

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF HAWAII

----- In the Matter of -----)
)
PUBLIC UTILITIES COMMISSION) DOCKET NO. 2018-0165
)
Instituting a Proceeding)
To Investigate Integrated)
Grid Planning.)
_____)

ORDER NO. **38253**

APPROVING, WITH MODIFICATIONS,
HAWAIIAN ELECTRIC'S REVISED INPUTS AND ASSUMPTIONS

TABLE OF CONTENTS

I. BACKGROUND 2

II. POSITIONS OF THE PARTIES 4

 A. County of Hawaii..... 4

 B. Progression..... 4

 C. Joint Parties..... 6

 D. Ulupono..... 7

 E. Consumer Advocate..... 15

 F. Hawaiian Electric..... 16

III. DISCUSSION 17

 A. Hawaiian Electric’s Response
 to Order No. 37730 Directives..... 17

 1. Technical Advisory Panel..... 21

 2. Stakeholder Engagement..... 23

 3. Modeling Explanation..... 25

 4. Reliability Planning Criteria..... 28

 5. Underlying Load Forecast,
 and Peak Forecast..... 30

 i. Underlying Load Forecast..... 30

 ii. Peak Forecast..... 34

 6. DER Forecast..... 37

 7. Energy Efficiency..... 40

 8. Electric Vehicle Forecast..... 46

 9. Fuel Price Forecast..... 49

 10. Resource Cost Forecast..... 50

 11. Resource Potential..... 55

 12. Bookend Scenarios and
 Additional Sensitivities..... 58

 13. Thermal Unit Retirement Plans..... 63

 14. Data Presentation..... 66

 i. Workbooks..... 67

 ii. IGP Webpage..... 69

 B. Next Steps..... 70

IV. ORDERS 70

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By this Order, the Public Utilities Commission ("Commission") approves with modifications the Revised Inputs and Assumptions filed by HAWAIIAN ELECTRIC COMPANY, INC., HAWAII ELECTRIC LIGHT COMPANY, INC., and MAUI ELECTRIC COMPANY, LIMITED (collectively, "Hawaiian Electric")¹ on August 19, 2021.²

¹The Parties to this proceeding are Hawaiian Electric, the DIVISION OF CONSUMER ADVOCACY ("Consumer Advocate"), an ex officio party, and the Intervenors: (1) LIFE OF THE LAND ("LOL"); (2) ENERGY ISLAND; (3) COUNTY OF HAWAII; (4) HAWAII PV COALITION ("HPVC"); (5) HAWAII SOLAR ENERGY ASSOCIATION ("HSEA"); (6) PROGRESSION HAWAII OFFSHORE WIND, LLC ("Progression"); (7) ULUPONO INITIATIVE, LLC ("Ulupono"); and (8) BLUE PLANET FOUNDATION ("Blue Planet").

²"Hawaiian Electric Revision to Updated and Revised Inputs and Assumptions," filed on August 19, 2021 ("Revised Inputs and Assumptions").

I.

BACKGROUND

On July 12, 2018, the Commission opened this docket to investigate the IGP process.³ As IGP progressed, the Commission issued three orders providing guidance.⁴

On January 19, 2021, Hawaiian Electric filed its first set of inputs and assumptions.⁵

On April 14, 2021, the Commission issued Order No. 37730, directing Hawaiian Electric to file revised forecasts and assumptions.⁶

On August 19, 2021, Hawaiian Electric filed its Revised Inputs and Assumptions.

³See Order No. 35569, "Instituting a Proceeding to Investigate Integrated Grid Planning," filed on July 12, 2018 ("Order No. 35569").

⁴See Order No. 36218, "Accepting the IGP Workplan and Providing Guidance," filed on March 14, 2019; Order No. 36725, "Providing Guidance," filed on November 4, 2019; Order No. 37419, "Providing Guidance," filed on November 5, 2020.

⁵"Hawaiian Electric Companies Updated IGP Workplan and Review Point; and Certificate of Service," filed on January 19, 2021.

⁶See Order No. 37730, "Directing Hawaiian Electric to File Revised Forecasts and Assumptions," filed on April 14, 2021 ("Order No. 37730").

On August 23, 2021, the Commission established the procedural schedule to review the Revised Inputs and Assumptions.⁷

On September 10, 2021, (1) Ulupono filed comments;⁸ (2) County of Hawaii filed comments;⁹ (3) Progression filed comments;¹⁰ (4) Blue Planet, HPVC, and HSEA (together, "Joint Parties") filed joint comments;¹¹ and (5) the Consumer Advocate filed comments.¹² On September 21, 2021, Hawaiian Electric filed reply comments.¹³

⁷See Order No. 37927, "Establishing a Procedural Schedule for the Updated Revised Inputs and Assumptions," filed on August 23, 2021.

⁸"Comments of Ulupono Initiative LLC on the Hawaiian Electric Companies Updated Revised Inputs and Assumptions; and Certificate of Service," filed on September 10, 2021 ("Ulupono Comments").

⁹"County of Hawaii's Comments; and Certificate of Service," filed on September 10, 2021 ("County Comments").

¹⁰"Progression Hawaii Offshore Wind, LLC's Comments on Hawaiian Electric Companies' August IGP Update; and Certificate of Service," filed on September 10, 2021 ("Progression Comments").

¹¹"The Joint Parties' Comments on the Hawaiian Electric Companies' August IGP Update; Exhibit A; and Certificate of Service," filed on September 10, 2021 ("Joint Comments").

¹²"Division of Consumer Advocacy's Comments on the August IGP Update; and Certificate of Service," filed on September 10, 2021 ("Consumer Advocate Comments").

¹³"Hawaiian Electric Companies' Reply to Party Comments and Commission Questions; and Certificate of Service," filed September 21, 2021 ("Hawaiian Electric Reply Comments").

On November 5, 2021, Hawaiian Electric filed redlined updates to its Revised Inputs and Assumptions.¹⁴

II.

POSITIONS OF THE PARTIES

A.

County of Hawaii

County of Hawaii poses questions to Hawaiian Electric regarding Hawaiian Electric's: (1) proposed use of curtailed power for virtual inertia; (2) plans to use or store curtailed energy so it is not wasted; and (3) projected wasted energy from Phase 1 and 2 photovoltaic and battery storage projects.¹⁵

B.

Progression

Progression offers several comments on the Commission's question four, regarding Hawaiian Electric's base assumptions. Progression states it is not feasible to develop photovoltaic projects on 30% slope, and that assuming otherwise "dramatically

¹⁴"The Hawaiian Electric Companies' Grid Needs Assessment Methodology Review Point, Exhibit 6, Redlined Updates to Inputs and Assumptions," filed on November 5, 2021 ("Exhibit 6"). Unless otherwise specified, the term Revised Inputs and Assumptions as used in this Order includes Exhibit 6.

¹⁵See County Comments at 3.

overstates the capacity of solar energy that can be developed on Oahu," and therefore risks disappointment at the low number or high cost of future solar photovoltaic ("PV") projects.¹⁶ Progression argues that if the 30% slope assumption is used, the additional cost associated with developing solar PV on lands with high slopes should also be reflected in the resource price modeling of the solar resource.¹⁷ In addition, Progression believes that the Revised Inputs and Assumptions fail to properly account for the Hawaii Natural Energy Institute's report "that Oahu could reach a maximum of approximately 70% renewable electricity on solar and batteries."¹⁸ Finally, Progression argues that Hawaiian Electric should properly account for tax credits, consider long-term procurement and include long-term projects in future rounds, and that Hawaiian Electric's renewable energy zones proposal should not delay future procurements and projects.¹⁹

¹⁶Progression Comments at 2-3.

¹⁷See Progression Comments at 3-4.

¹⁸Progression Comments at 4.

¹⁹See Progression Comments at 4-6.

C.

Joint Parties

The Joint Parties state that although Hawaiian Electric has made recent progress incorporating stakeholder feedback, it has rejected numerous proposed sensitivities and analyses, made last minute changes to sensitivities without adequate vetting, and Hawaiian Electric's sole access to much of the underlying data and formulas for the inputs and assumptions "limits stakeholders' ability to meaningfully opine on the reasonableness of the proposed inputs and assumptions except at a high level or where Hawaiian Electric adopts public inputs."²⁰ The Joint Parties hope that Hawaiian Electric views the current bookends with the intent to reduce peak demand growth with energy efficiency and load flexibility, including behind the meter storage.²¹ The Joint parties urge that the Commission require "all utilities to open up the modelling process," to enhance transparency, flexibility, and overall confidence in the planning process.²²

In response to the Commission's questions, the Joint Parties state that Hawaiian Electric's thermal generating unit retirement plan is insufficiently explained,

²⁰Joint Comments at 2.

²¹See Joint Comments at 2.

²²Joint Comments at 4.

and does not either: (1) show how the retirement plan in the base case changes the optimization of new renewable and storage resources; or (2) thoroughly analyze and clearly explain why the model selects large amounts of biomass and biofuel resources.²³ The Joint Parties further recommended that Hawaiian Electric use its previously proposed "Faster Customer Technology Adoption" scenario in order to assess a future with high electric vehicle ("EV") adoption with managed charging to appropriately assess the value of managed charging policies.²⁴ The Joint Parties recommend Hawaiian Electric clarify its modeling assumptions for tax credits and future rate designs.²⁵ Finally, the Joint Parties urge Hawaiian Electric to understand the true impacts of high technology adoption, and the ability to create flexible loads, to better design programs, procurements, and pricing options.²⁶

D.

Ulupono

Ulupono generally supports Hawaiian Electric's Revised Inputs and Assumptions recommendations in several areas,

²³See Joint Comments at 4-5 (citing Order No. 37730 at 34-35).

²⁴Joint Comments at 5-6.

²⁵See Joint Comments at 9-10.

²⁶See Joint Comments at 11.

but states concerns or additional recommendations regarding: (1) resource cost forecasts; (2) the inertia requirement; (3) the energy reserve margin ("ERM") and hourly dependable capacity ("HDC"); (4) regulating reserve margin requirements; (5) hourly shapes for loads and renewable resources; and (6) distributed energy resources ("DER") adoption.

