While most currently in-service IBRs use "Grid-Following Inverters" (GFL), newer GFM technologies have been shown to provide better inherent mitigation of grid stability risks, particularly in low inertia or microgrid applications. These advanced inverter controls are currently being provided by leading OEMs, but the technology is new and definitions, grid codes, and requirements are still being developed internationally. While it is anticipated that grid forming capability will advance, it poses uncertainty for future RPS attainment.

Transmission and Distribution Constraints

Distribution System Capacity and Integration of Distributed Energy Resources

While the grid is able to accommodate additional solar PV generation in some areas, there are local, distribution-level constraints that could limit the further adoption of distributed PV in some locations. Additional solar PV generation on some individual circuits is likely to require additional interconnection studies and/or upgrades. This is a concern because in 2022, 46.6% of renewable generation is customer-based, and is expected to continue to grow.

It is likely that distribution system upgrades will be required to meet the utilities' safety standards. The development and deployment of grid forming inverters may provide some solution to improving impacts to distribution systems. However, communication protocols will need to be developed on a system-wide basis. Improved siting of storage systems on distribution systems may provide a partial solution. This may become increasingly important as load-shifting technologies and procedures will be required in the future.

Experts suggested that the CBRE initiative be re-evaluated to better engage communities in addition to developers. Additionally, consideration needs to be given to ensuring that the outcomes for CBRE developments are economic for both the communities and the utility.

Transmission Interconnection

Since recent utility-scale renewable generation has been sufficiently close to existing transmission lines, there has been no need for substantive upgrading of transmission or for the development to of new transmission lines. However, current interconnection capacity is becoming more limited. It is very likely that future utility-scale renewable energy development will require either transmission line upgrades (reconductoring) or development of new transmission lines both for interconnection and deliverability to load centers. This need will increase the cost of development, may require additional land for new transmission lines, and will, in all likelihood, lead to another level of community opposition.

In the Integrated Grid Plan, HECO has developed Renewable Energy Zones (REZs) across each island, identifying the potential areas of new renewable energy development and the required transmission upgrades necessary to "unlock" the renewable potential in each region. An example of the REZ in 2030 is provided for Oahu in Figure 16. Additional analysis is needed to understand incremental transmission additions required for near-term projects and the evaluation of Grid Enhancing Technologies (GETs) that could potentially defer or reduce the need for new transmission.

