March 31, 2022

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

Dear Commissioners:

Subject: Docket No. 2018-0165
Instituting a Proceeding to Investigate Integrated Grid Planning
Hawaiian Electric Response to Order No. 38253 Approving Inputs and Assumptions with Modifications

Hawaiian Electric[1] appreciates the Commission's issuance of Order No. 38253 *Approving, With Modifications, Hawaiian Electric's Revised Inputs And Assumptions*, issued on March 3, 2022 in this proceeding ("Order 38253"). As described in this letter, the Company has modified the inputs and assumptions consistent with Commission directives in Order 38253. The revised workbooks reflecting the modified Inputs and Assumptions and the associated electronic files[2] of the modified Inputs and Assumption workbooks will be available on the Company's website.

Technical Advisory Panel

> 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. (Order 38253 at 23.)

The Company acknowledges the Commission's direction with respect to the TAP's involvement. Now that the inputs and assumptions phase has been finalized, the upcoming phases of the IGP process are more technical in nature, as such the Company has been engaging the TAP on a

[1] Hawaiian Electric Company, Inc., Hawai‘i Electric Light Company, Inc., and Maui Electric Company, Limited are collectively referred to as the "Hawaiian Electric" or the "Company."

[2] Electronic files are also included in support of this filing. The files are voluminous (approximately 715 MB) and therefore are being provided to both the Commission (via its One Drive) and the Consumer Advocate (DVD). A copy of these files will be saved to the Company's website: https://www.hawaiianelectric.com/clean-energy-hawaii/integrated-grid-planning/stakeholder-and-community-engagement/key-stakeholder-documents for access by the parties to this proceeding. In addition, copies of the DVD will be made available to any party to this proceeding. Interested parties may email Regulatory@hawaiianelectric.com to request a copy.

recurring basis. Since the third quarter of 2021, the Company has been focused on its TAP engagement, meeting with the TAP and the various sub-committees on:[3]

- October 1, 2021
- October 4, 2021
- October 11, 2021
- November 1, 2021
- November 18, 2021
- December 13, 2021
- January 20, 2022
- January 21, 2022
- February 25, 2022
- March 10, 2022
- March 11, 2022

The Company plans to continue to meet with the TAP as the IGP process continues.

Resource Adequacy Methodology and HDC Approach

> 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. (Order 38253 at 30.)

The Company believes that it has addressed the Commission's concern regarding the HDC approach with the Company's responses to PUC-HECO-IR-36 and -37, filed on March 24, 2022. The next step is for the Company to start testing the agreed upon framework for assessing resource adequacy and review the results of the model testing with the TAP at its next meeting scheduled for April 2022. Further adjustments will be made upon consultation with the TAP.

Underlying Load Forecast, and Peak Forecast

> 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. 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. (Order 38253 at 33.)

[3] As of the date of the November 5, 2021 Grid Needs Assessment Methodology Review Point filing, TAP feedback was submitted as Appendix K. Subsequent meetings were filed in various information requests since that time. A complete listing of all TAP meeting materials and notes are available at, https://www.hawaiianelectric.com/clean-energy-hawaii/integrated-grid-planning/stakeholder-and-community-engagement/technical-advisory-panel

The Company acknowledges the Commission's direction and will collaborate with stakeholders and the TAP to develop additional Underlying Load forecast sensitivities in future rounds of IGP.

> [T]he 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. *Id.* at 36.

For O‘ahu, the Company updated the underlying peak load forecast by utilizing load profile data by rate classes collected from the 2017 Class Load Study.[4] The impacts of the update can be seen in the figures below comparing the August 2021 and the revised March 2022 Underlying Load profile and peak load forecasts. The impacts to the forecasted peak load reflect changes in both the Underlying Load shape and the modifications to EE free-ridership described later in the document.

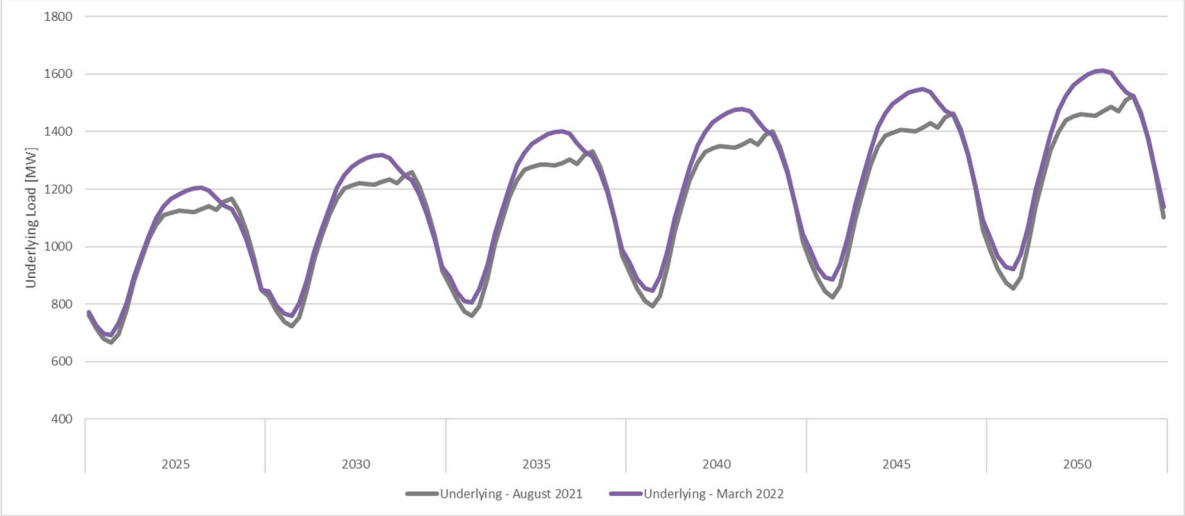

Figure 1. Comparison of Oahu Annual Average Underlying Load: IGP August 2021 vs. March 2022

[4] The Company used the methodology outlined in O‘ahu Underlying Layer of Company's response to PUC-HECO-IR-2, filed in Docket No. 2018-0165 on July 2, 2020, at page 3.