Resource Cost Forecasts. Ulupono believes that Hawaiian Electric should provide spreadsheets that explain how Hawaiian Electric made certain calculations related to its "methods for translating NREL ATB 2020 costs into inputs for RESOLVE."²⁷ In addition, Ulupono recommends several changes to Hawaiian Electric's resource cost calculation methods. First, Ulupono recommends that Hawaiian Electric "use the actual size of existing projects when calculating the equivalent NREL ATB cost for these prior to benchmarking, rather than a standard 1 MW size" to ensure that State tax credits are correctly calculated and incorporated into proposed project costs.²⁸ Second, Ulupono recommends "that Hawaiian Electric use existing projects on each island to benchmark the cost of projects for the same island" because "[p]ooling projects across islands tends to overstate the cost of solar on Oahu and understate it on

²⁷Ulupono Comments at 3.

²⁸Ulupono Comments at 4.

other islands[.]”²⁹ Ulupono also believes Hawaiian Electric must better explain why it increased its benchmark multiplier in the Revised Inputs and Assumptions.³⁰ Third, Ulupono recommends “that Hawaiian Electric use benchmarks based on projects that have either a 20 or 25 year power purchase agreement (“PPA”), rather than just using the ones with 25,” because this will “make it possible to benchmark battery energy storage projects that have variable payment streams[,]” and “broaden the pool of projects that are included in the benchmark[.]”³¹ Fourth, Ulupono recommends that Hawaiian Electric “use the costs from the NREL ATB 2021 ‘Utility-Scale PV-Plus-Battery’ worksheet if possible, instead of the separate ‘Solar - Utility PV’ and ‘Solar - Utility PV’ worksheets” for paired solar and battery projects.³² Fifth, Ulupono recommends “that Hawaiian Electric revise the schedule of state tax credits to reflect current law[,]” and “verify that they are using the correct schedule of federal tax credits before running the model.”³³

²⁹Ulupono Comments at 4.

³⁰See Ulupono Comments at 4.

³¹Ulupono Comments at 5.

³²Ulupono Comments at 5.

³³Ulupono Comments at 5-6.

Finally, Ulupono recommends that Hawaiian Electric revise its cost assumptions for offshore wind generation so as to avoid inconsistent assumptions that may “arise from inconsistencies in the data sources and small or missing benchmark datasets.”³⁴ Ulupono suggests that Hawaiian Electric could “use the NREL ATB costs for onshore and/or offshore wind power, with [Energy Information Administration (“EIA”)] location adjustments but little or no benchmarking to existing projects[,]” or “examine the actual costs of developing and installing offshore floating wind farms compared to the actual costs of developing and installing onshore wind farms, preferably in the same country to ensure substantially complete comparability.”³⁵

Inertia Requirement. Ulupono recommends “that Hawaiian Electric assume that virtual inertia and other grid-forming capabilities can be provided by batteries and curtailed renewable sources when running PLEXOS or other software to assess the adequacy of Hawaiian Electric’s plans.”³⁶ Ulupono argues that if Hawaiian Electric’s plan to impose “a requirement for inertia service while assuming that inverters cannot provide this service would artificially bias the model in

³⁴Ulupono Comments at 6.

³⁵Ulupono Comments at 6.

³⁶Ulupono Comments at 7.

favor of spinning machines—thermal plants or synchronous condensers.”³⁷ As discussed below, Ulupono is concerned that “[s]imultaneously using faulty assumptions about both inertia and ERM/HDC could drive excess thermal capacity into the plan . . . where either assumption will drive investment in thermal capacity on its own, even if the other one is corrected.”³⁸

ERM and HDC. Ulupono supports Hawaiian Electric’s proposal to test several potential ERM targets “then evaluate the reliability of the proposed plan with each one, and adopt the lowest ERM target that produces adequate reliability.”³⁹ Ulupono recommends that Hawaiian Electric: (1) “include N-1 outage criteria in RESOLVE itself, so the model can optimize the selection of large vs. small power plants[;]” (2) once modelling is under way “evaluate finer steps between the maximum inadequate ERM and the minimum adequate ERM, to more closely identify the correct level[;]” and (3) include demand response and all other resources in the “ERM calculation in the same way that they are included in the day-to-day load balancing”⁴⁰

³⁷Ulupono Comments at 8.

³⁸Ulupono Comments at 8.

³⁹Ulupono Comments at 9.

⁴⁰Ulupono Comments at 9.

Ulupono believes that the "HDC framework is an outdated approach that is not suitable for power systems with large shares of renewable power, storage and demand-side flexibility[,] because it does not "consider the full time-series of production or behavior available from each resource, and select a portfolio that will provide a reliable supply of power under all conditions . . . and instead biases the model in favor of traditional, 'firm' assets."⁴¹ Instead of using HDC, Ulupono recommends that Hawaiian Electric model ERM "by adding a collection of 'ERM' sample days with higher than normal loads, which the model is free to serve using all resources at its disposal."⁴² Ulupono believes that "[t]his approach will force RESOLVE to design a power system that *could* meet the extra-high loads on ERM days, but which is also optimized primarily for the conditions on the standard sample days[,] thus choosing "the cheapest portfolio of resources to meet normal loads, while also including additional capacity to improve generation adequacy."⁴³

Regulating Reserve Margin. Ulupono recommends four changes to Hawaiian Electric's proposed methodology for calculating regulating reserve. First, Ulupono states that

⁴¹Ulupono Comments at 9-10.

⁴²Ulupono Comments at 10.

⁴³Ulupono Comments at 11 (emphasis in original).

"[w]hile charging, batteries should be able to provide up-reserves equal to the amount of charging plus the maximum potential discharge[.]"⁴⁴ Second, Ulupono recommends that Hawaiian Electric find its desired percentile of reliability "directly from their data, rather than using an approach based on standard deviations[,]" or alternatively "identify the actual probability distribution of wind and solar variations and use the appropriate number of standard deviations for that particular distribution."⁴⁵ Third, Ulupono believes that "[r]eserve requirements should be capped at the lesser of the renewable energy output or load[.]" because "there is no need to provide 800 MW of backup for solar during hours when it is only expected to produce 600 MW[,]" or "peak up-reserve requirements of 1721 MW for Oahu in 2045, when the power system is forecast to have a peak demand of 1493 MW[.]"⁴⁶ Finally, Ulupono recommends "that Hawaiian Electric investigate times when regulating reserve targets are unusually high, to verify that this reflects true uncertainty in the resource, rather than a data analysis error, outlier in the input data, or missing assumption[.]"⁴⁷

⁴⁴Ulupono Comments at 12.

⁴⁵Ulupono Comments at 12.

⁴⁶Ulupono Comments at 12.

⁴⁷Ulupono Comments at 12.

Hourly Shapes for Loads and Renewable Resources.

Ulupono states that "it is important that the sample days reflect the range of weather conditions that the power system may experience, including both difficult days and typical days, with appropriate probability weights[,]" and that "[t]he hourly wind, solar and load profiles should also correctly reflect the weather-driven correlation or anticorrelation between these elements."⁴⁸ Ulupono believes that Hawaiian Electric should clarify: (1) "what method [it] used to select sample days, or whether those days include the correct distribution or correlation for wind and solar power[;]" and (2) "whether the loads used in RESOLVE will be driven by the specific weather on these sample dates (e.g., rescaled versions of historical loads) or generated more abstractly, e.g., based on average weather."⁴⁹

DER Adoption. Ulupono recommends "that Hawaiian Electric adopt a framework that encourages customers to export power for use by other customers at avoided cost, e.g., via a feed-in tariff that locks in long-term payments that are competitive with PPAs for grid-scale solar[,]" because it "would enable DER to serve as a backstop resource if Hawaiian Electric

⁴⁸Ulupono Comments at 13.

⁴⁹Ulupono Comments at 13.

cannot develop sufficient grid-scale solar power.”⁵⁰ Ulupono also recommends “that the RESOLVE modeling include the option of large-scale DER export, using the ATB costs for DER[,]” because “it will be very important if some islands are modeled as being short of grid-scale solar, e.g., in scenarios with more restrictions on land use.”⁵¹

E.

Consumer Advocate

The Consumer Advocate suggests that Hawaiian Electric should further justify its assumptions and noted that it views the 2045 100% EV saturation as an “ultra-high” scenario and that additional flexibility should be built into the planning process to account for scenarios that deviate from forecasts.⁵² The Consumer Advocate also believes that Hawaiian Electric should

⁵⁰Ulupono Comments at 13-14.

⁵¹Ulupono Comments at 14.

⁵²See Consumer Advocate Comments at 4-6.

provide the underlying assumptions behind the energy efficiency forecasts.⁵³

F.

Hawaiian Electric

Hawaiian Electric notes that it has “strived to employ best practices, focus on stakeholder engagement, develop appropriate scenarios and sensitivities, and demonstrate forecasting rigor and reasonableness through transparent justification of [its] forecast to stakeholders and the Commission.”⁵⁴ Hawaiian Electric believes “that the stakeholder engagement activities since April 2021 have substantially improved the IGP inputs and assumptions[,]” such that “the IGP process is now well positioned to identify near-term and long-term grid needs portfolios that will provide a range of options to assist the Company, stakeholders, and Commission to make informed decisions on solution sourcing.”⁵⁵ Hawaiian Electric believes that “[t]he inputs and assumptions are designed to have the support of stakeholders that have been involved in the process as a substantial majority of the changes described herein are

⁵³See Consumer Advocate Comments at 6-7.

⁵⁴Hawaiian Electric Reply Comments at 6.

⁵⁵Hawaiian Electric Reply Comments at 6.

responsive to stakeholders and the Review Point Guidance.”⁵⁶ Hawaiian Electric provided detailed answers and responses to Party comments and questions, and ultimately believes “that there is no outstanding stakeholder feedback that has not been reasonably considered or addressed.”⁵⁷

III.

DISCUSSION

A.

Hawaiian Electric’s Response to Order No. 37730 Directives

In Order No. 37730, the Commission directed Hawaiian Electric to “revise its IGP forecasts and assumptions pursuant to the directives in this Order.”⁵⁸ The Commission directed Hawaiian Electric to: (1) include a sensitivity with the National Renewable Energy Laboratories (“NREL”) Annual Technology Baseline (“ATB”) for all resource cost forecasts and clearly explain the differences between the NREL ATB and IHS Markit forecasts;⁵⁹ (2) include a scenario using the Annual Energy Outlook (“AEO”) Brent forecast and clearly explain what drives differences

⁵⁶Hawaiian Electric Reply Comments at 6.

⁵⁷Hawaiian Electric Reply Comments at 65.

⁵⁸Order No. 37730 at 56.