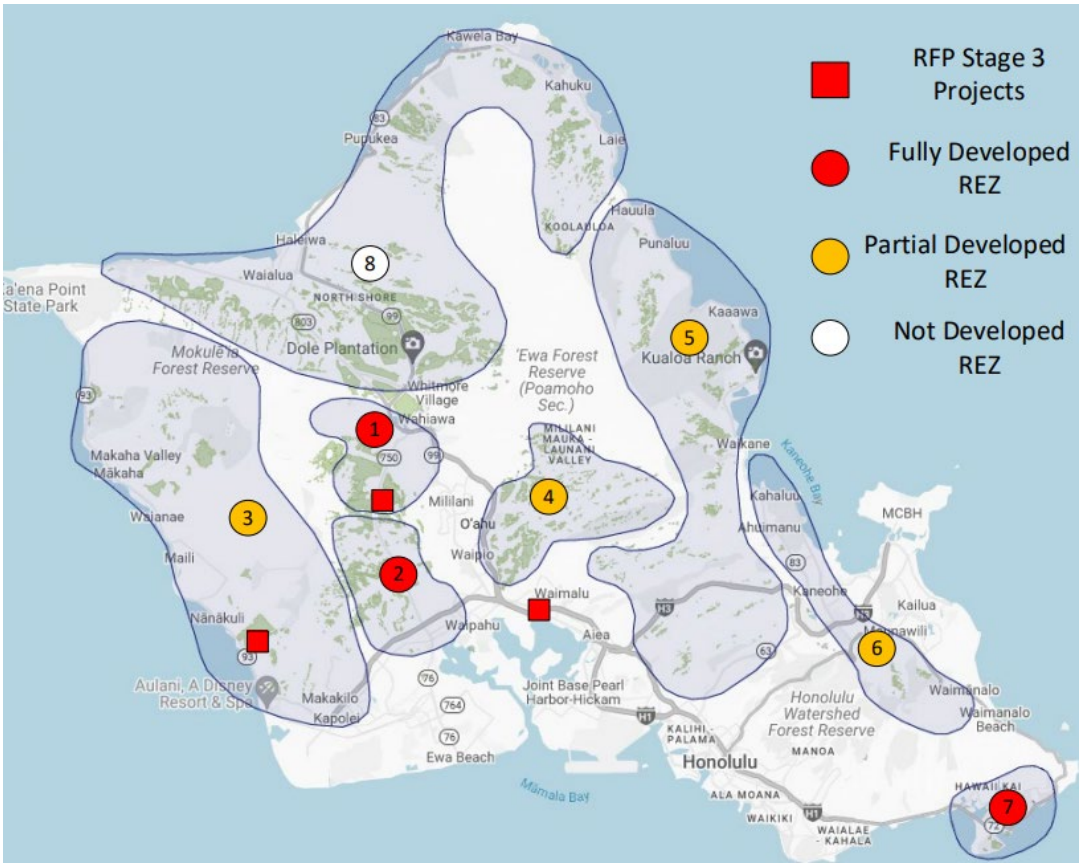


Figure 16. 2030 Oahu Renewable Energy Zones. (Source: HECO Integrated Grid Plan, pg. 140.)

Land Use and Community Acceptance Challenges

Siting, Permitting, and Land Constraints 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, cultural concerns, and competing local agriculture and affordable housing objectives is more limited.

Land availability, particularly for Oahu, is likely to become a considerable impediment for adding a significant amount of utility-scale renewable energy resources. Because 70% of the state's electricity load is located on Oahu, land use concerns are significant. A state-based coordinated approach for better management of land and competition for different uses of land is needed. Some experts believe that utility-scale solar farms can be sited on significantly sloped land. However, other independent power producers believe that trying to place solar farms on such

land will be very difficult and costly. Among other possibilities, interaction with Department of Hawaiian Homelands and the military must be factored into potential solutions for expanding land availability.

There will also need to be better cooperation between state and local authorities for expeditiously permitting approved projects. Some projects in HECO Companies' Stage 1 and Stage 2 developments have been delayed, in part, due to delays in permit applications and approval. These issues, coupled with some national developers' reluctance to work in Hawaii or with the utility, may create issues in being able to obtain the lowest cost solutions for future renewable energy development.

Community Acceptance and Equity

The achievability of the longer-term RPS requirements depends on public acceptance. While the state's residents, are in general, supportive of local, renewable energy, there is often considerable opposition to specific projects. Impacted community concerns must be addressed regarding how construction of future renewable generation projects will affect them. This can be a key uncertainty in determining 2030, 2040, and 2045 RPS achievability. Better mechanisms must be developed for engaging impacted communities, including improved methods for developing public outreach and related educational programs. The Stage 3 projects solicited by HECO are required to provide $3,000/MW of benefits to local communities that will be impacted by utility-scale renewable energy development. However, it remains uncertain as to how impacted communities and their residents will respond to these enticements. Additionally, determination of how these funds might be used to benefit the community is uncertain.[7]

An additional issue, which is now being addressed by the Commission's proceeding to investigate equity (Docket # 2022-0250) is the impact to grid modernization on low and middle income (LMI) households, among other topics. The outcome of these deliberations could lead to changes for future siting and development of utility-scale renewable projects.

[7] See Ulopono Initiative, *Let communities decide: Using participatory budgeting for renewable energy community benefits packages*, January 2023, https://ulupono.com/media/4c1phrv0/pb-for-community-benefits-packages-jan-2023.pdf.

Project Development Challenges

Cost and Supply Chain Uncertainty

The capital costs for equipment, construction, and labor have increased for all new power projects, including renewables. This is due to inflation and global supply chain disruptions. Financing costs have also increased due to federal interest rate increases. These rising costs may be exacerbated by the downgrading of HECO's credit rating following the Lahaina fire. The longer-term uncertainty of how the Lahaina fire may have unintended consequences on HECO's financial well-being can lead to rising costs, according to a number of experts. While federal incentives in the IRA and improving technology help reduce the cost of new technology, these other factors may offset these cost declines. Thus, it should be expected that future costs of renewable energy development may increase above historical norms, especially in near-term solicitations.

Project Delays and Cancellations

HECO Companies Stage 1 and Stage 2 projects experienced significant delays and cancellations across almost all projects/developers. Much of this was due to COVID, supply chain disruptions, and cost increases, but failure rates should be considered in future procurements. Experts have pointed out that perceived difficulty in working with the utility leads to some winning bidders backing out of their agreements, sometimes leading to other entities taking over these projects, sometimes with higher costs.