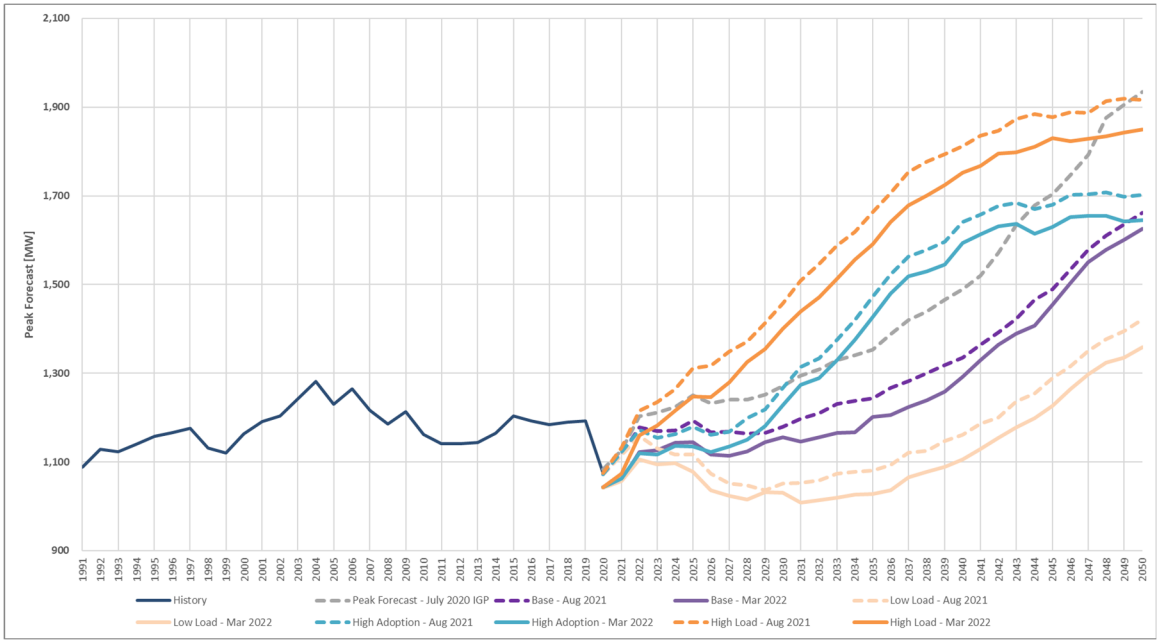

Figure 2. Comparison of Oahu Peak Load Forecast Scenarios: IGP August 2021 vs. March 2022

For Hawai‘i Island, the Company previously communicated in its response to PUC-HECO-IR-2, filed on July 2, 2020, models for the underlying peak load forecast used years 2015-2018 (excluding 2016) hourly system load profiles instead of the 2013 Class Load Study.[5] Hawai‘i Island had historically low air conditioning saturation, but with warmer weather in 2015 and 2016, there was increased adoption of air conditioning on island. Using the system load shapes for more recent years better captured those effects in the load profiles and forecasted peaks. .

For Maui, the Company previously clarified that the most recent complete class load study for Maui conducted from July 2013 – June 2014 was used to develop the underlying peak load forecast as described in the Companies' response to PUC-HECO-IR-2.[6]

The most recent complete class load studies for Lāna‘i and Moloka‘i were conducted in 2009. Due to changes in customer behavior, self-generation and end uses that have occurred

[5] See Hawai‘i Underlying Layer of the Company's response to PUC-HECO-IR-2, filed in Docket No. 2018-0165 on July 2, 2020, at page 4.
[6] See Maui Underlying Layer of the Company's response to PUC-HECO-IR-2, filed in Docket No. 2018-0165 on July 2, 2020 at, pages 4-5.

since 2009, the Company chose to use more recent available data to develop the peak load forecasts for these islands as described in the Company's response to PUC-HECO-IR-2.[7]

> 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. (Order 38253 at 36.)

The Company will work towards developing a plan to integrate AMI data in future IGP proceedings. Once more AMI meters are rolled out and data is acquired, the Company will have a better understanding of how best to utilize that data to inform future load forecasts in future rounds of IGP.

> DER Forecasts
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> 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 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 DER Forecast have on the resource selection process, aside from impacts on the forecast. (*Id.* at 38-39.)

The No State ITC sensitivity was initially proposed to evaluate the impacts to the resource plan when removing the State ITC for both grid-scale PV and distributed rooftop PV. Because the State ITC was removed for grid-scale PV for systems larger than 5 MW that require an approved power purchase agreement in the 2020 legislative session,[8] the results of this sensitivity would be less useful to inform grid needs. The Company agrees that the DER freeze case and other cases that directly use the DER forecast layers for higher and lower uptake of DER would be more informative for the solution sourcing process and that the No State ITC sensitivity does not need to be carried forward. Thus, the No State ITC sensitivity will no longer be run and has been removed from the workbooks. Below is an updated visual of the Oahu's DER forecast sensitivities, including the addition of DER Freeze sensitivity.

[7] See Moloka‘i Underlying Layer and Lāna‘i Underlying Layer of the Company's response to PUC-HECO-IR-2, filed in Docket No. 2018-0165 on July 2, 2020, at pages 5-6.
[8] See Hawai‘i Revised Statutes § 235-12.5.