⁵⁹See Order No. 37730 at 24.

between it and the Facts Global Energy ("FGE") forecast;⁶⁰ (3) conduct a sensitivity analysis to determine how different commodity costs impact resource selection, retail rates, and electricity demand;⁶¹ (4) incorporate the best estimates of DER tariffs and programs to inform the load forecast layers;⁶² (5) include disaggregated hourly (i.e., 8760) load data by location and rate class in revisions;⁶³ (6) clearly explain which EV charging assumptions are used in the base case and other scenarios;⁶⁴ (7) develop its EV charging assumptions to consider hourly load profiles for managed charging;⁶⁵ (8) explain how LoadSEER and Synergi models are used to develop and inform DER and EV forecasts;⁶⁶ (9) demonstrate how the probabilistic forecasts developed with LoadSEER will inform the reference case load forecast scenarios;⁶⁷ (10) present a proposed unit retirement plan

⁶⁰See Order No. 37730 at 25.

⁶¹See Order No. 37730 at 25-26.

⁶²See Order No. 37730 at 27.

⁶³See Order No. 37730 at 27.

⁶⁴See Order No. 37730 at 32.

⁶⁵See Order No. 37730 at 32.

⁶⁶See Order No. 37730 at 29.

⁶⁷See Order No. 37730 at 29.

for use in the base case;⁶⁸ (11) analyze how the proposed unit retirement plan affects the optimization of new renewable and storage resources outside of incremental renewable portfolio standard ("RPS") compliance needs;⁶⁹ (12) analyze the factors driving resource selection during and near the end of the RPS compliance schedule;⁷⁰ (13) analyze and clearly explain why the model selects such large amounts of biomass and biofuel resources, including what cost assumptions in the modeling contribute to this selection;⁷¹ (14) apply the remaining nine sensitivities identified in the Draft Grid Needs Assessment ("GNA") to the reference forecast;⁷² (15) provide a clear narrative that describes how each scenario or sensitivity adjusts data in the inputs and assumptions workbooks;⁷³ (16) provide a clear explanation of the assumptions and calculations it used to develop its sensitivities;⁷⁴ (17) identify additions to the Technical Advisory Panel ("TAP") to bring in more expertise on how to incorporate grid services in the

⁶⁸See Order No. 37730 at 34.

⁶⁹See Order No. 37730 at 35.

⁷⁰See Order No. 37730 at 33.

⁷¹See Order No. 37730 at 35.

⁷²See Order No. 37730 at 36-37.

⁷³See Order No. 37730 at 37.

⁷⁴See Order No. 37730 at 35-36.

planning criteria;⁷⁵ (18) respond to Ulupono's suggestions for modifying grid planning criteria within RESOLVE and how it differs from Ulupono's recommended approach;⁷⁶ (19) improve access to information by streamlining the IGP home webpage and providing more frequent updates,⁷⁷ (20) improve transparency by providing live and unlocked workbooks with intact cell logic alongside a clear narrative explanation of data,⁷⁸ (21) engage Applied Energy Group ("AEG") to model energy efficiency on a comparable basis to other supply-side resources,⁷⁹ (22) direct the TAP to review the changes incorporated in this revised filing;⁸⁰ (23) allow stakeholders ample opportunity to provide feedback;⁸¹ and (24) integrate stakeholder feedback into the inputs and assumptions.⁸²

Hawaiian Electric complied with most of the directives listed above, including incorporating changes to the

⁷⁵See Order No. 37730 at 40-41.

⁷⁶See Order No. 37730 at 38.

⁷⁷See Order No. 37730 at 42-45.

⁷⁸See Order No. 37730 at 45-48.

⁷⁹See Order No. 37730 at 49-51.

⁸⁰See Order No. 37730 at 54.

⁸¹See Order No. 37730 at 54.

⁸²See Order No. 37730 at 54.

Revised Inputs and Assumptions, the IGP webpage, and other reports documenting the progress of the IGP process. Hawaiian Electric did not, however, address certain directives in its Revised Inputs and Assumptions, namely analyzing the impact of the proposed unit retirement plan and RPS compliance schedule on resource selection. Below, the Commission addresses how Hawaiian Electric responded to Commission directives, and the work that remains.

1.

Technical Advisory Panel

In Order No. 37730, the Commission ordered Hawaiian Electric to “add at least one expert on utility systems modeling to the TAP . . . to provide feedback on the grid services and planning criteria discussed in this Section,” including optimization of storage, the Energy Reserve Margin calculation, and the provision of virtual inertia from batteries and renewables.⁸³ In response, Hawaiian Electric added two members to the TAP: Dr. Debbie Lew and Dr. Mathias Fripp,⁸⁴ and further

⁸³Order No. 37730 at 38-41.

⁸⁴See Letter From: M. Asano To: Commission Re: “Docket No. 2018-0165, Instituting a Proceeding to Investigate Integrated Grid Planning, Hawaiian Electric Companies’ September Status Update,” filed on September 15, 2021, at 3. Dr. Debbie Lew is an Associate Director for Energy Systems Integration Group. Dr. Lew’s background is in wind, solar and distributed energy resource integration with a focus on 100 percent clean energy.

modified the TAP by creating three subcommittees focusing on distribution, transmission, and resource adequacy.⁸⁵

The Commission also directed Hawaiian Electric to file Revised Inputs and Assumptions only after "the TAP has thoroughly reviewed the revised Draft IGP Inputs and Assumptions[.]"⁸⁶ Hawaiian Electric did not submit the TAP's review with the Revised Inputs and Assumptions. Although it was initially unclear if the TAP reviewed and agreed with the entirety of the Revised Inputs and Assumptions, Hawaiian Electric continued to meet with the TAP regarding key inputs and assumptions to address outstanding concerns.⁸⁷ In response to Commission information requests, Hawaiian Electric clarified that it engaged the TAP in a thorough review of the Revised Inputs and Assumptions.

Dr. Mathias Fripp is an Associate Professor at the University of Hawaii at Manoa. Dr. Fripp's research specializes in modeling the technical and economic performance of power systems with large shares of renewable energy, particularly focusing on the potential for demand-side response to ease the integration of intermittent renewable resources.

⁸⁵See Letter From: K. Katsura To: Commission Re: "Docket No. 2018-0165, Instituting a Proceeding to Investigate Integrated Grid Planning, Response to Commission's Information Requests," filed on October 21, 2021 ("Hawaiian Electric Response to PUC-HECO-IR") -19 at 1-2.

⁸⁶Order No. 37730 at 54.

⁸⁷See Letter From: K. Katsura To: Commission Re: "Docket No. 2018-0165, Instituting a Proceeding to Investigate Integrated Grid Planning, Response to Commission's Information Requests," filed on November 12, 2021, Hawaiian Electric Response to PUC-HECO-IR-25 through -28.

Hawaiian Electric described the TAP's role in reviewing key inputs and assumptions and providing recommendations.⁸⁸ The Commission appreciates that Hawaiian Electric ultimately complied with the Commission's directive, and directs Hawaiian Electric to include any TAP review as a part of all review point filings.

2.

Stakeholder Engagement

In Order No. 37730, the Commission ordered Hawaiian Electric to re-file the Draft IGP Inputs and Assumptions document only after "stakeholders have had ample opportunity to provide corrective feedback; and [] any necessary corrective stakeholder feedback has been integrated into the Draft IGP Input[s] and Assumptions."⁸⁹

Hawaiian Electric responded by creating the Stakeholder Technical Working Group ("STWG") and hosting several STWG meetings. Such meetings occurred several times in 2021 including on June 2, June 17, July 14, and July 16.⁹⁰ During these meetings, Hawaiian Electric and stakeholders discussed such topics

⁸⁸See Hawaiian Electric Response to PUC-HECO-IR-19 at 1-2; see also Hawaiian Electric Responses to PUC-HECO-IR-25 through -28.

⁸⁹Order No. 37730 at 21.

⁹⁰See Revised Inputs and Assumptions at 10-12.

as the RESOLVE model, DER forecasts, bookend scenarios, LoadSEER and Synergi models, EV unmanaged and managed charging, fossil fuel unit retirements, inertia, resource and fuel cost projections, and renewable energy zones ("REZ"). As a result of these discussions, stakeholders were able to communicate their concerns and engage with Hawaiian Electric toward further refining the Inputs and Assumptions.

The Commission recognizes the improvements to Hawaiian Electric's stakeholder engagement from these STWG meetings. The Commission also recognizes the extent to which Hawaiian Electric has incorporated stakeholder feedback into the Revised Inputs and Assumptions. For example, as instructed by the Commission in Order No. 37730, Hawaiian Electric has calibrated resource costs using NREL ATB.⁹¹ Hawaiian Electric also switched from the FGE Brent fuel forecast to the EIA reference fuel forecast as the base fuel price assumption.⁹² Therefore, Hawaiian Electric has satisfied Order No. 37730's directives to allow ample opportunities for stakeholder feedback and to incorporate that feedback.

⁹¹See Revised Inputs and Assumptions at 13.

⁹²See Revised Inputs and Assumptions at 14.

3.

Modeling Explanation

In Order No. 37730, the Commission directed Hawaiian Electric to “explain how it uses the LoadSEER and Synergi models to develop and/or inform DER and EV forecasts, and include qualitative summaries and quantitative results of its LoadSEER and Synergi findings as part of its revised Draft IGP Inputs and Assumptions.”⁹³ The Commission further ordered that the revised Draft Inputs and Assumptions “provide the results of the probabilistic DER hosting capacity analysis from the Synergi circuit models[,]” and “show how Hawaiian Electric used LoadSEER to disaggregate load forecasts further (e.g., by rate class or location).”⁹⁴

In its Revised Inputs and Assumptions, Hawaiian Electric included discussion of several models, including RESOLVE,⁹⁵

⁹³Order No. 37730 at 27.

⁹⁴Order No. 37730 at 29.

⁹⁵See Revised Inputs and Assumptions at 25-26.

PLEXOS,⁹⁶ LoadSEER⁹⁷ and Synergi.⁹⁸ On the IGP website, Hawaiian Electric further discussed LoadSEER in the context of Location-Based Distribution Forecasts,⁹⁹ explaining how it used LoadSEER to “to analyze the distribution system and determine grid needs required to serve load growth and safely interconnect distributed energy resources (“DER”) while maintaining power quality and reliability for all customers.”¹⁰⁰ Hawaiian Electric described how LoadSEER is used to develop location-based forecasts for Oahu, but cautioned that it used a different methodology for Maui County and Hawaii Island because “LoadSEER modeling is not yet available[.]”¹⁰¹

⁹⁶See Revised Inputs and Assumptions at 38-39.