Increasing Load Challenges

Increased Electrification

The state GHG emissions goal is to be zero by 2045. Currently, the most direct way to reduce the State's GHG emissions is to "electrify everything." While electrification of transportation, buildings (cooking and heating), and industrial and commercial sectors is a viable path for GHG reduction in those sectors, the amount of electricity that is needed to service these sectors would increase substantially. Because the RPS is a function of the total generation, the amounts of renewable generation would increase proportionally to achieve a given RPS goal. Given the practical constraints, such as community acceptance, transmission, and land use, the RPS will be harder to achieve with the electrification of these other sectors.

Energy Efficiency

One possibility for improved RPS is more aggressive use and development of energy efficiency technologies and policies. In 2008, HCEI originally proposed that 40% of the improvements in reaching 2030 would be obtained with energy efficiency. Significant advances have been made since then, but more is needed. Possible areas could include better mechanisms for subsidizing building energy use of energy efficient air conditioning, water heating, and other appliances. This would not only improve RPS values, but judicious use of subsidies could support low- and middle-income households in lowering their energy costs.

Future Uncertainties

Optimal Resource Mix

The RPS provides timelines for the installation and use of specific amounts of renewable generation 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 economic delivery of electricity. One concern that has been raised is the current push by the legislature to constrict where technologies, such as wind, should be located. The potential impact of new legislation may make it more difficult to achieve RPS requirements. Providing the necessary analysis, planning, and regulatory guidance to develop an optimal resource mix that best meets State energy objectives, is a challenge that requires the collaboration of many stakeholders, including the utilities and the Commission. The Commission must retain the ability to approve the integration of new systems and technologies into the grid, such as advances in communications and information technologies that can support more efficient management of grid operations.

Uncertainties Associated with New Resources and Technologies

HNEI's analysis, consistent with IGP planning, indicates that the 2040 RPS goal of 70%, or even more, is technically achievable with currently available technologies, although other issues, such as land availability and community acceptance, may make this achievement difficult. HNEI has conducted additional analysis, which indicates that significant amounts of dispatchable firm capacity will be required to ensure resource reliability needs are met, even when accounting for large deployment of battery energy storage. This analysis is consistent with analysis conducted

by HECO using other methodologies. These firm resources would be run sparingly, but would be critical for reliability during multi-day periods of low wind and solar production. HNEI's analysis simulated HECO's future wind and solar resource mixes across 23-years of historical weather variability and under these circumstances, battery storage systems at today's durations would not be sufficient to maintain reliability.

The HECO Companies identified a grid need for up to 400 MW of off-shore wind power in the IGP. No offshore wind was selected under Stage 3. While offshore wind may offer a solution to land constrained development, it is another variable generation source and therefore will not provide the dispatchability needed to ensure grid reliability. Additionally, the financial, aesthetic, permitting, and cultural issues involving the development of this technology are not fully understood. Other emerging technologies, such as ocean thermal energy conversion (OTEC) and enhanced geothermal, could potentially support firm dispatchable needs, but they have not, to date, been demonstrated at the scale required. Renewable hydrogen and long-term storage may reduce the firm capacity needs, but are unlikely to eliminate it entirely.

Biofuels are often identified as a solution to provide the final increment of dispatchable firm power, but availability at reasonable cost from certified sources remains uncertain. Continued research and development is needed to bring down the cost and increase the availability of firm power renewable resources in order to meet 2045 goals.

Life-Cycle Emissions

In response to a request by the Commission, HNEI conducted an extensive literature review which examined life-cycle emissions for various energy technologies and resources used (or potentially planned to be used) in the state. Additional analyses were conducted to evaluate the life-cycle emissions for solar + storage systems operating in Hawaii.

Wind and geothermal were found to be the least emitting, with median calculated emissions being about 11 grams of carbon dioxide equivalent per kwh. For solar with battery storage, configured similarly to today's utility projects, the median value based on type of lithium-ion battery ranged from 84 to 113 grams of carbon dioxide equivalent per kwh. Even when mining, material processing, manufacturing, and shipping of these systems is considered, the life-cycle analysis (LCA) GHG emissions remain far below the burning of fossil fuels. While there is considerable debate regarding biomass and biofuels, the predominance of the literature indicates that managed growth of forest for fuels can significantly reduce GHG emissions compared to the

mining and use of fossil fuels. Emissions from biofuels are significantly more complex. Biofuels without additional carbon capture can still reduce GHG emissions compared to fossil fuels, but depends on crop, inputs for harvesting, and processing. The reductions are typically less than the other technologies discussed here. Since climate change is a global problem, the LCA of biofuels must be carefully examined on a case by case basis. Imported biofuels with large overall life-cycle carbon dioxide emissions does not support climate change initiatives, even if these would reduce Hawaii-based emissions.