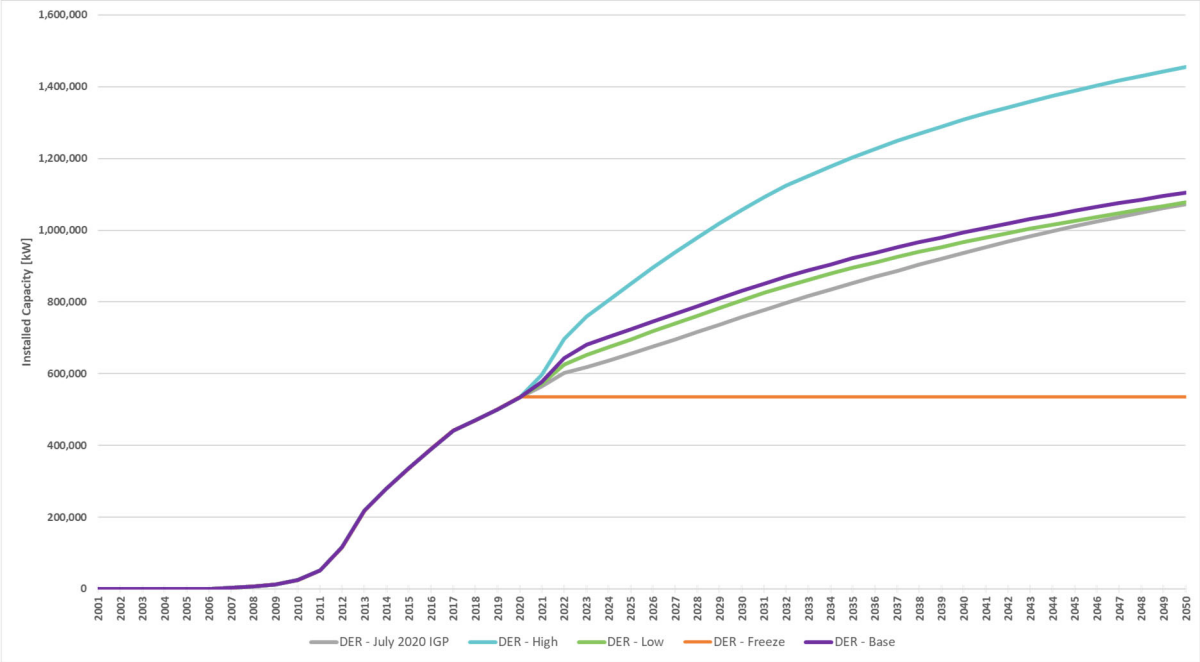

Figure 3. DER Forecast Sensitivities, Including DER Freeze

Energy Efficiency

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. (Order 38253 at 44-45.)

The Company updated the Underlying Load forecast layer by moving future free-ridership savings to the EE layer for all forecast sensitivities. Additionally, AEG confirmed the EE supply curves' potential were not reduced due to free-ridership. The adjustments to the Underlying Load forecast and EE forecast sensitivity layers are reflected in the hourly profiles, Sales by Layers, and Peaks by Layers of the modified Inputs and Assumption workbooks.

Per the Company's PUC-HECO-IR-23(c) response: "The potential study C&S [Codes and Standards] projection included the impacts of new codes and standards set to take effect in future years that were known and codified by June 2020. This analysis has not been modified or updated for the IGP supply curves."[9] The Company confirms the future C&S impacts include codes and standards to be known and codified by June 2020.

For the High Load Bookend scenario, the EE Low sensitivity forecasts were updated to include C&S savings for all islands. To represent the potential for lower EE savings, the programmatic Business-As-Usual ("BAU") component of the EE Low sensitivity forecasts were reduced by 25%. Additionally, the EE Freeze sensitivity was updated to include future C&S savings that are aligned to the EE Base, Low, and High sensitivities. No modifications were made to Business-As-Usual component of the EE Freeze sensitivity. Below is a revised summary of the EE sensitivities.

Low	Base	High	Freeze
BAU (Reduced by 25%) + C&S	BAU + C&S	Achievable High + C&S	BAU capacity fixed at 2021 levels + C&S

The Company clarifies that the energy efficiency supply curves need to be modeled with the EE Freeze forecast. The supply curves already represent the potential for future energy efficiency, whereas the EE freeze forecast represents the existing installed energy efficiency, and together provide the total amount of energy efficiency for each island. Similarly, the base, low, and high energy efficiency forecasts account for both existing installed and future adoption of energy efficiency so the Base and Bookend Sensitivities could be compared to the EE Freeze sensitivity. The EE Freeze sensitivity is the same as the EE as a Candidate Resource Sensitivity that was discussed earlier in the IGP process. Using the EE freeze forecast with the EE supply curves as candidate resources will then allow for the appropriate comparison to other cases

[9] See the Company's response to PUC-HECO-IR-23, filed in Docket No. 2018-0165 on October 25, 2021 at page 2.

wherein future EE that is embedded in the various scenarios can be compared to EE measures that were selected in the EE freeze case.

Electric Vehicle Forecast

> [T]he 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. (Order 38253 at 48.)
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> * * *
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> Therefore, the Commission directs Hawaiian Electric to assess both the base and high EV adoption scenarios with and without managed charging. (*Id.* at 61.)

The Company can assess the base and high EV adoption scenarios with and without managed charging as part of the solution sourcing process, following the Grid Needs Assessment phase. This will be considered in addition to the EV freeze case currently proposed.

Fuel Price Forecast

> 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. (*Id.* at 50.)

The Company has not proposed a low fuel price forecast sensitivity because, all other assumptions being the same, a low fuel price would delay the addition of renewable resources until they become cost effective later in the planning horizon or are required to be added to meet Renewable Portfolio Standards ("RPS") constraints. Modeling already conducted to scope the Hawai‘i Island Stage 3 RFP and O‘ahu Firm Renewable RFP, using the August 2021 Inputs and Assumptions, indicates that renewable resources can be cost effectively added in the near-term, ahead of RPS milestones.

Resource Cost Forecasts and Resource Potential

> 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.
>
> 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. 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. (*Id.* at 53-54.)