⁹⁷See Revised Inputs and Assumptions at 159-161; see also “Hawaiian Electric Companies’ Grid Needs Assessment Methodology Review Point; Books 1-2,” filed on November 5, 2021 (“Grid Needs Assessment”), Exhibit 3.

⁹⁸See Revised Inputs and Assumptions at 2, 11; see also Grid Needs Assessment Exhibit 4.

⁹⁹Although not filed as part the Revised Inputs and Assumptions, Hawaiian Electric shared this document with the STWG and later discussed during the October 6, 2021, STWG meeting.

¹⁰⁰Grid Needs Assessment, Exhibit 3 at 5.

¹⁰¹Grid Needs Assessment, Exhibit 3 at 8.

Hawaiian Electric discussed Synergi as part of its Distribution DER Hosting Capacity Grid Needs,¹⁰² which “focuses on hosting capacity grid needs identified for the next five years (year 2021 through 2025) driven by the forecasted DER growth on distribution circuits based on forecast sensitivities[.]”¹⁰³ Hawaiian Electric used Synergi to assess circuit-level hosting capacity for DER by simulating DER growth.¹⁰⁴ This allowed Hawaiian Electric to “do a wide-scale update of the available hosting capacity on all primary distribution circuits, as well as determine which circuits require further analysis to accommodate the total anticipated DER in year 2025.”¹⁰⁵ Using the high DER forecast, Hawaiian Electric identified 527 circuits with no current grid needs and 93 circuits with grid needs at the primary distribution circuit-level.¹⁰⁶

The Commission is satisfied with how Hawaiian Electric described the purpose and functionality of its modeling tools and

¹⁰²Hawaiian Electric filed this document as part of the Revised Inputs and Assumptions, and re-filed this document as part of the Grid Needs Assessment.

¹⁰³Grid Needs Assessment, Exhibit 4, at 8.

¹⁰⁴See Grid Needs Assessment, Exhibit 4, at 19.

¹⁰⁵Grid Needs Assessment, Exhibit 4, at 47.

¹⁰⁶See Grid Needs Assessment, Exhibit 4, at 47.

accepts Hawaiian Electric's explanation of the modeling tools it uses to inform this Inputs and Assumptions stage of IGP.

4.

Reliability Planning Criteria

Reliability planning criteria associated with the Revised Inputs and Assumptions have been the subject of several recent meetings, including the STWG meetings. In particular, the ERM and HDC approaches play an important role in determining resource plans. Before filing the Revised Inputs and Assumptions, Hawaiian Electric met with Ulupono Initiative to discuss its suggestions for modifying grid planning criteria within RESOLVE and came to a consensus on an approach incorporating many of Ulupono's suggestions.¹⁰⁷

In response to stakeholder feedback on the ERM and HDC approaches, Hawaiian Electric analyzed a range of scenarios modifying the ERM constraint, including 0%, 10%, 20%, 30%, and 40% for Oahu, Maui, and Hawaii and 0%, 20%, 40%, and 60% for Molokai and Lanai. Hawaiian Electric also analyzed cases using regular production profiles for variable generation rather than the HDC approach, using alternative standard deviations for the HDC

¹⁰⁷See "Hawaiian Electric Updated Timeline and Stakeholder Engagement Plan," filed June 18, 2021, at 4.

approach, and removing all thermal units as resource options for RESOLVE selection. Among the results, Hawaiian Electric determined that simulations with ERM constraints set below 30% provided insufficient energy on Oahu and that RESOLVE plans built using the HDC approach performed more reliably over a range of PV outputs. Following this analysis, Hawaiian Electric concluded that the 30% ERM constraint with HDC for renewables is a reasonable metric for reliability planning, noting that a fuller analysis of reliability will be completed in the Grid Needs Assessment Resource Adequacy Step with potential further refinement of reliability planning criteria.¹⁰⁸

The Commission notes that the TAP has proposed additional considerations for the ERM constraint,¹⁰⁹ and that Hawaiian Electric has proposed alternative approaches to the HDC for capacity accreditation that the TAP will review.¹¹⁰ The Commission is actively reviewing these proposed reliability planning criteria approaches and plans to address these issues with the Grid Needs Assessment methodology in the second

¹⁰⁸Hawaiian Electric Presentation, titled "IGP Stakeholder Technical Working Group Energy Reserve Margin Criteria Analyses," to Stakeholder Technical Working Group on October 13, 2021, at slides 9, 10, 15, 20, and 37.

¹⁰⁹See Hawaiian Electric Response to PUC-HECO-IR-25-a at Attachment 1.

¹¹⁰See Hawaiian Electric Response to PUC-HECO-IR-26-a at 1-2.

review point. At this time, the Commission has serious concerns about the HDC approach, and strongly encourages Hawaiian Electric to continue working with the TAP to develop better alternatives.

Regarding additional planning criteria, the Commission notes that Hawaiian Electric removed from RESOLVE optimization the minimum inertia requirement so that the model would not limit or bias resources that can fulfill various grid services.¹¹¹ Hawaiian Electric also clarified the day sampling methodology in response to stakeholder feedback, including that the data used to identify sample days includes gross and net load and aggregate solar, wind, and hydro conditions.¹¹²

5.

Underlying Load Forecast, and Peak Forecast

i.

Underlying Load Forecast

Hawaiian Electric provided a detailed description of the econometric methods it used to develop the underlying load forecasts for each island.¹¹³ To develop the overall load forecast (i.e., sales forecast), Hawaiian Electric accounted for

¹¹¹See Revised Inputs and Assumptions at 17.

¹¹²See Revised Inputs and Assumptions at 25-26.

¹¹³See Revised Inputs and Assumptions at 40.

the sales impacts of: (1) Energy Efficiency ("EE"); (2) DER; and (3) Electrification of Transportation ("EoT") and treated the forecasts associated with EE, DER, and EoT as separate adjusting layers to be applied to the underlying load forecast.¹¹⁴ Hawaiian Electric used the following data sources to develop its underlying load forecast.

Input Data Sources for Underlying Load Forecast¹¹⁵	
University of Hawaii Economic Research Organization ("UHERO")	Real personal income Resident population Non-farm jobs Visitor arrivals
National Oceanic and Atmospheric Administration ("NOAA") - Honolulu, Kahului, Hilo, and Kona Airports	Cooling degree days Dewpoint temperature Rainfall
Itron, Inc.	Commercial energy intensity trend for Pacific region for non-heating/cooling end uses
Hawaiian Electric	Recorded kWh sales Recorded customer counts Large load adjustments Real electricity price

Hawaiian Electric provided a list of its responses to stakeholder questions and comments for the underlying

¹¹⁴See Revised Inputs and Assumptions at 40.

¹¹⁵See Revised Inputs and Assumptions at 42. A detailed description of the assumptions and models used to develop the underlying forecasts is also provided in response to PUC-HECO-IR-1, filed July 2, 2020.

load forecast.¹¹⁶ Hawaiian Electric indicated whether it responded to stakeholder feedback with clarifications only or if stakeholder feedback resulted in a direct change to the Inputs and Assumptions or Grid Needs Assessment documents. Changes Hawaiian Electric made in response to stakeholder feedback include: (1) developing a stakeholder engagement summary to explain how and why stakeholder feedback was incorporated into the underlying load forecast; (2) integrating a narrative and workbook attachments to the original Inputs and Assumptions document explaining key load drivers for each customer class; (3) increasing the future warming trend to account for climate change, which resulted in adjustments to cooling degree days; and (4) updating underlying load forecasts to account for the economic impacts of the COVID-19 pandemic.

The Commission emphasizes the importance of using modern models that are transparent and have credible assumptions. During the course of IGP, Hawaiian Electric has expanded its input assumptions and methodologies used to develop the underlying load forecast to include data and models from organizations such as UHERO, NOAA, and Itron, Inc. The Commission appreciates the stakeholder meetings that Hawaiian Electric held while developing

¹¹⁶See Letter From: K. Katsura To: Commission Re: Docket No. 2018-0165, Instituting a Proceeding to Investigate Integrated Grid Planning, "Hawaiian Electric's Reply Comments," filed on March 4, 2021 ("March 4 Reply Comments"), Appendix A.

its underlying load forecasts. By listening to and incorporating stakeholder feedback, Hawaiian Electric improved many parts of the underlying forecast with credible third-party data, and technical experts.

It is common for utilities to apply more than one scenario to the underlying load forecast such as different scenarios for economic/demographic growth, climate change impacts, and electricity prices.¹¹⁷ In contrast, Hawaiian Electric included one scenario for its underlying load forecast. In any future rounds of IGP, Hawaiian Electric must apply different scenarios such as these to its underlying forecasts.

Ultimately, the Commission accepts the assumptions and models Hawaiian Electric used to develop the underlying load forecasts for use in the first round of IGP, and directs Hawaiian Electric to incorporate the foregoing improvements in any future rounds of IGP.

¹¹⁷See e.g., Puget Sound Energy Resource Planning, available at: <https://pse-irp.participate.online/2021-irp/reports>; see also Australian Energy Market Operator (“AEMO”) integrated System Plan, available at: <https://aemo.com.au/en/energy-systems/major-publications/integrated-system-plan-isp>.

Peak Forecast

To develop the peak forecasts for each of the islands, Hawaiian Electric converted monthly sales forecasts into load forecasts for each hour over the forecast horizon. The hourly load profiles Hawaiian Electric used to estimate the underlying peak forecast are based on the following class load studies for Oahu, Maui, and Hawaii Island: (1) Oahu, May 2012 - April 2013 class load study; (2) Maui, July 2013 - June 2014 class load study; and (3) Hawaii Island, historical hourly profiles for the total system load for the years 2015-2018 (excluding 2016).¹¹⁸ For Molokai, Hawaiian Electric used the following methods to determine underlying peak:

[A]n annual sales load factor method that uses a historical average sales load factor applied to future sales. The sales load factor is calculated as: $(\text{annual underlying sales MWh}) / (\text{annual peak MW} \times 8760 \text{ hours})$ [.] The forecasted annual peak month (November) and hour (hour ending at 7:00 p.m.) are based on analysis of historical peak month and hour, which are relatively consistent historically and not expected to vary from the historical pattern in future years.¹¹⁹

¹¹⁸See Letter From: K. Katsura To: Commission Re: "Docket No. 2018-0165, Instituting a Proceeding to Investigate Integrated Grid Planning, Response to Commission's Information Requests," filed on July 2, 2020, Hawaiian Electric Response to PUC-HECO-IR-2.

