



June 7, 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
TAP Feedback Summary

In accordance with Order No. 38253, issued on March 3, 2022 in the subject proceeding, Hawaiian Electric respectfully submits a summary of feedback received from the Technical Advisory Panel ("TAP") in the Transmission, Distribution, and Resource Adequacy subcommittees, and as it relates to the second review point filed on November 5, 2021.

Sincerely,

/s/ Marc Asano

Marc Asano
Director, Integrated Grid Planning

Enclosure

c: Service List

IGP Technical Advisory Panel Update

May 2022

The Technical Advisory Panel (“TAP”) restructured into sub-committees on transmission, distribution, and resource adequacy to allow for more focused discussions with the TAP members that better aligned with their subject matter expertise. Since October 2021, the respective sub-committees have met 13 times, including two half-day sessions and the Company has incorporated the TAP’s feedback into various work products including its underfrequency load shed studies, system stability studies, distribution planning methodology, and resource adequacy analyses. All TAP meetings and meeting notes prepared by the TAP sub-committee chairs are provided on the Integrated Grid Planning (“IGP”) TAP website at: <https://www.hawaiianelectric.com/clean-energy-hawaii/integrated-grid-planning/stakeholder-and-community-engagement/technical-advisory-panel>.

The Company clarifies that the meeting notes are not prepared by Hawaiian Electric but rather the views of the TAP. The TAP chairs recently presented an update on the TAP progress to the Stakeholder Council. The presentation can be found at: https://www.hawaiianelectric.com/documents/clean_energy_hawaii/integrated_grid_planning/stakeholder_engagement/stakeholder_council/20220518_sc_meeting_slides_progress_update.pdf.

A recording of the meeting can also be viewed at: https://youtu.be/aIEA_MwQUqM.

The Company’s engagement with the TAP has led to improvements in its planning processes which are summarized below.

Transmission Sub-committee

The Company has been working with TAP Transmission Sub-committee to review Transmission Planning Criteria, IGP System Security Study methodology and 2021 System Stability Study methodology and results since September 2021. The 2021 System Stability Study is a follow up to the Stage 2 System Impact Studies¹ with grid-forming inverters to further examine certain issues and study the system as forecasted out to 2028 for O’ahu and Maui and 2029 for Hawai‘i island. The Company has incorporated a significant portion of TAP’s feedback into work products.

Transmission Planning Criteria. During the discussion of Transmission Planning Criteria, the following major revisions recommended by the TAP are incorporated in the Transmission Planning Criteria:

¹ See, the June 30, 2021, Stakeholder Technical Working Group presentation available at, https://www.hawaiianelectric.com/documents/clean_energy_hawaii/integrated_grid_planning/stakeholder_engagement/working_groups/stakeholder_technical/20210630_presentation_slides_igp.pdf

1. Combining damp ratio criteria with control stability criteria into a single category called system stability criteria which generally includes criteria related to stability margins in addition to damping ratio.
2. Revising the language “shall carry sufficient inertia and frequency response reserves” as “shall carry sufficient, fast and timely delivered frequency response (including some combination of rotating machine inertia, frequency response reserves, and inverter-based frequency response capabilities)” to avoid possible misinterpretation as excluding fast inverter-based frequency response.
3. Revising “loss of largest generating unit” to “credible contingencies” to clarify that fault scenarios are also included in the studied contingencies.

There is one comment from the TAP that is still under consideration by the Company, and the Company is planning to incorporate into the next revision of the Transmission Planning Criteria.

1. The duration of conductor emergency rating should be based on physical mechanisms that may lead to conductor failure or other unsafe conditions, as well as on the ratings and parameters of the conductor. TAP suggests the Company to understand the basis for the duration of conductor emergency rating and select a value of duration based on an engineering justification as conductor emergency rating.

IGP System Security Study Methodology. Regarding the IGP System Security Study methodology, the TAP provided both near-term and long-term recommendations for planning studies. The Company has been incorporating the TAP’s recommendations into the process of performing 2021 System Stability Study and will incorporate the recommendations for the IGP System Security Study which is expected to be kicked off later this year.