The Company will include a cost adder for developing PV on slopes greater than 15%. This cost adder will be used in addition to the REZ enablement costs that were defined in the Transmission Renewable Energy Zone Study ("REZ Study"). To manage the number of available resource options in RESOLVE, the REZ would be further grouped by groups that had similar REZ enablement costs. However, the model will still recognize PV built on slopes up to 15% and on slopes greater than 15% with a five cents per watt cost adder as separate resource options. This approach should minimize the need to iterate the RESOLVE modeling. The table below provides the REZ groups as stated in the REZ Study and for modeling in RESOLVE for O‘ahu. Similar groupings would also be made for Hawai‘i Island and Maui modeling. The updated resource cost with the five cents per watt cost adder for PV built on slopes greater than 15% can be found in each islands' IGP Resource Costs Forecast tab in Workbook 3.

O‘ahu REZ Group	Capacity, Up to 15% Slope (MW)	Capacity, Greater than 15% Slope (MW)	RESOLVE Group	RESOLVE Capacity, Up to 15% Slope (MW)	RESOLVE Capacity, Greater than 15% Slope (MW)
1	15	105	A = REZ Group 1, 2, 7	84	426
2	39	285	B = REZ Group 3, 4, 5, 6	439	1,235
3	238	350	C = REZ Group 8	435	725
4	35	296			
5	124	484			
6	42	105			
7	30	36			
8	435	725			

Bookend Scenarios and Additional Sensitivities

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. 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. (*Id.* at 60.)

The Company agrees to run the four scenarios: low load, base case, faster customer technology adoption, and high load. The Scenarios tab in each island's Workbook 3 and Workbook 4 have been updated to add the Faster Customer Technology Adoption sensitivity.

> 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. (*Id.* at 61.)

The updated tables for Table 6-2 and Table 6-3 are provided below. The Faster Customer Technology Adoption sensitivity was added, the No State ITC for PV sensitivity was removed, a column was added for the Non-DER/EV TOU Forecast, and the TOU Load Shape was changed to EV Load Shape for clarity.

Table 1: Revised Table 6-2 Table of Proposed Sensitivities

Sensitivity Name	Purpose
1. High Load Customer Technology Adoption Bookend	Understand the impact of customer adoption of technologies for DER, electric vehicles, energy efficiency, and time-of-use rates that lead to higher loads.
2. Low Load Customer Technology Adoption Bookend	Understand the impact of customer adoption of technologies for DER, electric vehicles, energy efficiency, and time-of-use rates that leads to lower loads.
3. DER Freeze	Understand the value of the distributed PV and BESS uptake in the Base forecast. Informative for program design and solution sourcing.
4. EV Freeze	Understand the value of the electric vehicles uptake in the Base forecast. Informative for program design and solution sourcing.
5. EE Freeze	Understand the value of the energy efficiency uptake in the Base forecast. Informative for program design and solution sourcing.
6. Land Constrained	Understand the impact of limited availability of land for future solar, onshore wind, and biomass development.

Sensitivity Name	Purpose
7. **Low Renewable Generation**	Understand the value of the resource portfolio during periods of low renewable production and additional forced outage combinations.
9. **Faster Customer Technology Adoption**	Understand the impact of faster customer adoption of DER, EV, and EE.

Table 2: Revised Table 6-3 Forecast Layer Mapping of Modeling Scenarios and Sensitivities

No.	Modeling Case	DER Forecast	EV Forecast	EE Forecast	Non-DER/EV TOU Forecast	EV Load Shape	Fuel Price Forecast	Resource Cost Forecast	Resource Potential
1	Base	Base Forecast	Base Forecast	Base Forecast	Base Forecast	Managed EV Charging	Base Forecast	Base Forecast	NREL Alt-1
2	High Load Customer Technology Adoption Bookend	Low Forecast	High Forecast	Low Forecast	Low Forecast	Unmanaged EV Charging	Base Forecast	Base Forecast	NREL Alt-1
3	Low Load Customer Technology Adoption Bookend	High Forecast	Low Forecast	High Forecast	High Forecast	Managed EV Charging	Base Forecast	Base Forecast	NREL Alt-1
4	DER Freeze	DER Freeze	Base Forecast	Base Forecast	Base Forecast	Managed EV Charging	Base Forecast	Base Forecast	NREL Alt-1
5	EV Freeze	Base Forecast	EV Freeze	Base Forecast	Base Forecast	Managed EV Charging	Base Forecast	Base Forecast	NREL Alt-1

No.	Modeling Case	DER Forecast	EV Forecast	EE Forecast	Non-DER/EV TOU Forecast	EV Load Shape	Fuel Price Forecast	Resource Cost Forecast	Resource Potential
6	EE Freeze	Base Forecast	Base Forecast	EE Freeze	Base Forecast	Managed EV Charging	Base Forecast	Base Forecast	NREL Alt-1
7	Land Constrained	Base Forecast	Base Forecast	Base Forecast	Base Forecast	Managed EV Charging	Base Forecast	Base Forecast	Land Constrained Resource Potential
8	Low Renewable Generation	Base Forecast	Base Forecast	Base Forecast	Base Forecast	Managed EV Charging	Base Forecast	Base Forecast	NREL Alt-1
9	High Fuel Price	Base Forecast	Base Forecast	Base Forecast	Base Forecast	Managed EV Charging	EIA High Fuel Price Forecast	Base Forecast	NREL Alt-1
10	Faster Customer Technology Adoption	High Forecast	High Forecast	High Forecast	High Forecast	Managed EV Charging	Base Forecast	Base Forecast	NREL Alt-1

> 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. (*Id.* at 62.)

The Company intends to share the results of its modeling with stakeholders through the various stakeholder engagement groups, during which there will be opportunities for discussion and feedback. In these discussions, the Company will decide whether additional modeling iterations are needed and how the results of the various cases can inform modifications to the base case resource plan and assumptions to carry forward through the process. As discussed previously with the Stakeholder Technical Working Group, the low load and high load bookends will be informative here, especially if the same resources are selected but with different timing,

to indicate that certain resource types are preferred under different load scenarios given the uncertainty in future uptake of DER, EE, EV, and TOU programs.[10] The high and low bookends can also be helpful to inform procurement scenarios where a targeted range of services can be sought instead of an absolute target quantity of services. This will especially be useful as customer adoption of technologies accelerate and future loads become more uncertain.