Climate Uncertainty

A number of experts in Hawaii believe that managing the reduction of greenhouse gas emissions is more important than pushing for specific RPS goals. Despite the state's goals, Hawaii is in the top 10% of states with regards to emissions per capita. Uncertainty due to changes in weather patterns must continue to be factored into any overall grid planning and evolve with the changing landscape. As the potential for hurricanes hitting the state increases, addressing grid resiliency must be factored into adding more variable renewables to the grid. Additionally, as the August 2023 Maui wildfires have demonstrated, the utilities must be in a better position for addressing risk factors for their infrastructure. Finally, sea level rise may require modification as to where future and even existing facilities are located. Thus, resilience, siting, and utility liability are issues that must be addressed in future planning.

Section 7. Summary

This Report presents findings regarding the effectiveness and achievability of the existing RPS requirements, while recognizing that there is uncertainty regarding the RPS targets after 2030. The existing RPS targets remain appropriate and effective at promoting the implementation and operation of renewable generation resources and are achievable based on currently available information. Several principal findings in this Report include:

- Achievement of the 2030 RPS requirement of 40% is likely for the Hawaiian Electric Company (HECO) service territory, which includes Oahu, Maui County, and the Hawaii Island ("Big Island"); and is essentially certain for the Kauai Island Utility Cooperative (KIUC). As of 2022, KIUC and Hawaii Island have already achieved the 2030 goal.
- Based on current plans for the PUC approved Stage 1 and Stage 2 solar + storage projects, the HECO territory is expected to reach the 40% by 2030. However, force majeure and related supply chain issues have created problems for Stage 1 and Stage 2 projects. If these issues continue, it could create problems in achieving the 40% mandated goal. Additionally, the recent Lahaina wildfires and cancellation of four out of five Stage 1 and Stage 2 projects (66% of proposed capacity on Maui) could potentially impact the pace of new renewable energy generation on Maui.
- The RPS has led to a substantial reduction of greenhouse gases (GHGs) being emitted by the electricity sector. However, GHGs have not diminished significantly in other sectors (transportation, buildings, etc.) as much as the Hawaii Clean Energy Initiative (HCEI) originally projected.
- Increasing electric loads from electric vehicle adoption will make it more difficult to achieve the RPS targets in the future, but will ultimately benefit statewide emissions.
- The costs of renewable energy projects under development and recently proposed in Hawaii are expected to remain comparative to or below costs of oil-fired generation – making renewable projects cost-competitive alternatives compared to continuing to utilize fossil fuel generation resources.
- Initial analysis by HNEI to explore the ability to integrate solar + storage or solar/wind and storage suggests that reaching the 70% RPS target by 2040 is feasible and likely cost effective with current technologies. However, land use restrictions, community acceptance, and transmission will pose challenges and need to be carefully managed.
- The RPS remains effective in helping the State achieve its policies and objectives with respect to developing renewable energy resources in Hawaii.

The Commission will continue to take steps to investigate 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 remains effective and achievable and whether the RPS requirements need to be amended. The Commission will continue to report findings to the Legislature every five years.

Section 8. Appendix

Appendix A: KIUC Letter to the PUC dated May 4, 2023

Kaua`i Island Utility Cooperative
Your Touchstone Energy® Cooperative

May 4, 2023

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

Re: Docket No. 2007-0008 – In the Matter of Public Utilities Commission Instituting a Proceeding to Examine Hawaii's Renewable Portfolio Standards Law, Hawaii Revised Statutes ("HRS") §§ 269-91 – 269-95, as Amended by Act 162, Session Laws of Hawaii 2006: Kauai Island Utility Cooperative's ("KIUC's") 2022 Annual Renewable Portfolio Standards ("RPS") Status Report

Dear Commissioners and Commission Staff:

Please find enclosed KIUC's Annual RPS Status Report for the year ending December 31, 2022 ("2022 RPS Report").

As shown in the attached 2022 RPS Report, renewable energy resources supplied 60.2% of KIUC's net electricity generation during the 2022 calendar year. This exceeds the requirement of 30% by 2020 and 40% by 2030, to be achieved by each electric utility as established by HRS § 269-92(a), as amended.

The attached 2022 RPS Report also includes a breakdown of the renewable energy resources on Kauai comprising the 60.2% RPS for 2022 and the 2021 RPS pre-HB2089 and post-HB2089, which amended the definition of "renewable portfolio standard" to mean a percentage of electrical energy generation, rather than sales, excluding customer-sited fossil fuel generation. Also included in said report is a discussion of KIUC's commitment to continue to increase the growth of renewable energy on Kauai.