1. The TAP does not recommend complete reliance on only positive sequence models or only Electromagnetic Transient (“EMT”) simulation model in transmission planning study. Development and use of advanced screening techniques and solutions can be leveraged to identify scenarios where EMT simulation is to be carried out. At least some of the most critical cases should always be run in the EMT domain. The Company has already developed a PSS/E screening-based hybrid methodology (including both PSS/E simulation and EMT simulation) for transmission planning study. This methodology has been applied in the 2021 System Stability Study, which identifies critical contingency lists for each system.
2. The TAP recommends the Company to use statistical analysis on the output of production simulations to identify system dispatch scenarios for transmission planning study. The Company has been using a statistics analysis-based process to identify dispatch scenarios from the production simulation data for system stability analysis. In this process, key variables, such as system gross load, Distributed Energy Resources (“DER”) generation, thermal generation, are analyzed. Dispatches are generated based on the analysis of those key variables. Normally, the scenarios of interest for system stability analysis are low

thermal generation with different combinations of generation from DER and utility scale plants.

3. The TAP recommends analyzing how protection system will work in the high inverter-based resource scenarios, in particular protection relying on negative sequence current and overcurrent protection, regardless the protection planning is part of transmission planning or not. Currently, though the protection planning is not part of Company's transmission planning, the Company has been working with consultants reviewing protection system in the high-Inverter Based Resources ("IBR") scenarios.

2021 System Stability Study. The TAP Transmission sub-committee meet with the Company three times to review 2021 System Stability Study results from December 2021. In general, the TAP agrees with study methodology and findings. The following is a list of comments or questions on the details of the study, which were raised by the TAP. The Company will provide a summary of response to those inquiry in the appendix of the 2021 System Stability Study report.

1. The TAP recommends showing inertia (MVA-s), total machine rating (MVA), machine headroom (MVA), grid forming ("GFM") capacity online (MVA), GFM power headroom (MVA), and grid following ("GFL") headroom (MVA, for GFL plants providing PFR) of the studied dispatches along with whole year 8760 hours information from production data to clearing illustrate how the studied dispatches related to the system condition during the whole year. Meanwhile, TAP recommends clarifying how the studied dispatches differ from the production simulation data and what changes are made to obtain new cases, and why.
2. The TAP inquired about transmission planning study results for the current system, specifically, planning criteria violation(s) results for the current system. The TAP is interested to see the comparison between current system results with future system results so that it is clear how system is evolving.
3. The TAP requests more detail on the segmentation and characterization of the DER fleet.

The following recommendations are incorporated into the study:

1. The TAP recommends that the dispatch scenario with very low thermal generation level (1st-2nd percentile MW value) should be studied if the 1st-2nd percentile value is very different than 10th percentile value the Company used in the study to define low thermal generation scenarios. In the study, all very low thermal generation dispatch scenarios from production simulation data are identified and investigated in both PSS/E and EMT simulations.
2. The TAP recommends incorporating new information regarding DER momentary cessation. The Company incorporated momentary cessation information into the study immediately after it was available by NREL. Also, the Company designed a sensitivity study with different values of DER undervoltage momentary cessation limit and recovery

ramp rate limit to address uncertainty in DER momentary cessation behavior on system stability in details.

3. The TAP brought up a concern regarding the risk to system from negative sequence voltage resulting from DER tripping on a single phase. The Company investigates negative sequence current component from study simulation results for single phase to ground fault contingencies and by comparing it with existing negative sequence protection settings in the synchronous machine generation units the Company confirms that the magnitude of negative sequence current identified from the study would not pose significant risk of tripping synchronous generation.

The following recommendation from the TAP that has not been incorporated into the 2021 System Stability Study:

1. The TAP inquired the reason for not modeling a scenario with 0% synchronous machine-based generation. The TAP recommends studying 0% synchronous machine generation scenario in the study. The 0% synchronous machine-based generation scenario has not been identified from the production simulation data. Therefore, this scenario was not incorporated into the scope of the 2021 System Stability Study. The Company will include this scenario in the IGP System Security Study.