¹¹⁹See Hawaiian Electric Response to PUC-IR-2.

For Lanai, Hawaiian Electric estimated underlying peak using the following methods:

A revised peak forecast was developed using a method that allows for the use of individual large customer data. The method used is to add together four individual hourly shapes to arrive at the total underlying shape - three for individual large customers and one for all other loads. 1) Historical load data from December 1, 2018 through March 7, 2020 was used to define the four underlying hourly shapes. This includes total system load from December 1, 2018 - November 30, 2018, load from one individual customer for December 1, 2018 - December 31, 2019, load from two additional individual customers for October 1, 2018 - March 7, 2020 (all available data for these customers). 2) Monthly customer sales level forecast associated with each shape and system loss factor applied to derive system level energy. 3) The system level energy and future profiles are used in the MetrixLT modeling software, to develop a system level hourly forecast.¹²⁰

The class load studies Hawaiian Electric used to develop the underlying peak forecasts are significantly outdated, especially given the amount of new development that has occurred on each island, in addition to possible changes in consumption behaviors since these load studies were completed. For example, Hawaiian Electric used the 2012-2013 load study for Oahu to inform

¹²⁰See Hawaiian Electric Response to PUC-IR-2.

the underlying load forecast. Yet a more up to date 2017 class load study exists for Oahu.¹²¹

Accordingly, the Commission directs Hawaiian Electric to update its underlying peak load forecast for Oahu. For Maui, Hawaii Island, Molokai, and Lanai, the Commission directs Hawaiian Electric to explain why it did not use class load studies to develop the underlying peak load forecasts. Hawaiian Electric must do this as a part of its finalized inputs and assumptions.

As it broadly deploys Advanced Metering Infrastructure ("AMI") as part of its grid modernization strategy, Hawaiian Electric will soon have detailed information on customer consumption. This will allow Hawaiian Electric to integrate more granular and location-specific load data into future rounds of IGP. The Commission therefore directs Hawaiian Electric to establish a plan for how it will integrate AMI data into future IGP proceedings. Further, with the inception of more widespread TOU rates in the near future, Hawaiian Electric must include expected load impacts associated with TOU for all customer classes in its underlying peak forecasts for the base case in future rounds of IGP.

¹²¹See Docket No. 2019-0085, Hawaiian Electric Response to CA-IR-416, filed on March 16, 2019.

DER Forecast

Order No. 37730 directed Hawaiian Electric to incorporate the best estimates of future DER tariffs and programs to inform the DER forecast layer and to include disaggregated hourly (i.e., 8760) load data by location and rate class in revisions.¹²² Hawaiian Electric developed five DER forecasts: the DER Freeze, No State Investment Tax Credit ("ITC"), Low Uptake, Base Uptake, and High Uptake. Aside from the DER Freeze, which sets the DER forecast equal to 2020 levels through the planning period, the assumptions used to develop the DER forecasts are laid out in Table 4-2 of the Revised Inputs and Assumptions.¹²³ These assumptions include resource cost projections, federal tax credit schedules, state tax credit schedules, Emergency Demand Response Program ("EDRP")¹²⁴ participation, available long-term upfront incentives, available long-term export program, addressable residential and commercial markets, and additional add-ons. Hawaiian Electric utilized current trends to develop the near-term forecast, including installation pace, existing program subscription level, feedback from program

¹²²See Order No. 37730 at 27.

¹²³See Revised Inputs and Assumptions at 43-44.

¹²⁴The EDRP is also known as the Scheduled Dispatch Program and the Battery Bonus Program.

administrators and installers, and distribution hosting capacity. To develop its long-term forecast, Hawaiian Electric used an economic choice model with an additional set of assumptions regarding installation costs, incentives, electricity prices, program structure, and the addressable market.¹²⁵

Although the difference in forecasted installed capacity through the planning period, which is visualized in Figure 4-1 of the Revised Inputs and Assumptions, is relatively small between the No State ITC Uptake, Low Uptake, and High Uptake forecasts, there is a significant increase in forecasted installed capacity for the High Uptake forecast.¹²⁶ The Commission assumes there would be a significant decrease in forecasted installed capacity for the DER Freeze forecast, which is not visualized in Figure 4-1. The Commission believes the variation provided by the High Uptake and DER Freeze forecasts should provide informative analysis during the Grid Needs Assessment and solution sourcing process, but it is not clear what analysis can be derived with the No State ITC forecast and sensitivity given the minimal variation in installed capacity. Analysis of this sensitivity should therefore consider what impacts the altered assumptions in the

¹²⁵See Revised Inputs and Assumptions at 44.

¹²⁶See Revised Inputs and Assumptions at 53.

DER Forecast have on the resource selection process, aside from impacts on the forecast.

Hawaiian Electric incorporated its assumptions regarding future DER tariffs and programs into the DER forecasts, using its best estimate for program structure, as directed by the Commission. These assumptions include that export compensation will be aligned with system needs, that export may be controllable during system emergencies, that customers will choose to use battery storage to offset their own load rather than export, and that an upfront incentive will be available beyond the Emergency Demand Response Program period.¹²⁷ Although these outcomes depend on Commission action in other dockets, these assumptions provide a reasonable approximation for use in the DER forecasts at this time. In future iterations of the IGP process, the Commission expects Hawaiian Electric to update such assumptions to reflect new tariffs and programs.

In response to comments indicating that the assumptions for the ITC schedule may include errors or not reflect known changes to the schedule, Hawaiian Electric corrected and clarified

¹²⁷See Revised Inputs and Assumptions at 44-45.

its approach.¹²⁸ Hawaiian Electric also expanded the addressable market for DERs based on input from stakeholder meetings.¹²⁹

The Commission finds that the assumptions Hawaiian Electric used in each of the five DER forecasts, the range of these forecasts, and the use of these forecasts for the scenarios and sensitivities Hawaiian Electric plans to model are reasonable, and comply with the directives set forth in Order No. 37730. The Commission also appreciates Hawaiian Electric's updates in response to stakeholder comments.

7.

Energy Efficiency

Order No. 37730 reiterated the requirement that Hawaiian Electric evaluate energy efficiency ("EE") (and other demand-side resources) on a comparable basis with supply-side resources by developing supply curves to optimize within its capacity expansion modeling, and further directed Hawaiian Electric to work with AEG to scope development of these supply curves based on the state's recently completed Market Potential Study ("MPS").¹³⁰ As an initial point,

¹²⁸See Hawaiian Electric Reply Comments at 15-19, 26, 50-51.

¹²⁹See Hawaiian Electric Response to PUC-HECO-IR-9 at 2.

¹³⁰Order No. 37730 at 49-51.

the Commission acknowledges the substantial work by both Hawaiian Electric and AEG to implement this directive, and appreciates the efforts to date, including numerous opportunities for stakeholder feedback, provision of data, and responses to information requests. Second, the finalized supply curves have been included with Hawaiian Electric's subsequent Grid Needs Assessment filing. Accordingly, at present, the Commission will only focus on the inclusion of energy efficiency in the load forecast as it relates to Party comments and facilitation of use of the supply curves.

Hawaiian Electric described the development of the EE inputs and assumptions, and the modifications it made to accommodate the EE inputs in the overall IGP process. Hawaiian Electric also mapped the EE forecasts to the Bookend Sensitivities as follows: (1) Base Case Sensitivity: Business as Usual ("BAU") and Codes and Standards ("C&S") MPS forecasts; (2) High Load Bookend Sensitivity ("Low EE"): BAU MPS EE forecast only; (3) Low Load Bookend Sensitivity ("High EE"): Achievable High and C&S MPS forecasts; and (4) EE Freeze Sensitivity: Forecasted EE capacity fixed at 2021 Base Forecast.¹³¹

The Consumer Advocate noted that Hawaiian Electric should provide additional information on the types of EE included

¹³¹See Revised Inputs and Assumptions at 53-55.

in its forecasts and to better explain the reasoning behind its assumptions.¹³² Hawaiian Electric further explained the EE forecasts in its reply comments,¹³³ in stakeholder working group meetings, via data shared on the IGP webpages, and in IR responses.¹³⁴ The EE forecasts are based on publicly available data from the MPS, as modified slightly by Hawaiian Electric to fit its modeling process.¹³⁵ Based on this, the Commission understands the EE forecasts as follows.

Forecast or Sensitivity	Components¹³⁶
<u>Underlying Load</u>	(1) Programmatic EE measures implemented through 2018, net of free-riders, and assumes persistence of the same level of efficiency throughout the study period (2) C&S through 2018 (as part of historical sales) (3) Naturally occurring EE (4) Free-riders associated with future achievable measures
<u>Base Load Forecast</u>	(1) EE in the underlying load (2) BAU and C&S MPS forecasts
<u>Low Load Bookend Sensitivity</u>	(1) EE in the underlying load (2) Achievable High and future C&S MPS forecasts

¹³²See Consumer Advocate Comments at 6-8.

¹³³See Hawaiian Electric Reply Comments at 11-13, 64-65.

¹³⁴See Hawaiian Electric Responses PUC-HECO-IRs-6 through -8 and PUC-HECO-IRs-22 through -24.

¹³⁵See Revised Inputs and Assumptions at 54.

¹³⁶See Revised Inputs and Assumptions at 53-55.

<u>High Load Bookend Sensitivity</u>	(1) EE in the underlying load (2) BAU MPS forecast
<u>EE Freeze Sensitivity</u>	(1) EE in the underlying load (2) Forecasted EE capacity fixed at 2021 Base Forecast
<u>EE as a Candidate Resource Sensitivity</u>	(1) EE in the underlying load (2) Forecasted EE capacity fixed at 2021 Base Forecast (3) EE supply curves

Based on this understanding, the EE as a Candidate Resource Sensitivity is responsive to the Commission's direction to model EE within the capacity expansion modeling process. However, the Commission is concerned that certain aspects of the approach taken to include EE in the load forecasts and supply curves creates uncertainty in the results and could lead to either over- or under-forecasting of EE. In particular, the Commission is concerned about inconsistent treatment of free-ridership, net-to-gross ratios, naturally occurring EE, and the calibration of EE included in the econometric forecast and load layers with that included in the supply curves based on the MPS. With this in mind, the Commission approves Hawaiian Electric's EE inputs and assumptions, specifically the energy efficiency load forecasts, with modifications described below. These modifications are intended to help reduce uncertainty in the results for this round of IGP, and are also accompanied by directives to further improve the EE modeling process for future rounds of IGP.