While the Company is not proposing to use the high load bookend directly, there may be Grid Needs and associated resources or solutions that should be accounted for in the base case resource plan to mitigate future uncertainty in resource mix, weather, and load. The additional resources that are added to the base case will be discussed with the stakeholder engagement groups to ensure that these changes are vetted by stakeholders.

> 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. (Order 38253 at 62.)

The Company is committed to transparency throughout this IGP process and will continue to meet with the Stakeholder Technical Working Group, Stakeholder Council, and Technical Advisory Panel to seek feedback on the analytical results. The Company also expects that feedback will be provided along the way from stakeholders so that feedback can be considered and incorporated in an efficient manner instead of feedback being received at the end of a process step that may lead the Commission to direct the Company to "redo" certain analyses that would further delay the IGP process.

> 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. (*Id.* at 63.)

The Company intends to incorporate additional impacts of economy-wide decarbonization policies; such as moderate and high electrification of other sectors of the economy aside from ground transportation which is currently included in this cycle of IGP.

[10] See July 14, 2021 STWG meeting summary notes, available at https://www.hawaiianelectric.com/documents/clean_energy_hawaii/integrated_grid_planning/stakeholder_engagement/working_groups/stakeholder_technical/20210714_stwg_meeting_summary_notes.pdf

> Thermal Unit Retirements
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> 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 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. (*Id.* at 64-65.)
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> 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 modeling period. Hawaiian Electric must include this analysis in its finalized Inputs and Assumptions. (*Id.* at 65-66.)

First, as a general matter, the analysis (and questions) the Commission has posed are precisely the questions that the Company seeks to provide clarity on as part of the Grid Needs Assessment step not during the Inputs and Assumptions development phase of the IGP process. The Company notes that the proposed unit retirement assumptions should be addressed as part of the Grid Needs Assessment to ensure that the suite of grid services provided by a thermal generator are adequately replaced by future resources assumed in the resource plans. Following the IGP modeling framework, the Company will identify the timing, type, and quantity of proxy resources that provide the required grid services in an iterative process that includes capacity expansion planning, resource adequacy analysis, production cost simulations, and a network stability assessment. Until the set of four analyses can be conducted, the effect of the Company's proposed retirement plans on the optimization of new renewable and storage resources outside of incremental RPS compliance needs, the factors driving resource selection during and near the end of the RPS compliance schedule, and why large amounts of biomass and biofuel resources may be selected towards the end of the modeling period can only be speculated. For this reason, the retirement assumptions should be considered within the context of the entire Grid Needs Assessment process and not solely as an input assumption.

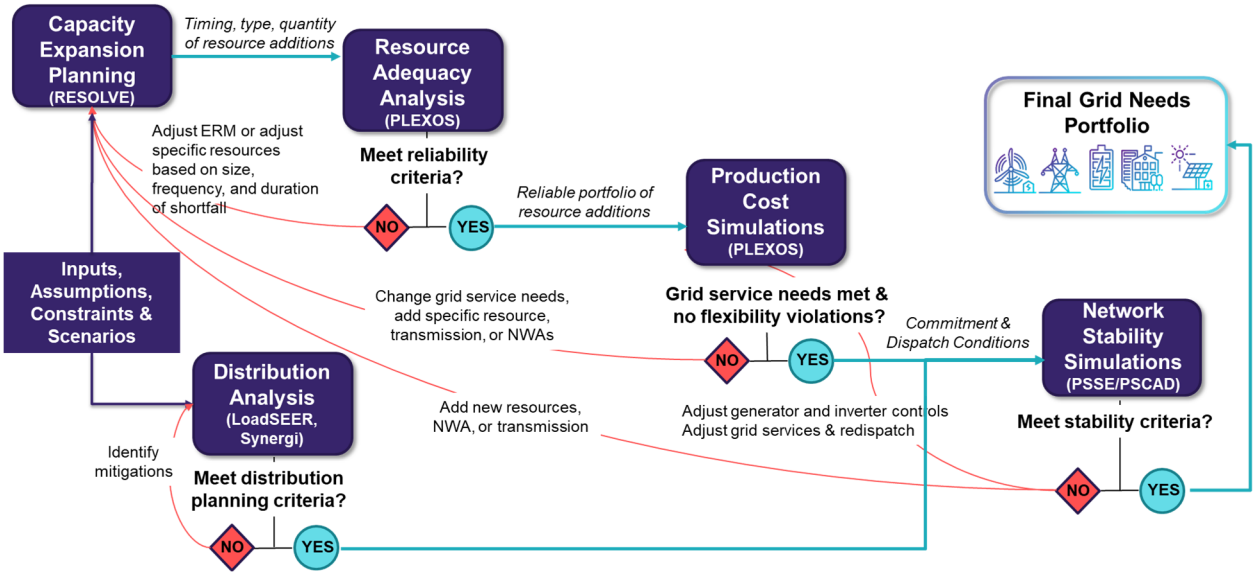

Figure 4: Grid Needs Assessment Methodology

Notwithstanding the above, in response to the Commission's direction, the Company has conducted modeling in RESOLVE to determine the change in resource additions when the thermal generating units are assumed to no longer be dispatched in the years identified in the Company's August 19, 2021 IGP Inputs and Assumptions. Similarly, the sales forecast and fuel price forecast for this analysis uses the assumptions filed in the Company's August 19, 2021 Inputs and Assumptions. The resource cost forecast uses the revision to the August 19, 2021 IGP Inputs and Assumptions described in the Company's Reply to Party Comments and Commission Questions, filed on September 21, 2021.

The cumulative resource additions in a case where thermal generating units are removed from service, compared to a status quo case where they are continued, is summarized in select years where either a unit is removed from normal service or is an RPS milestone year. The differential in resource additions are also provided, where additions and reductions are reported relative to the status quo.