At the time of preparing this response, the Company already presented major findings from the 2021 System Stability Study to the TAP at the May 4-5, 2022 meetings.² The Company is awaiting the TAP's written feedback regarding the 2021 System Stability Study results.

Distribution Sub-committee

The Company requested the TAP Distribution Sub-committee review of its Distribution Planning Methodology and Non-Wires Opportunity Evaluation Methodology documents and received feedback on October 11, 2021. Both documents and the TAP feedback were subsequently included in the Grid Needs Assessment ("GNA") Methodology Review Point that was filed on November 5, 2021.³

In March 2022, the Company sought guidance from the TAP Distribution Sub-committee on the appropriate transformer/circuit load forecast scenario to determine the grid needs that drive the scope and timing of capital expansion projects.⁴ As part of IGP, three transformer/circuit load forecast scenarios were created (Base Load, High Load, and Low Load forecasts). The TAP provided feedback which will be taken into account.⁵

² Available at,

https://www.hawaiianelectric.com/documents/clean_energy_hawaii/integrated_grid_planning/stakeholder_engagement/technical_advisory_panel/20220505_tap_presentation_materials.pdf

³ Distribution Planning Methodology – GNA Methodology Review Point, Exhibit I, Appendix I
Non-Wires Opportunity Evaluation Methodology - GNA Methodology Review Point, Exhibit I, Appendix J
TAP Feedback - GNA Methodology Review Point, Exhibit I, Appendix K, Sections K.4 and K.5

⁴https://www.hawaiianelectric.com/documents/clean_energy_hawaii/integrated_grid_planning/stakeholder_engagement/technical_advisory_panel/20220311_load_forecast_scenario_discussion.pdf

⁵https://www.hawaiianelectric.com/documents/clean_energy_hawaii/integrated_grid_planning/stakeholder_engagement/technical_advisory_panel/20220311_tap_feedback.pdf

Resource Adequacy Sub-Committee

The Company has met with the Resource Adequacy sub-committee on November 1, and 18, 2021, January 20, 2022, March 10, 2022, and April 28, 2022. Through those meetings, the Company has continued to advance its Resource Adequacy (“RA”) planning by further developing its probabilistic resource adequacy methodology as a complement to the Energy Reserve Margin (“ERM”) criteria. The resource adequacy step in the IGP modeling framework is an important part of the process to ensure the reliability of the resource plan.

In the IGP docket, the Company first published the results of its probabilistic RA modeling to justify its proposed ERM targets in the GNA Methodology Review Point that was filed on November 5, 2021.