The power of human connections®
4463 Pahe`e Street, Suite 1 • Lihue, Kaua`i, HI 96766-2000 • (808)246-4300 • www.kiuc.coop

The Honorable Chairman and Members of the
Hawaii Public Utilities Commission
Page 2

We thank you for your consideration of this matter. If you should have any questions concerning this report, please call me at (808) 246-8289.

Very truly yours,

Brad W. Rockwell

Brad W. Rockwell, P.E.
Chief of Operations

Enclosure

cc: Kent Morihara
Consumer Advocate
Mr. Joseph Viola
Mr. Dean Matsuura
Peter Kikuta., Esq.
Craig I. Nakanishi, Esq.
Mr. David Bissell
Mr. Henry Q. Curtis

Kauai Island Utility Cooperative
Renewable Portfolio Standards (RPS) Status Report
Year Ending December 31, 2022

Pursuant to Hawaii Revised Statutes § 269-92, the Renewable Portfolio Standard ("RPS") requirement, as a percentage of net electricity *sales*, for year 2020 is 30%. The RPS requirement, as a percentage of net electricity *generation*, for year 2030 is 40%, for year 2040 is 70%, and for year 2045 is 100%.

Kauai Island Utility Cooperative (KIUC) achieved an RPS percentage of 60.2% of net electricity generation for calendar year 2022, which exceeds the requirement of 30% by 2020 and 40% by 2030.

KIUC met the electrical energy needs of its customers with a combination of Company-owned fossil fueled generation, Company-owned renewable generation, and both non-firm and firm renewable power purchases.[1] 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. As of January 1, 2015, these sources are no longer counted toward KIUC's RPS.

Electrical energy generated using renewable energy as the source totaled 317,877 megawatt-hours (MWh) for 2022. Exhibit A, attached hereto, illustrates how KIUC met the energy needs of its approximately 35,000 accounts.

KIUC Future RPS Activities

While KIUC has already exceeded the 2020 and 2030 RPS goals of 30% and 40%, respectively, 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 December 30, 2020, KIUC signed a PPA with AES Clean Energy for the purchase of capacity and energy from a new solar, battery, pumped storage, and hydroelectric facility to be located on State land on the west side of Kauai. The Commission approved the PPA on December 1, 2021 but start of construction has been delayed due to pending litigation. This facility, given a full year of production, is expected to increase KIUC's annual RPS by twenty

[1] KIUC has twelve power purchase contracts with Gay & Robinson (G&R) (hydro), Brue Bakol Capital Partners (hydro), Kekaha Agriculture Association (KAA) (hydro), Kapaa Solar (solar), Kaieie Waho Company (solar), MP2 Hawaii (solar), KRS2 Koloa (solar), KRS1 Anahola (solar), Dom Solar Lessor / Tesla (solar and storage), AES Lawai (solar and storage), AES Kekaka (solar and storage), and Mahipapa (biomass).

percentage points (i.e. to 80%), although this depends heavily on future electric sales growth.

2. On November 30, 2022 KIUC signed a biodiesel fuel supply agreement with Pacific Biodiesel Technologies. The Commission approved the fuel supply agreement on an interim basis on March 24, 2023. This agreement is expected to increase KIUC's annual RPS, albeit very slightly (i.e. less than one percentage point) due to the limited nature of the agreement.

Kauai Island Utility Cooperative
Renewable Portfolio Standard (RPS) Status Report
Year Ending December 31, 2022
EXHIBIT A

Electrical Energy Generated Using Renewable Energy Sources	2022	2021 post-HB2089*	2021 pre-HB 2089*
Biomass	51,555	48,479	46,019
Hydro	56,421	64,807	61,518
Photovoltaic (PV)	141,770	138,251	131,235
Customer-Sited, Grid-Connected PV	68,131	64,649	63,444
Total Renewable Electrical Energy	317,877	316,186	302,217
Total Electrical Energy Generation (Sales for 2021 pre-HB 2089)	527,924	499,413	435,156
RPS Percentage	60.2%	63.3%	69.5%

* H.B. 2089 of 2022 amended the RPS to be based on net electricity generation rather than sales. Prior to HB2089, net electricity generation was reduced by system losses in order to correlate to net electricity sales.