Table 3: O'ahu Selected Resource Summary - With Thermal Generating Unit Removals from Service

Year	Onshore Wind	Offshore Wind	PV+BESS	BESS	Fossil and Biofuel	Biomass
2027	163 MW	0	0	231 MW, 434 MWh	0	0
2029	163 MW	0	0	287 MW, 539 MWh	35 MW	0

2030	163 MW	0	1,577 MW, 4,461 MWh	379 MW, 712 MWh	35 MW	0
2033	163 MW	0	1,835 MW, 5,584 MWh	387 MW, 727 MWh	35 MW	0
2040	163 MW	78 MW	2,623 MW, 7,794 MWh	387 MW, 727 MWh	245 MW	6 MW
2045	163 MW	78 MW	3,187 MW, 9,086 MWh	394 MW, 740 MWh	245 MW	121 MW
2050	163 MW	78 MW	3,187 MW, 9,308 MWh	417 MW, 791 MWh	437 MW	253 MW

Table 4: O‘ahu Selected Resource Summary - No Thermal Generating Unit Removals from Service

Year	Onshore Wind	Offshore Wind	PV+BESS	BESS	Fossil and Biofuel	Biomass
2027	163 MW	0	0	231 MW, 434 MWh	0	0
2029	163 MW	0	0	257 MW, 483 MWh	0	0
2030	163 MW	0	1,630 MW, 4,826 MWh	401 MW, 753 MWh	0	0
2033	163 MW	0	1,691 MW, 5,166 MWh	423 MW, 794 MWh	0	0
2040	163 MW	188 MW	2,129 MW, 6,528 MWh	423 MW, 796 MWh	0	0
2045	163 MW	188 MW	2,978 MW, 8,600 MWh	423 MW, 796 MWh	0	83 MW
2050	163 MW	188 MW	3,187 MW, 9,368 MWh	428 MW, 809 MWh	0	142 MW

Table 5: O‘ahu Differential Cumulative Resource Additions

Year	Onshore Wind	Offshore Wind	PV+BESS	BESS	Fossil and Biofuel	Biomass
2027	0	0	0	0	0	0
2029	0	0	0	30 MW, 56 MWh	35 MW	0
2030	0	0	-54 MW, -364 MWh	-21 MW, -40 MWh	35 MW	0
2033	0	0	144 MW, 418 MWh	-36 MW, -67 MWh	35 MW	0
2040	0	-110 MW	494 MW, 1,266 MWh	-36 MW, -69 MWh	245 MW	6 MW
2045	0	-110 MW	209 MW, 486 MWh	-30 MW, -56 MWh	245 MW	38 MW
2050	0	-110 MW	0 MW, -59 MWh	-12 MW, -18 MWh	437 MW	111 MW

For O‘ahu, there is an acceleration of PV+BESS resources in the earlier years of the planning horizon when thermal units are removed from service but by 2050, the cumulative capacities are nearly the same. The same resource plan with thermal unit removals has additional conventional and biomass thermal capacity added whereas the resource plan with no thermal unit removals builds a lesser amount of biomass and no new fossil generation. In the resource plan with thermal unit removals, this additional firm capacity is built to meet the energy reserve margin criteria in years 2029, 2040, and 2050. The biomass addition in 2045 is built to reduce system costs only. In the resource plan without thermal units removed, the biomass additions are all built to reduce system costs only.

Table 6: Hawai‘i Island Selected Resource Summary - With Thermal Generating Unit Removals from Service

Year	Onshore Wind	PV+BESS	BESS	Geothermal
2027	51 MW	0	2 MW, 3 MWh	0
2030	51 MW	26 MW, 26 MWh	11 MW, 21 MWh	39 MW
2040	51 MW	37 MW, 48 MWh	13 MW, 28 MWh	50 MW
2045	51 MW	67 MW, 147 MWh	15 MW, 37 MWh	68 MW
2050	51 MW	86 MW, 170 MWh	18 MW, 60 MWh	82 MW

Table 7: Hawai‘i Island Selected Resource Summary - No Thermal Generating Unit Removals from Service

Year	Onshore Wind	PV+BESS	BESS	Geothermal
2027	56 MW	0	4 MW, 5 MWh	0
2030	56 MW	30 MW, 30 MWh	11 MW, 21 MWh	35 MW
2040	56 MW	42 MW, 54 MWh	13 MW, 28 MWh	47 MW
2045	56 MW	84 MW, 198 MWh	16 MW, 36 MWh	63 MW
2050	56 MW	102 MW, 232 MWh	17 MW, 41 MWh	77 MW

Table 8: Hawai‘i Island Differential Cumulative Resource Additions

Year	Onshore Wind	PV+BESS	BESS	Geothermal
2027	-5 MW	0	-1 MW, -2 MWh	0
2030	-5 MW	-4 MW, -4 MWh	0	4 MW
2040	-5 MW	-4 MW, -6 MWh	-1 MW, -1 MWh	3 MW
2045	-5 MW	-17 MW, -51 MWh	0 MW, 1 MWh	5 MW
2050	-5 MW	-16 MW, -62 MWh	1 MW, 20 MWh	5 MW

For Hawai‘i Island, the resource plan with thermal units removed from service builds slightly more geothermal and slightly less wind and PV+BESS when compared to the resource plan with no thermal unit removals. In the resource plan with thermal unit removals, only the 2050 additions are needed for capacity to meet the energy reserve margin criteria whereas in the resource plan with no thermal unit removals, all resource additions are built to reduce system costs only.