For this round of IGP, Hawaiian Electric must make the following changes to its load forecasts with regards to EE:

1. Remove free-riders associated with future achievable measures from the *Underlying Load* layer. The level of free-ridership for future programs is unknown because the future programs have not been designed or selected at this time and should therefore not be included as an input to the underlying load. The energy savings from the identified free-ridership impacts should be included in the EE supply curves.

2. Include the estimated impacts through 2045 of all C&S in place as of June 2020 in the *Base Load Forecast*. In response to PUC-HECO-IR-23, Hawaiian Electric stated it would do so, however, the Commission feels it appropriate to clarify because previous documents stated that only C&S on the books as of 2019 would be included in the *Base Load Forecast*.

3. Include the estimated impacts through 2045 of all C&S in place as of June 2020 in the *High Load Bookend Sensitivity*. Savings from C&S that have already been adopted should not be removed from this sensitivity because they are legislatively mandated. In order to adjust EE downwards for this sensitivity, Hawaiian Electric should reduce programmatic savings by adjusting participation rates downward.

4. Use the *Underlying Load* and the EE Supply Curves in the *EE as a Candidate Resource Sensitivity*, and adjust

the EE Supply Curves accordingly (e.g., include all other Achievable Technical Potential EE from the MPS in the supply curves). This sensitivity should be run using only the *Underlying Load* layer to allow for comparison with the results of the Base and Bookend Sensitivities. This Sensitivity should not be run based on the *EE Freeze Sensitivity* because this would create results that are not directly comparable to other IGP results.

The Commission agrees with the Consumer Advocate's concerns about the need for Hawaiian Electric to more clearly explain the types of EE included in each forecast and the reasoning for its approach. Therefore, in future rounds of IGP, Hawaiian Electric must more thoroughly explain, in writing, the types of EE included in each forecast and within the supply curves, how they map to underlying data such as the MPS, and the reasoning for the approaches taken to develop the forecasts and supply curves. In particular, Hawaiian Electric must:

1. Reduce reliance on prescriptive forecasts of EE by applying EE supply curves to all load sensitivities. This will result in more accurate system modeling by allowing EE to compete with supply-side resources on a consistent basis.

2. Better calibrate the timing, quantity and type of EE in the underlying load to the MPS by including all embedded EE (adopted C&S and historical naturally occurring EE/free-ridership) within the underlying load, and including historical program

impacts and future C&S as independent variables within the econometric load forecast. This will allow the amount of EE in the underlying load to capture existing savings and to respond to econometric variables such as the economy.

3. Provide clear definitions of free-riders and naturally occurring EE and clearly tie treatment of both to IGP modeling objectives.

4. If applying net-to-gross ratios ("NTGRs") to C&S in future rounds of IGP, provide clear and obvious justification for doing so and for the NTGRs used.

These modifications will provide more transparency into Hawaiian Electric's approach to modeling EE and will give stakeholders more confidence in the resulting magnitude, timing, and price of any EE selected. In general, greater understanding of methodology allows stakeholders to better interpret and use any subsequent modeling results.

8.

Electric Vehicle Forecast

Order No. 37730 directed Hawaiian Electric to "clearly identify which assumption, i.e., managed charging or unmanaged charging, it will include in the base case and other scenarios. In addition, Hawaiian Electric shall further develop its charging assumptions to consider hourly load profiles for managed charging,

and transparently explain every assumption driving these hourly load profiles".¹³⁷ In response, Hawaiian Electric explained its Electrification of Transportation forecast layer, including hourly load profiles for managed and unmanaged charging by island, and worked with its consultant E3 to develop updated managed charging profiles using E3's linear optimization model.¹³⁸ This model shifts as much charging as possible to the daytime in order to reduce customers' electricity bills.¹³⁹

In response to comments from the Consumer Advocate and the Joint Parties,¹⁴⁰ Hawaiian Electric clarified that its high and low EV adoption scenarios are based on the 100% EV by 2045 scenario from the Transcending Oil report and the results of the Integral Analytics Bass Diffusion model combined with additional models and adjusting variables, respectively.¹⁴¹ This change in the high EV adoption scenario approach was in response to the Joint Parties' recommendations and also part of the overall strategy to test how the resource plan would need to change to

¹³⁷Order No. 37730 at 32.

¹³⁸See Revised Inputs and Assumptions at 60-61.

¹³⁹See Revised Inputs and Assumptions at 60-61.

¹⁴⁰See Joint Comments at 5-6; Consumer Advocate at 4-6.

¹⁴¹See Hawaiian Electric Reply Comments at 7-8.

serve higher customer load rather than as a most likely scenario.¹⁴² Hawaiian Electric added that the modeling process can iterate on assumptions to accommodate lower EV adoption scenarios if needed.

The Commission appreciates Hawaiian Electric's clarifications, and agrees that the inputs and assumptions for the Electrification of Transportation layer represent a reasonable starting point for modeling given that they are based on publicly- available and jurisdictionally-specific data, capture a range of possible futures including for policy-based outcomes such as a 100% zero emissions vehicle mandate, and that the EV adoption curves are similar to those in other jurisdictions.¹⁴³ Therefore, the Commission accepts Hawaiian Electric's EV inputs and assumptions for use in this first round of IGP. However, the Commission believes that it is important to understand the value of managed charging and directs Hawaiian Electric to assess the base EV adoption scenario with and without managed charging. The Commission believes that this can occur following the currently scheduled six-month Grid Needs Assessment phase, and directs Hawaiian Electric to implement this assessment accordingly.

¹⁴²See Hawaiian Electric Reply Comments at 9-10.

¹⁴³See Hawaiian Electric Reply Comments at 10.

Fuel Price Forecast

In Order No. 37730, the Commission directed Hawaiian Electric to include a scenario using the EIA AEO Brent Forecast and to clearly explain what drives the differences between the FGE Forecast and the AEO Brent Forecast and to perform a sensitivity analysis to explore how different commodity costs would impact resource selection, retail rates, and electricity demand (e.g., low, medium, and high fuel forecasts).¹⁴⁴ Following this directive, Hawaiian Electric and stakeholders discussed which forecasts to use for this sensitivity analysis with the STWG. Hawaiian Electric states that stakeholders reached a consensus to make the following changes to the fuel price forecasts:

[1] Switch[ing] from FGE Brent fuel forecast to a 2021 EIA reference fuel forecast as the base assumption

[2] Add[ing] a 2021 EIA low fuel price forecast; however, currently there are no sensitivities planned to use the low fuel price forecast

[3] Add[ing] a 2021 EIA high fuel price forecast, recognizing there is disagreement in the validity of EIA's high scenario. However, [Hawaiian Electric] and stakeholders do agree that the EIA high fuel price forecast should not be used as the base fuel assumption but that it is useful to evaluate a potential

¹⁴⁴See Order No. 37730 at 25-26.

worst case fuel price and its impact on the resource plan[.]¹⁴⁵

The Commission believes the revisions that Hawaiian Electric made to its fuel price forecasts are reasonable, and approves them for the first round of IGP. The Commission further directs Hawaiian Electric to provide a written justification for not including a low fuel price forecast in any scenario or sensitivity with its finalized Inputs and Assumptions.

10.

Resource Cost Forecast

The Commission directed Hawaiian Electric to “include a sensitivity with the NREL [Annual Technology Baseline (“ATB”)] for all resource cost forecasts and clearly explain . . . the differences between the NREL ATB and IHS Markit forecasts.”¹⁴⁶ In response, Hawaiian Electric updated the resource cost projections included in its Revised Inputs and Assumptions with the recently released 2021 NREL ATB costs.¹⁴⁷ Further, Hawaiian Electric stated that it plans to integrate stakeholder comments filed in response to the Commission’s request

¹⁴⁵Revised Inputs and Assumptions at 14.

¹⁴⁶Order No. 37730 at 24.

¹⁴⁷See NREL 2021 ATB Data, from <https://atb.nrel.gov/electricity/2021/data>.

for comments and the recommendations that have emerged from numerous meetings with Ulupono to update resource cost forecasts in the next version of the Inputs and Assumptions and associated workbooks.¹⁴⁸ Those changes will include (1) updates to how Hawaiian Electric includes State and Federal ITCs; (2) removal of benchmarking for all resources; and (3) updates to cost forecasts.¹⁴⁹

Comments relevant to grid-scale PV resource costs also emerged during stakeholder discussions surrounding resource potential, especially related to the appropriate slope assumption and related cost adders. In NREL's Updated Resource Potential Study, NREL incorporated a cost adder of five cents per watt in calculating the site levelized cost of energy of PV capacity installed on lands with slope >15% in the PV-Alt-1 and PV-Alt-2 scenarios.¹⁵⁰ The PV-Alt-3 and PV-Alt-4 scenarios did not allow for development on slopes >15% and therefore did not include this cost adder; they are otherwise identical to the PV-Alt-1 and PV-Alt-2 scenarios, respectively.

¹⁴⁸See Hawaiian Electric Reply Comments at 13-14.

¹⁴⁹See Hawaiian Electric Reply Comments at 15-30.

¹⁵⁰See Nick Grue, Katy Waechter, Travis Williams, and Jane Lockshin, Assessment of Wind and Photovoltaic Technical Potential for the Hawaiian Electric Company, NREL (July 30, 2021) ("Updated Resource Potential Study"), at 81-82, attached to the Revised Inputs and Assumptions, after Appendix E.

Hawaiian Electric clarified that the bookend scenarios and sensitivities will use the Alt-1 resource potential scenarios, but that no cost adder would be applied to projects on slopes above a certain percentage.¹⁵¹ Hawaiian Electric also noted that the Renewable Energy Zone analysis would provide costs for transmission upgrades and interconnection costs which would have the effect of accounting for increased costs associated with siting solar in particular areas.¹⁵²

Using publicly available data increases IGP's transparency and allows interested stakeholders to verify resource costs. At the outset of IGP, the Commission stated its intention to foster an IGP process that is transparent.¹⁵³ The Commission therefore approves Hawaiian Electric's use of the 2021 NREL ATB, DOE, and EIA costs for the majority of resource costs instead of the IHS Markit costs. The Commission also approves Hawaiian Electric's plan to eliminate benchmarking from all resources in favor of using 2021 NREL ATB costs with the EIA locational adjustment for offshore wind, as well as the other resources already modeled with the EIA locational adjustment. This will ensure all resources are treated equally and eliminates

¹⁵¹See Hawaiian Electric Response to PUC-HECO-IR-18.