"Renewable portfolio standard" means the percentage of electrical energy generation that is represented by renewable electrical energy, excluding customer-sited, grid connected generation that does not produce renewable energy

Appendix B: HECO Letter to the PUC dated February 17, 2023

February 17, 2023

The Honorable Chair and Members of the
Hawai'i Public Utilities Commission
465 South King Street
Kekuanao'a Building, First Floor
Honolulu, Hawai'i 96813

Dear Commissioners:

Subject: Docket No. 2007-0008
Renewable Portfolio Standards Law Examination

In accordance with Decision and Order No. 23912 and the Framework for Renewable Portfolio Standards, issued December 20, 2007, attached is the Renewable Portfolio Standard Status Report for the year ended December 31, 2022 for Hawaiian Electric.[1]

Sincerely,

/s/ Kevin M. Katsura

Kevin M. Katsura
Director, Regulatory Non-Rate Proceedings

c: Division of Consumer Advocacy
R.J Hee/T. Blume
H. Curtis

[1] "Hawaiian Electric" or "Company" refers to Hawaiian Electric Company, Inc., Hawai'i Electric Light Company, Inc., and Maui Electric Company, Limited. On December 20, 2019, the State of Hawai'i Department of Commerce and Consumer Affairs ("DCCA") approved Hawaiian Electric Company, Inc., Hawaii Electric Light Company, Inc. and Maui Electric Company, Limited's application to do business under the trade name "Hawaiian Electric" for the period from December 20, 2019 to December 19, 2024. See Certificate of Registration No. 4235929, filed December 20, 2019 in the Business Registration Division of the DCCA.

Hawaiian Electric PO BOX 2750, HONOLULU, HI 96840-0001

2022 Renewable Portfolio Standard Status Report

Hawaiian Electric
For the Year Ended December 31, 2022

This report was prepared pursuant to the Framework for Renewable Portfolio Standards, which was adopted by the Hawai'i Public Utilities Commission ("Commission") in Docket No. 2007-0008.[1]

Pursuant to Hawai'i Revised Statutes § 269-92, the Renewable Portfolio Standard ("RPS") requirement for year 2020 is 30%, 2030 is 40%, 2040 is 70%, and 2045 is 100%. In July 2022, Governor Ige signed Act 240 (H.B. 2089) that amended the RPS calculation from renewable energy as a percentage of sales to renewable energy as a percentage of total system generation. The new calculation of RPS includes total generation, including generation from private rooftop solar, in the denominator, and total renewable generation, including generation from private rooftop solar, in the numerator. The previous calculation included electric sales in the denominator, which did not include renewable generation from private rooftop solar. The change in definition causes a lower RPS under the amended definition. The 2022 RPS under the amended and previous definition is provided in Figure 1.

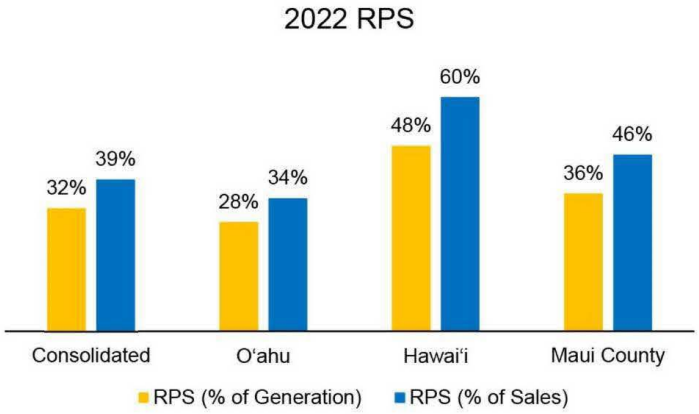


Figure 1: RPS by service territory, amended versus previous RPS definition

Because private rooftop solar represents a significant portion of the renewable generation portfolio, the RPS under the new definition is lower compared to the RPS

[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).

Hawaiian Electric

reported in previous years. However, the Company continues to comply with the RPS requirement.

Figure 2, below, shows Hawaiian Electric's historical RPS progress under the new definition.