Table 9: Maui Selected Resource Summary - With Thermal Generating Unit Removals from Service

Year	Onshore Wind	PV+BESS	Biomass
2027	50 MW	0	0
2030	70 MW	7 MW, 7 MWh	0
2040	95 MW	177 MW, 374 MWh	0
2045	95 MW	354 MW, 696 MWh	8 MW
2050	95 MW	450 MW, 912 MWh	18 MW

Table 10: Maui Selected Resource Summary - No Thermal Generating Unit Removals from Service

Year	Onshore Wind	PV+BESS	Biomass
2027	50 MW	0	0
2030	71 MW	6 MW, 6 MWh	0
2040	98 MW	165 MW, 325 MWh	0
2045	98 MW	353 MW, 692 MWh	8 MW
2050	98 MW	457 MW, 884 MWh	10 MW

Table 11: Maui Differential Cumulative Resource Additions

Year	Onshore Wind	PV+BESS	Biomass
2027	0	0	0
2030	0	1 MW, 1 MWh	0
2040	-4 MW	12 MW, 50 MWh	0
2045	-4 MW	1 MW, 4 MWh	0
2050	-4 MW	-7 MW, +28 MWh	7 MW

For Maui, the resource plan with thermal units removed from service builds slightly more biomass and slightly less wind and PV+BESS when compared to the resource plan with no thermal unit removals. In the resource plan with thermal units removed, the new PV+BESS and biomass in 2040 and 2050 is built to meet the energy reserve margin criteria whereas no resource additions are needed to meet the energy reserve margin in the resource plan with no thermal units removed.

In all resource plans, the models assume that new and existing fossil generating units must be on biofuel from 2045 onward, in compliance with 100% RPS goals in the same year. This fuel switch causes an increase in the fuel cost associated with the thermal generating units and provides an opportunity for new geothermal and biomass additions to be cost effective. The geothermal and biomass candidates are both renewable resources that have high fixed capital cost but low variable cost and their low variable cost relative to the fuel cost on biodiesel may partly explain their addition in such large amounts toward the end of the modeling period.

Further, the sales forecast increases in the back half of the planning horizon, primarily due to load growth associated with electric vehicles, which causes RESOLVE to add resources to meet the energy reserve margin criteria. Because RESOLVE considers the resource plan cost through the entire planning horizon, the model may add new thermal generating units like the biomass and biofuel units in 2045 or other years that are not binding for the energy reserve margin criteria because it is lower cost to do so and because those same thermal units would provide capacity value in the years that additional capacity is needed to meet the energy reserve margin. There is also a substantial amount of new variable renewables added in the resource plans on all islands. Although all resources contribute toward meeting the energy reserve margin

criteria, the relatively smaller additions of thermal generating units in 2050 to meet the energy reserve margin may indicate that the greater availability of the thermal resources provides a more cost effective means of meeting the capacity need than increased amounts of variable renewables and storage at a lower availability. The load growth, in combination with the increase in fuel costs from the biofuel fuel switch, cause the addition of biomass, biofuel, and geothermal resources in the later years.

Data Presentation and Workbooks

> 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 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. (Order 38253 at 68-69.)

The comparative statistics are summarized in each island's Workbook 3 on the Comparative Statistics tab. The historical data that inform the forecast layers were provided in response to PUC-HECO-IR-1 and posted on the IGP webpage.[11] The workbooks also included other updates to correct for minor errors in the provided data and update the O'ahu planned maintenance, maintenance outage rates, forced outage rates, and unit minimums to more closely reflect expected near term operations.

IGP Webpage

> 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. (*Id.* at 69.)

On the main IGP webpage, a process graphic has been added as shown below. Clicking on the process graphic will allow the user to view an enlarged version of the graphic.

[11] See Historical Data for Forecast Layers, available at https://www.hawaiianelectric.com/clean-energy-hawaii/integrated-grid-planning/stakeholder-and-community-engagement/key-stakeholder-documents

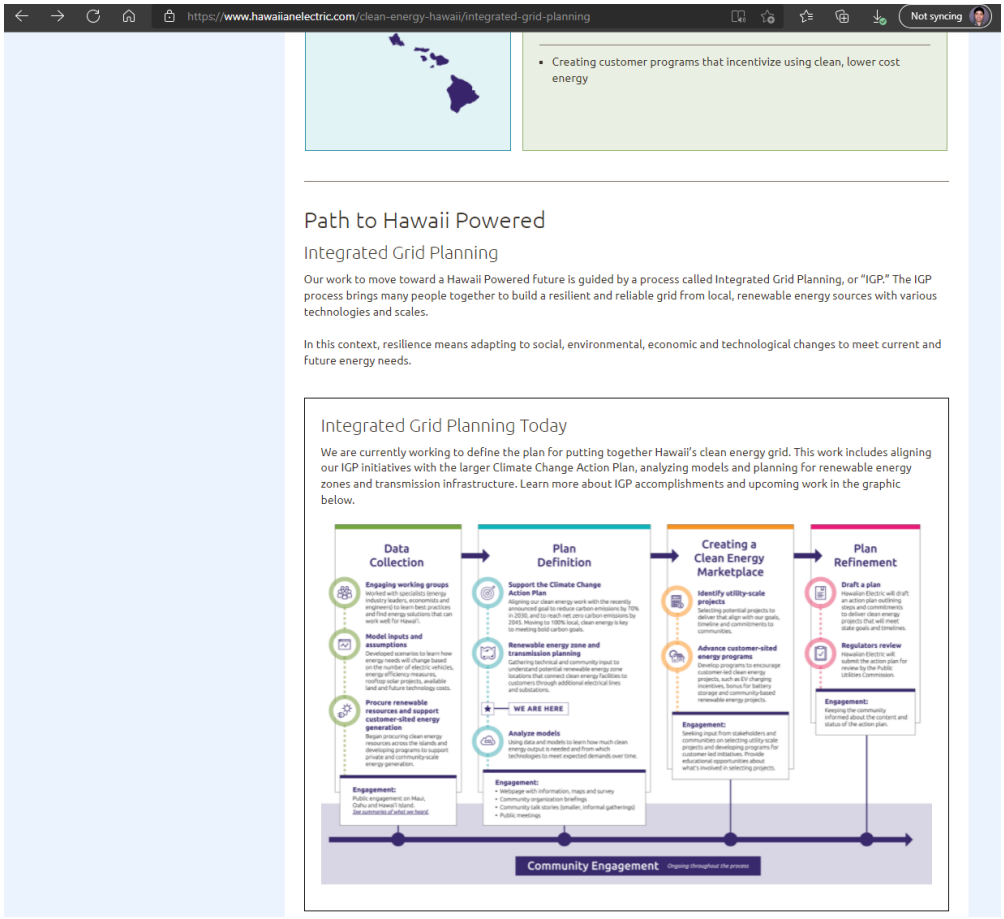

Figure 5: Current IGP Landing Page

The Company is cognizant of the user experience in accessing the webpage; therefore, it is still evaluating the best place to provide descriptions of the models and of the iterative modeling process.