¹⁵²See Hawaiian Electric Response to PUC-HECO-IR-18.

¹⁵³See Order No. 35569 at 20.

the likelihood of a small sample size skewing benchmarking results. Additionally, the Commission approves Hawaiian Electric's plan to remove the State ITC for future grid-scale PV and adjust the Federal ITC to match what is reflected in the DSIRE database.

Like Progression, the Commission is concerned with Hawaiian Electric's plan to not use a cost adder for solar projects built on high slopes, because it may skew modeling results if utility-scale PV resources are deployed at sites with high slopes. Therefore, the Commission requires the following modifications to Hawaiian Electric's resource cost assumptions.

First, Hawaiian Electric must include a capital cost adder of five cents per watt for utility-scale solar PV capacity deployed on sites with a slope greater than 15% as part of its capacity expansion modeling in RESOLVE. As part of its finalized Inputs and Assumptions, Hawaiian Electric must detail this "Slope Adjustment" to the resource cost forecast of utility-scale PV deployed on sites with a slope greater than 15% under the Photovoltaics (PV) header of Section 4.5, and update all workbooks accordingly. Hawaiian Electric may exclude this cost adder during its initial evaluation of the resource potential of utility-scale solar PV. But if the model selects for solar on slopes greater than 15%, which is all capacity built in excess of the maximum installable capacity determined for the PV-Alt-3 scenario, Hawaiian Electric must run RESOLVE again, and include this cost

adder for all utility-scale solar PV deployed in excess of the PV-Alt-3 scenario resource potential.¹⁵⁴

Second, the Commission does not believe that including transmission upgrades and interconnection costs in the REZ analysis is an appropriate substitute for a cost adder for utility-scale solar PV resources developed on high slopes. Hawaiian Electric must continue to work with the Commission and stakeholders during the Grid Needs Assessment phase to reach an agreement on how any additional resource cost adjustments will be factored into the REZ analysis.

Finally, the Commission acknowledges that Hawaiian Electric made changes to the resource cost forecasts as discussed and agreed upon with Ulupono in September of 2021 and filed in response to Ulupono and other stakeholders—as outlined above.¹⁵⁵ The Commission encourages Hawaiian Electric to assess the incremental cost of working on Department of Defense lands and evaluate how resource costs will be impacted by projects on Department of Defense lands, in addition to assessing the potential for wind and solar projects to be developed on Department of Defense lands in future planning cycles.

¹⁵⁴See Updated Resource Potential Study at 83.

¹⁵⁵See Hawaiian Electric Reply Comments at 13-25.

Resource Potential

In its Revised Inputs and Assumptions, Hawaiian Electric included the updated scenarios for both utility-scale solar PV and wind potential from NREL's updated resource potential study.¹⁵⁶ Among other variables, the PV-Alt-1 scenario for utility-scale solar notably excludes Department of Defense ("DoD") lands (along with the PV-Alt-3 scenario) and includes development on land with slopes up to 30% (along with the PV-Alt-2) scenario.¹⁵⁷ The Wind-Alt-1 scenario for onshore wind also excludes DoD lands and includes development on lands with slopes up to 20%.¹⁵⁸ Hawaiian Electric incorporated feedback from stakeholders regarding land limitations by introducing a Land Constrained scenario.¹⁵⁹ This sensitivity uses more limited resource potential assumptions than the Alt-1 scenarios for solar and wind

¹⁵⁶See Revised Inputs and Assumptions at 88-94.

¹⁵⁷See Revised Inputs and Assumptions at 93.

¹⁵⁸See Revised Inputs and Assumptions at 93.

¹⁵⁹See Hawaiian Electric Reply Comments at 40-41.

development, reflecting the possibility of future limited land availability.¹⁶⁰

The Commission believes that exclusion of DoD lands for this round of IGP is a reasonable assumption, because it would be difficult to make a reasonable blanket assumption that all DoD lands are available to develop.¹⁶¹ Therefore, the Commission approves Hawaiian Electric's decision to use the Alt-1 scenario as a base case assumption for utility-scale solar PV and wind resource potential.

In the PV-Alt-1 scenario, there is substantial technical potential on lands with slopes greater than 15% shy of reaching the maximum resource potential. For example, the PV-Alt-1 scenario has over twice the installable capacity as the PV-Alt-3 scenario, which is otherwise identical to the PV-Alt-1 scenario except that it excludes lands with slopes greater than 15% on Oahu and Maui.¹⁶² Therefore, the Commission approves the use of a 30% maximum slope angle as an input into the PV-Alt-1 scenario for utility-scale solar PV technical potential, but agrees with Progression that an appropriate capital cost adder must be included for development on sites with slopes greater than 15%. The Commission directs

¹⁶⁰See Hawaiian Electric Reply Comments at 55.

¹⁶¹See Revised Inputs and Assumptions at 94.

¹⁶²See Updated Resource Potential Study at 83.

Hawaiian Electric to flag for stakeholder discussion any scenarios modeled in RESOLVE where utility-scale solar is selected in excess of the maximum installable capacity determined for the PV-Alt-3 scenario.

Like the resource cost decision, set forth above, Hawaiian Electric must include a capital cost adder of 5 cents per watt for utility-scale solar PV capacity deployed on sites with a slope greater than 15% as part of its capacity expansion modeling in RESOLVE. Hawaiian Electric must also amend Section 5.1 to note the addition of this cost adder in NREL's updated resource potential study. Hawaiian Electric may exclude this cost adder during its initial evaluation of the resource potential of utility-scale solar PV, but if the model selects for solar in excess of the maximum installable capacity determined for the PV-Alt-3 scenario, Hawaiian Electric must re-run RESOLVE with the inclusion of this cost adder for all utility-scale solar PV deployed in excess of the PV-Alt-3 scenario resource potential.

The Commission supports Hawaiian Electric's objective to further develop and refine its assumptions regarding the availability of DoD lands for renewable energy development in future IGP cycles.¹⁶³ The Commission encourages Hawaiian Electric to continue working closely with stakeholders to iterate on the

¹⁶³See Hawaiian Electric Reply Comments at 30.

assumptions regarding resource potential as the resource plans are developed in RESOLVE.

12.

Bookend Scenarios and Additional Sensitivities

In response to Commission and Stakeholder feedback, Hawaiian Electric filed updates to the bookends after reviewing the various combinations of updated forecast layers. Hawaiian Electric concluded that the originally proposed fast and slow technology adoption bookends did not offer a significantly different demand forecast to that of the base case and would therefore not serve as appropriate bookends. Hawaiian Electric proposed high and low load forecasts to replace fast and slow technology adoption.¹⁶⁴ The rationale for Hawaiian Electric altering the bookend design was that the high and low load bookends significantly differ from the base forecasts, did not cross over other forecasts, and capture the high and low customer technology adoption forecasts within its bounds. Hawaiian Electric also filed a revised list of sensitivities that includes: (1) DER freeze; (2) EV freeze; (3) EE freeze;

¹⁶⁴See Revised Inputs and Assumptions at 64-66.

(4) Land Constrained; (5) No State ITC for PV; (6) Low Renewable Generation; and (7) High Fuel Price.¹⁶⁵

The Commission understands that the design of the high and low load bookend forecasts meets Hawaiian Electric's intent to "test the sensitivity of models and resulting portfolios by running bookend scenarios that utilize the cumulative potential high and low load forecasts for each layer."¹⁶⁶ However, it is not clear how Hawaiian Electric will use the high and low load bookends to inform a series of preferred options that accelerate its goals and meet plausible future grid needs. For example, in the low load bookend it is unclear what set of future circumstances would lead to high DER adoption, low EV adoption and managed EV charging. Similarly, in the high load bookend, it is unclear what future circumstance would see low DER adoption, high EV adoption and unmanaged EV charging. The apparent low likelihood of these actually occurring simultaneously, across layers, makes it unclear what useful insights will be gained from solely running the high and low load bookend scenarios.

¹⁶⁵See Revised Inputs and Assumptions at 109-110.

¹⁶⁶Revised Inputs and Assumptions at 64.

Due to the absence of a robust explanation that clearly and fully articulates how Hawaiian Electric will use the bookends to inform portfolio selection, and the lack of engagement with stakeholders and the TAP on the updated bookend design prior to the Revised Inputs and Assumptions, the Commission approves Hawaiian Electric's scenarios and sensitivities only with the following modifications. In addition to modeling the high and low load scenarios, Hawaiian Electric must also model the Faster Customer Technology Adoption scenario that was outlined in the Updated Timeline and Stakeholder Engagement Plan filed June 18, 2021.¹⁶⁷ The Commission believes that this scenario's assumptions reflect a plausible future aligned with the State's RPS and emissions reductions goals, and that it could help inform specific programs and pricing needed to meet them.

In total, Hawaiian Electric must run four scenarios: low load, base case, fast customer technology adoption, and high load.

¹⁶⁷"Hawaiian Electric Updated Timeline and Stakeholder Engagement Plan," filed on June 18, 2021, at 9.

Assumption	Low Load	Base	Fast Customer Technology Adoption	High Load
DER	DER Parties Proposal (High Forecast)	HE Company Proposal (Base Forecast)	DER Parties Proposal (High Forecast)	Market Forecast (Low Forecast)
Electric Vehicles	EV-(Low Forecast)	Market Forecast (Base Forecast)	EV++ (High Forecast)	EV++ (High Forecast)
Energy Efficiency	EE-(Low Forecast)	Market Forecast (Base Forecast)	EE++ (High Forecast)	EE -- (Low Forecast)
Time-of-Use	None	Managed	Managed EV	Unmanaged EV

Hawaiian Electric must incorporate the following "Fast Customer Technology Adoption" updates into the finalized Inputs and Assumptions: (1) add the "Fast Customer Technology Adoption" scenario to table 6-2; (2) add the "Fast Customer Technology Adoption" scenario to table 6-3; (3) add text description of the sensitivities in section 6.1.2, consistent with the other scenario descriptions; and (4) update the "Scenarios" tab in workbooks 3 and 4 for each island.