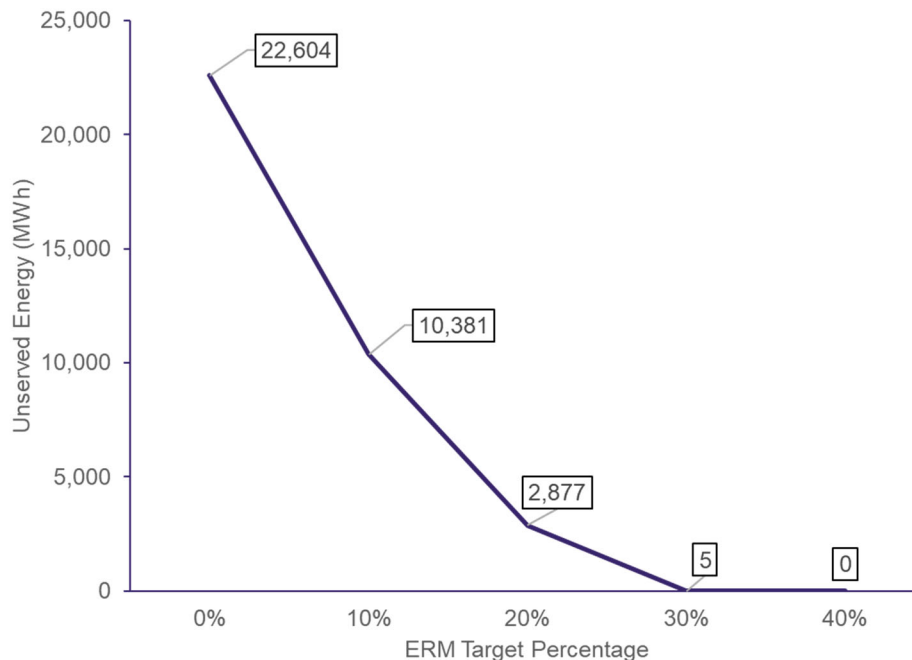


Figure 1: O‘ahu Unserved Energy by ERM percentage for PLEXOS Stochastic Outage Production Simulation

The Company had demonstrated in the GNA Methodology Review Point that an ERM target of 30% resulted in minimal unserved energy. This earlier version of the probabilistic RA analyses focused on stochastic modeling of thermal generating unit outages only.

The ERM analysis was reviewed with the TAP in the November 1, 2021 TAP RA sub-committee meeting. During this meeting, HNEI and Telos Energy also shared their independent analysis that validated the Company’s conclusion that 30% ERM was reasonable by showing that a resource plan designed for 30% ERM resulted in 0.13 LOLE on O‘ahu and 0.10 LOLE on Maui, which is comparable to the mainland standard of 0.10 LOLE. Following this meeting, the TAP endorsed the ERM in their written feedback, noting that it is sufficiently justified for a first use in the current IGP. The TAP also stated that the Company should continue to use the detailed

probabilistic RA analysis as a check on the portfolio, though not as an input to RESOLVE and that both ERM and the probabilistic RA should be used.⁶

Since November 2021, the Company has continued to meet with the TAP to address other aspects of its RA modeling including the Hourly Dependable Capacities (“HDC”) for the ERM criteria and other inputs that could be considered in the probabilistic framework.

On January 20, 2022, the Company shared alternative calculations of its HDC based on the TAP’s feedback to use a monthly grouping of similar hours, increase data samples using data provided by NREL, and to characterize the HDC by percentiles. The 80th percentile HDC that was developed using the TAP’s feedback will be carried forward in the IGP planning analyses for use in the RESOLVE modeling.

On March 10, 2022, the Company presented a framework for conducting the probabilistic analyses, expanding on the approach used in its November GNA Methodology Review Point to include additional thermal outages, additional weather years for PV and wind production, and the calculation of additional metrics to characterize the results probabilistic modeling. The methodology, inputs, and reported metrics for the probabilistic modeling were similar to the approach used by HNEI and Telos Energy. The TAP noted in its feedback that the proposed 250 samples was a reasonable start and that the Company has done a good job of gathering input from the TAP, researching the topic and coming up with a proposal that provides additional modeling detail needed to address adequacy issues.⁷

On April 28, 2022, the Company presented initial results of its newly developed probabilistic resource adequacy methodology in support of the request for proposals (“RFP”) target for renewable firm generation on O’ahu. The TAP provided suggestions on additional considerations for input and assumptions but there was general agreement that good progress had been made on the modeling with the adoption of many of the previous TAP recommendations. In particular, the TAP noted that while the 2029 case used outage rates that were closer to the long run average outage rate, it may introduce significant risk to the long-term planning since there is a notable increase in forced outage rates in recent years. The TAP suggested that sensitivities be conducted on the 2029 cases to evaluate the increased outage rates.⁸

⁶https://www.hawaiianelectric.com/documents/clean_energy_hawaii/integrated_grid_planning/stakeholder_engagement/technical_advisory_panel/20211101_tap_meeting_summary_notes.pdf

⁷https://www.hawaiianelectric.com/documents/clean_energy_hawaii/integrated_grid_planning/stakeholder_engagement/technical_advisory_panel/20220310_tap_feedback.pdf

⁸https://www.hawaiianelectric.com/documents/clean_energy_hawaii/integrated_grid_planning/stakeholder_engagement/technical_advisory_panel/20220428_tap_feedback.pdf

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