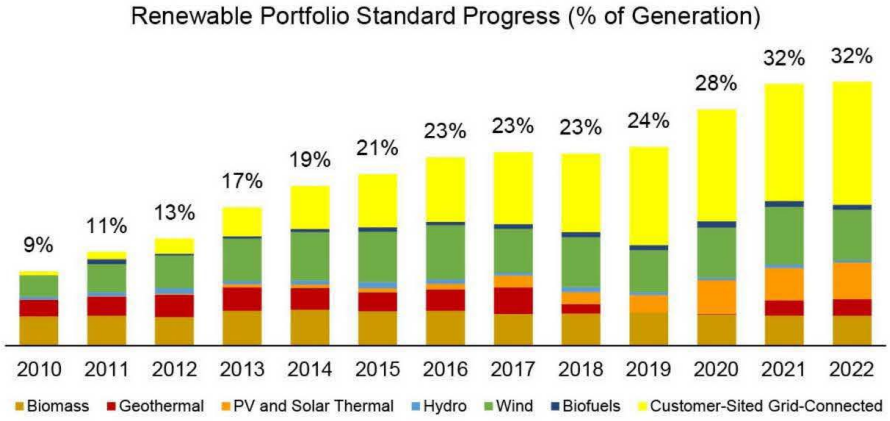


Figure 2: Renewable Portfolio Standards Under Amended Definition

In 2022, Hawaiian Electric achieved a consolidated RPS of 31.8%. In accordance with present RPS guidelines, this RPS does not include the electrical energy savings from energy efficiency and solar water heating technologies and is calculated as a percentage of total system generation.[2, 3] The 31.8% RPS was achieved through use of diverse renewable energy resources (biomass, geothermal, photovoltaic, hydro, wind, and biofuels) and customer-sited, grid-connected technologies (primarily private rooftop solar systems).

The O'ahu, Hawai'i Island, and Maui County systems achieved 28%, 48%, and 36% RPS, respectively.

[2] On April 25, 2011, Act 010 Relating to Renewable Portfolio Standards was signed into law. Act 010 provided that, as of January 1, 2015, electrical energy savings from energy efficiency and solar water heating technologies do not count towards calculating RPS. It also amended the definition of "renewable electrical energy" to include, beginning January 1, 2015, customer-sited, grid-connected renewable energy generation.
[3] On July 5, 2022, Act 240 Relating to Renewable Portfolio Standards was signed into law. Act 240 provided that "renewable portfolio standard" means the percentage of electrical energy generation that is represented by renewable electrical energy, excluding customer-sited, grid connected generation that does not produce renewable energy.

Hawaiian Electric continued to increase its renewable energy portfolio in 2022.

- Generation from grid-scale solar increased by 15% due to the 39 MW Mililani I Solar project achieving commercial operations in July 2022 and 36 MW Waiawa Solar project undergoing testing and commissioning in Q4 2022, achieving commercial operations in January 2023.

- New customer-sited energy resources (private rooftop solar), Community-Based Renewable Energy, and Feed-In Tariff installations totaled 40 MW. Generation from customer-sited, grid-connected resources increased by 7%.

- Geothermal production increased slightly this year as the Puna Geothermal Venture plant continues to return to full service.

- Wind production was down 11% compared to 2021; however, the 2022 wind production was within the range of historical wind production over the past decade.

In total, the electrical energy generated using renewable energy resources, including customer-sited, grid-connected technologies, resulted in a 3% increase compared to the previous year, which was partially offset by an approximate 2% increase in total generation (1% increase in electric sales) compared to 2021. Despite these offsetting changes to RPS, renewable generation continued to increase by 94,567 MWh in 2022, driven by the addition of new customer-sited and grid-scale resources.

In 2023, Hawaiian Electric expects to further increase the renewable energy provided to the system with commercial operations of additional grid-scale solar and battery energy storage projects, a full year production of the Waiawa Solar and Mililani Solar I projects, private rooftop solar additions, and continued progress on a return to full service of Puna Geothermal Venture.

2022 Renewable Portfolio Standard Status Report

Hawaiian Electric
For the Year Ended December 31, 2022
(In Net Megawatt Hours)

	2022				2021
	O'ahu	Hawai'i	Maui County	TOTAL	TOTAL
Electrical Energy Generated Using Renewable Energy Sources					
Biomass (including municipal solid waste)[1]	370,668			**370,668**	**366,365**
Geothermal[1]		208,346		**208,346**	**183,391**
Photovoltaic and Solar Thermal[1]	433,875	4,050	12,844	**450,769**	**390,353**
Hydro[1]		27,409		**27,409**	**43,050**
Wind[1]	249,766	141,301	234,849	**625,916**	**701,124**
Biofuels	16,256	46,292	566	**63,114**	**71,780**
Customer-Sited, Grid-Connected[2]	1,064,021	209,629	248,794	**1,522,444**	**1,418,036**
TOTAL	2,134,587	637,027	497,052	**3,268,667**	**3,174,100**
TOTAL GENERATION	7,559,608	1,330,718	1,394,862	**10,285,189**	**10,072,948**
RPS PERCENTAGE (% of Generation)	**28.2%**	**47.9%**	**35.6%**	**31.8%**	**31.5%**
TOTAL SALES	6,210,797	1,053,833	1,089,324	**8,353,955**	**8,261,103**
RPS PERCENTAGE (% of Sales)	**34.4%**	**60.4%**	**45.6%**	**39.1%**	**38.4%**

[1] Renewable electrical energy generation is based on recorded data from Feed-In Tariff contracts, Independent Power Producers that have Power Purchase Agreements with Hawaiian Electric, and Hawaiian Electric-owned grid-scale projects such as West Loch PV.