It is also important to understand the value of managed charging. Therefore, the Commission directs Hawaiian Electric to assess both the base and high EV adoption scenarios with and without managed charging. The Commission accepts that this can

occur following the currently scheduled six-month Grid Needs Assessment phase.¹⁶⁸

The Commission understands the logic behind using a wide range of load forecasts given significant uncertainty in customer adoption of EVs, DERs, EE, and TOU. But there has been general feedback from both Stakeholders and the Commission that the design of these bookends risks implausibility and lacks useful insight to inform resource decision-making. To alleviate this concern, Hawaiian Electric must further narrate and specify how it intends to assess, compare, and evaluate the results of the scenarios and sensitivities to inform or optimize its portfolio planning, both as a part of its finalized Inputs and Assumptions, and future IGP review point filings. This will help stakeholders assess if these assumptions are reasonable. Hawaiian Electric must continue working closely with stakeholders on further iterations of the scenarios beyond those prescribed above throughout the Grid Needs Assessment phase, particularly in cases where Hawaiian Electric needs to refine the resource portfolio based on the results of the bookend scenarios and sensitivities. Hawaiian Electric must transparently communicate, document, and solicit stakeholder input on all engineering judgements made.

¹⁶⁸See Grid Needs Assessment, Exhibit 1 at 44.

The bookends have been through several iterations since the TAP initially reviewed them. Hawaiian Electric must continue to prioritize the TAP's input on all filings, particularly given the new TAP members. In future rounds of IGP, Hawaiian Electric should consider economy-wide policy and GHG performance in designing and framing its scenarios and sensitivities. As with the inclusion of the high fuel price sensitivity, and the DER, EE and EV freeze sensitivities, the Commission advises Hawaiian Electric to continue prioritizing standalone sensitivities in future IGP cycles that isolate variables, evaluate the performance of the preferred portfolio, and inform future program design.

13.

Thermal Unit Retirement Plans

Order No. 37730 directed Hawaiian Electric to present a proposed unit retirement plan for use in the base case, analyze how the proposed unit retirement plan affects the optimization of new renewable and storage resources outside of incremental RPS compliance needs, analyze the factors driving resource selection during and near the end of the RPS compliance schedule, and analyze and clearly explain why the model selects such large amounts of biomass and biofuel resources towards the end of the modeling

period.¹⁶⁹ Hawaiian Electric outlined an initial schedule for planned unit removals from service¹⁷⁰ and explained how this unit retirement plan was developed and will be supplemented by future operational decisions.¹⁷¹ Hawaiian Electric noted that its initial retirement schedule was based on age and condition of the units, pairs of units that share auxiliary equipment, system security considerations, ability to obtain spare parts, flexibility, and environmental considerations.¹⁷² Hawaiian Electric indicated that "RESOLVE will be allowed to optimize the retirement of the thermal generating units compared to the . . . fixed removal from service schedule" for the high fuel price sensitivity.¹⁷³

Hawaiian Electric did not, however, carry out the required analysis to determine how this retirement schedule and the RPS compliance schedule impacts resource selection in RESOLVE, including the large selection of biomass and biofuel resources late in the modeling period. This analysis is critical because unit retirements are not yet official or set in stone, as Hawaiian Electric emphasized, and actual retirements may be

¹⁶⁹See Order No. 37730 at 32-35.

¹⁷⁰See Revised Inputs and Assumptions at 152.

¹⁷¹See Hawaiian Electric Response to PUC-HECO-IR-13 at 1-3.

¹⁷²See Hawaiian Electric Response to PUC-HECO-IR-13 at 1-2.

¹⁷³Revised Inputs and Assumptions at 113.

informed by such analysis. For example, analysis of the retirement schedule's impact on resource selection may determine that new renewable capacity buildout is selected when existing units are retired, so there may be an option to retire units earlier if renewable capacity is available earlier.

Hawaiian Electric noted that the retirement plans provided in the Revised Inputs and Assumptions are "starting assumptions that will be further analyzed during the upcoming Grid Needs Assessment phase; and may be iterated on, as needed, consistent with the modeling framework."¹⁷⁴ The Commission agrees that it is appropriate to evaluate the initial retirement assumptions during this process, and that the additional analysis the Commission has identified should help this evaluation. Therefore, as directed already in Order No. 37730, Hawaiian Electric must: (1) analyze how Hawaiian Electric's proposed unit retirement plans affect the optimization of new renewable and storage resources outside of incremental RPS compliance needs; (2) analyze the factors driving resource selection during and near the end of the RPS compliance schedule; and (3) and analyze why RESOLVE selects such large amounts of biomass and biofuel resources towards the end of the

¹⁷⁴Hawaiian Electric Reply Comments at 46.

modeling period.¹⁷⁵ Hawaiian Electric must include this analysis in its finalized Inputs and Assumptions.

14.

Data Presentation

In Order No. 37730, the Commission emphasized transparency with respect to the quantitative data and directed the Hawaiian Electric to provide clear narrative explanations, provide only live and unlocked workbooks with cell logic intact, use plain language, provide references and citations, and format documents to improve understanding.¹⁷⁶ In this area, the Commission focused on Hawaiian Electric's IGP webpage and the Excel workbooks that accompany the Inputs and Assumptions for each island.

On July 22, 2021, the Hawaiian Electric IGP team solicited feedback from the Commission and stakeholders on its revised workbooks and updated webpage via email. The Commission did not have access to the feedback that other stakeholders provided on these updates and therefore followed up with an IR to gather any feedback that Hawaiian Electric received.¹⁷⁷ Hawaiian Electric stated that it received feedback on its workbook

¹⁷⁵See Order No. 37730 at 32-35.

¹⁷⁶See Order No. 37730 at 45-46.

¹⁷⁷See PUC-HECO-IR-9 filed on October 6, 2021.

formatting and website organization to improve accessibility, such as adding navigational sheets with references to data sources and re-organizing the IGP webpage to include links to key stakeholder documents and dates for each link or working groups, and on certain assumptions and technical potential of the capacity expansion model, unrelated to data presentation.¹⁷⁸ While the feedback was not attributed to specific stakeholders, the formatting feedback and suggestions reported by Hawaiian Electric match the feedback provided by Commission staff.¹⁷⁹ Ultimately, the Commission is satisfied that Hawaiian Electric has complied with Order No. 37730's directives on data presentation.

i.

Workbooks

The Commission acknowledges the improvements that Hawaiian Electric made to its Inputs and Assumptions workbooks including the narrative explanations for inputs and forecasts, navigational sheets, references and citations for data sources, and providing details for each iteration of the workbooks.

¹⁷⁸See Hawaiian Electric Response to PUC-HECO-IR-9 at 3.

¹⁷⁹Commission staff provided feedback via email to Hawaiian Electric on August 9, 2021.

Additionally, Hawaiian Electric effectively organized the data into comprehensible workbooks for each island, for each sensitivity and scenario, and for the entire forecast period. The Commission also requested descriptive and comparative statistics between the scenarios to clarify areas where the forecast scenarios diverge; however, Hawaiian Electric stated that these additions are still in development.¹⁸⁰

One omission from the inputs and assumptions workbooks is the historic data that informed the various forecast layers, which have been updated multiple times since the March 2021 update. Additionally, the Joint Parties requested open access to the modeling software, such as is the case in California. Hawaiian Electric claimed that the workbooks provide sufficient information to detail the inputs and assumptions used in its modeling tools, that the Joint Parties have access to RESOLVE through the DER docket, and that other Parties have been able to conduct their own modeling and analysis using the inputs and assumptions.¹⁸¹

The Commission accepts the updates that Hawaiian Electric has made to the Inputs and Assumptions workbooks provided that the outstanding items (i.e., the comparative

¹⁸⁰See Hawaiian Electric Response to PUC-HECO-IR-9 at 3.

¹⁸¹Hawaiian Electric Reply Comments at 44-45.

statistics and the historic data that inform the forecast layers) are published to the webpage before filing the finalized Inputs and Assumptions, and commencing the modeling work for the grid needs assessment phase. Additionally, the Commission directs Hawaiian Electric to open access to the modeling tools in future IGP cycles.

ii.

IGP Webpage

In response to Order No. 37730, Hawaiian Electric updated its website by organizing information in order of recent developments, adding dates to make updates easy to follow, and uploading an immense volume of data. Hawaiian Electric has not yet added: (1) a "process" or "timeline" page or graphic to describe the overall IGP process and indicates the current stage; (2) descriptions of models with graphics describing the iterative modeling process; (3) links to meeting recordings, if available; and (4) descriptions to the working group pages to describe their purpose. Hawaiian Electric must implement these changes by the time it files the finalized Inputs and Assumptions.

Additionally, due to the number of links to data throughout the webpage and subpages, Hawaiian Electric must describe the data included in each working group page, including a description of the topics discussed in the working group meetings.

The Commission also directs Hawaiian Electric to consider reorganizing the downloadable data and information by topic or IGP step rather than, or in addition to, by working group. Finally, the Commission directs Hawaiian Electric to notify stakeholders and the Commission by email when updates are made to the webpage so that key filings are not overlooked.

B.

Next Steps

Hawaiian Electric shall file finalized Inputs and Assumptions, consistent with the directives and guidance in this order, by March 31, 2022. Hawaiian Electric's finalized Inputs and Assumptions shall be approved automatically ten days after they are filed, unless the Commission orders otherwise.

IV.

ORDERS

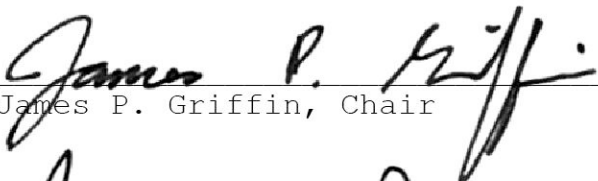
THE COMMISSION ORDERS:

1. Hawaiian Electric shall file finalized Inputs and Assumptions, consistent with the directives and guidance in this order, by March 31, 2022.


2. Hawaiian Electric's finalized Inputs and Assumptions shall be approved automatically ten days after they are filed, unless the Commission orders otherwise.

DONE at Honolulu, Hawaii MARCH 3, 2022.

PUBLIC UTILITIES COMMISSION
OF THE STATE OF HAWAII

By  _____
James P. Griffin, Chair

By  _____
Jennifer M. Potter, Commissioner

By  _____
Leodoloff R. Asuncion, Jr., Commissioner

APPROVED AS TO FORM:


Mike S. Wallerstein
Commission Counsel

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CERTIFICATE OF SERVICE

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