Because the Working Groups operate under modified Chatham House rules, it does not typically record those meetings. However, the Company has started to record the Stakeholder Council meetings and those recordings can be found on the Stakeholder Council page (available at, https://www.hawaiianelectric.com/clean-energy-hawaii/integrated-grid-planning/stakeholder-and-community-engagement/stakeholder-council).

Finally, each of the following working group pages have been updated with a description of the Working Group:

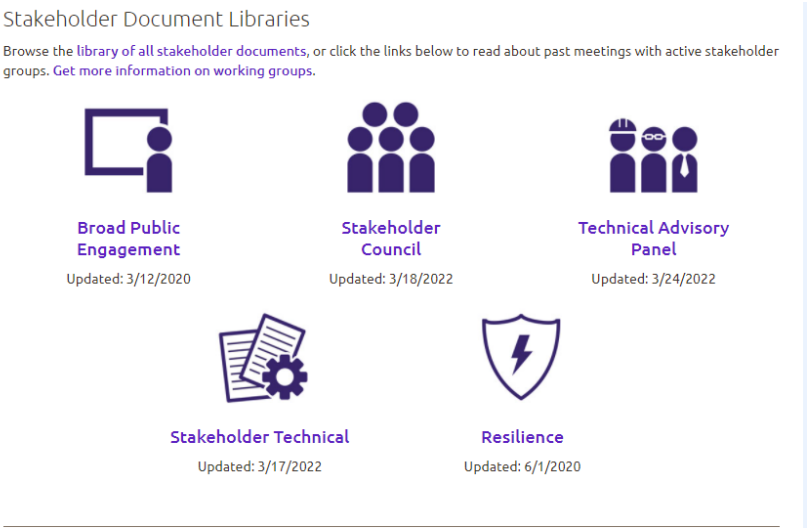

Figure 6: Stakeholder Document Libraries for Active Stakeholder Groups

> 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. (Order 38253 at 69-70.)

The Company is currently working on a stakeholder library search feature where the user can search for documents by working group, process step, or other categories to make it easier to access documents. The Company will provide an email update once that feature has been implemented. These updates will be made along with the descriptions of the topics discussed in the working group meetings.

> 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. (*Id.* at 70.)

The Company will provide email updates whenever a new update is made to the IGP webpages, such as when new documents, or meeting materials are posted to the website. As shown in the figure above, the Company currently updates the date under each working group when documents were last uploaded to the website.

Schedule Update

On March 10, 2022, the Company filed a letter in Docket Nos. 2017-0352 and 2018-0165 in response to the Commission's February 18, 2022 letter filed in Docket No. 2017-0352 directing the Company to initiate Stage 3 RFPs for Maui and O‘ahu. The Commission had previously directed the Company to initiate a Stage 3 RFP for Hawai‘i Island.

The Company's March 10th letter asserted that proceeding with the IGP process first to inform the Stage 3 procurements and addressing near-term reliability concerns through preserving and focusing resources on in-progress and pending projects is the most efficient path forward. This is based on the fact that near-term reliability concerns would not be mitigated by a Stage 3 RFP due to the duration of the procurement process, and that selected projects would reach commercial operations well after the period of concern. Additionally, with current solar market conditions, the pricing for new or "re-bid" projects will not necessarily yield better pricing than working to get Stage 1 and 2 projects to reach commercial operations.

In its letter, the Company provided a recommended schedule to advance IGP that is sorely needed to guide interrelated proceedings, and for which the Commission has stressed the importance of coordination of related dockets. However, on March 23, 2022, the Commission issued a letter disagreeing with the Company's approach and schedule. The Company is currently evaluating how best to move forward with the IGP analysis without knowing the results of the Stage 3 final award group, as this would be a critical input to the IGP grid needs analysis. The Company is also cognizant of the impacts of any significant delays to IGP due to the urgent need to allow longer development projects a chance to propose long-term solutions, including renewable energy zone infrastructure. Stage 3 RFPs and portfolio evaluations will require the Company to make assumptions and decisions on a significant tranche of resources without the benefit and context of full IGP work and robust stakeholder input of those long term plans. An Oahu Firm RFP would have been more narrowly scoped to address reliability concerns. The Company hopes to avoid a situation where the Stage 3 portfolio is put through a protracted process in which long term resource assumptions are disputed and numerous what-if scenarios are examined prior to projects moving forward due to the absence of accepted IGP plan(s) to serve as a foundation for procurement activities. Given the Commission's direction to proceed with Stage 3 RFPs immediately, the Company is currently assessing the implications on schedule; given the numerous other commitments that will require computing, software licenses, and human resources such as the CBRE RFPs for all islands and LMI RFPs, ERM and reliability analyses, annual budget activities, scoping analysis to scope Stage 3 RFPs, and Stage 3 RFP evaluations, among others. The Company will provide an updated schedule at a later time.

The Company appreciates the opportunity to provide these finalized Inputs and Assumptions in response to Order 38253.

Very truly yours,

/s/ Marc Asano

Marc Asano
Director, Integrated Grid Planning

c: Service list

SERVICE LIST
(Docket No. 2018-0165)

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