[2] Renewable electrical energy generation from customer-sited, grid-connected technologies is based on known system installations for 2022 including Net Energy Metering ("NEM") installations and non-NEM systems. 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 systems.

Hawaiian Electric

The foregoing document was electronically filed with the State of Hawaii Public Utilities Commission's Document Management System (DMS).

Appendix C: Stage 1, 2, and 3 Procurement Projects, as of December 13, 2023

Project Name	Procurement Stage	Status (12/13/2023)	Technology	Capacity (MW)	Estimated Additional Energy (GWh)
Variable Renewable Energy					
AES Kuihelani	Stage 1	Construction	Solar + BESS	60	131
AES Waikoloa Solar, LLC	Stage 1	Operating	Solar + BESS	30	66
AES West Oahu Solar, LLC	Stage 1	Construction	Solar + BESS	12.5	27
Hoohana Solar 1, LLC	Stage 1	Construction	Solar + BESS	52	114
Mililani I Solar, LLC	Stage 1	Operating	Solar + BESS	39	85
Waiawa Solar Power LLC	Stage 1	Operating	Solar + BESS	36	79
Hale Kuawehi Solar LLC	Stage 1	Construction	Solar + BESS	30	66
Paeahu Solar LLC	Stage 1	Canceled	Solar + BESS	15	33
Kapolei Energy Storage	Stage 2	Testing	BESS (standalone)	185	405
Kaukonahua Solar	Stage 2	Canceled	Solar + BESS	6	13
Keahole Battery Energy Storage	Stage 2	Awaiting PUC Approval	BESS (standalone)	12	26
Kupehau Solar	Stage 2	Canceled	Solar + BESS	60	131
Kupono Solar	Stage 2	Construction	Solar + BESS	42	92
Mehana Solar	Stage 2	Canceled	Solar + BESS	6.6	14
Barbers Point Solar	Stage 2	Canceled	Solar + BESS	15	33
Kahana Solar	Stage 2	Canceled	Solar + BESS	20	44
Kamaole Solar	Stage 2	Canceled	Solar + BESS	40	88
Mahi Solar	Stage 2	Canceled	Solar + BESS	120	263
Mountain View Solar	Stage 2	Construction	Solar + BESS	7	15
Puako Solar PV + Battery Storage	Stage 2	Canceled	Solar + BESS	60	131
Pulehu Solar	Stage 2	Canceled	Solar + BESS	40	88
Waena BESS	Stage 2	Awaiting PUC Approval	BESS (standalone)	40	88
Waiawa Phase 2 Solar	Stage 2	Construction	Solar + BESS	30	66
Waikoloa Village Solar + Storage	Stage 2	Canceled	Solar + BESS	60	131
Puuloa Solar	Stage 3	Proposed	Solar + BESS	6	13
Mahi Solar and Storage (Rebid)	Stage 3	Proposed	Solar + BESS	120	263
Makana La	Stage 3	Proposed	Solar + BESS	80	175
Kuihelani Phase 2 Solar	Stage 3	Proposed	Solar + BESS	40	88
Puu Hao Solar	Stage 3	Proposed	Solar + BESS	20	44
Kaheawa Wind 1 (PPA Extension)	Stage 3	Proposed	Wind	30	0 (PPA Extension)
Pulehu Solar & Storage (Rebid, smaller)	Stage 3	Proposed	Solar + BESS	20	44
Keamuku Solar	Stage 3	Proposed	Solar + BESS	86	188
Puako Solar	Stage 3	Proposed	Solar + BESS	60	131
Kaiwiki Solar	Stage 3	Proposed	Solar + BESS	55	120
Firm Resources					
Puuloa Energy	Stage 3	Proposed	Internal Combustion (biofuel)	99	Unknown
Kalaeloa PPA Extension (Base Proposal)	Stage 3	Proposed	Combustion Turbine (biofuel)	208	Unknown
Waiau Repower	Stage 3	Proposed	Combustion Turbine (biofuel)	253	Unknown
Par Hawaii Renewable CHP	Stage 3	Proposed	Renewable CHP	33.9	Unknown
Hamakua Firm Renewable Energy	Stage 3	Proposed	Combined Cycle + BESS	60	Unknown