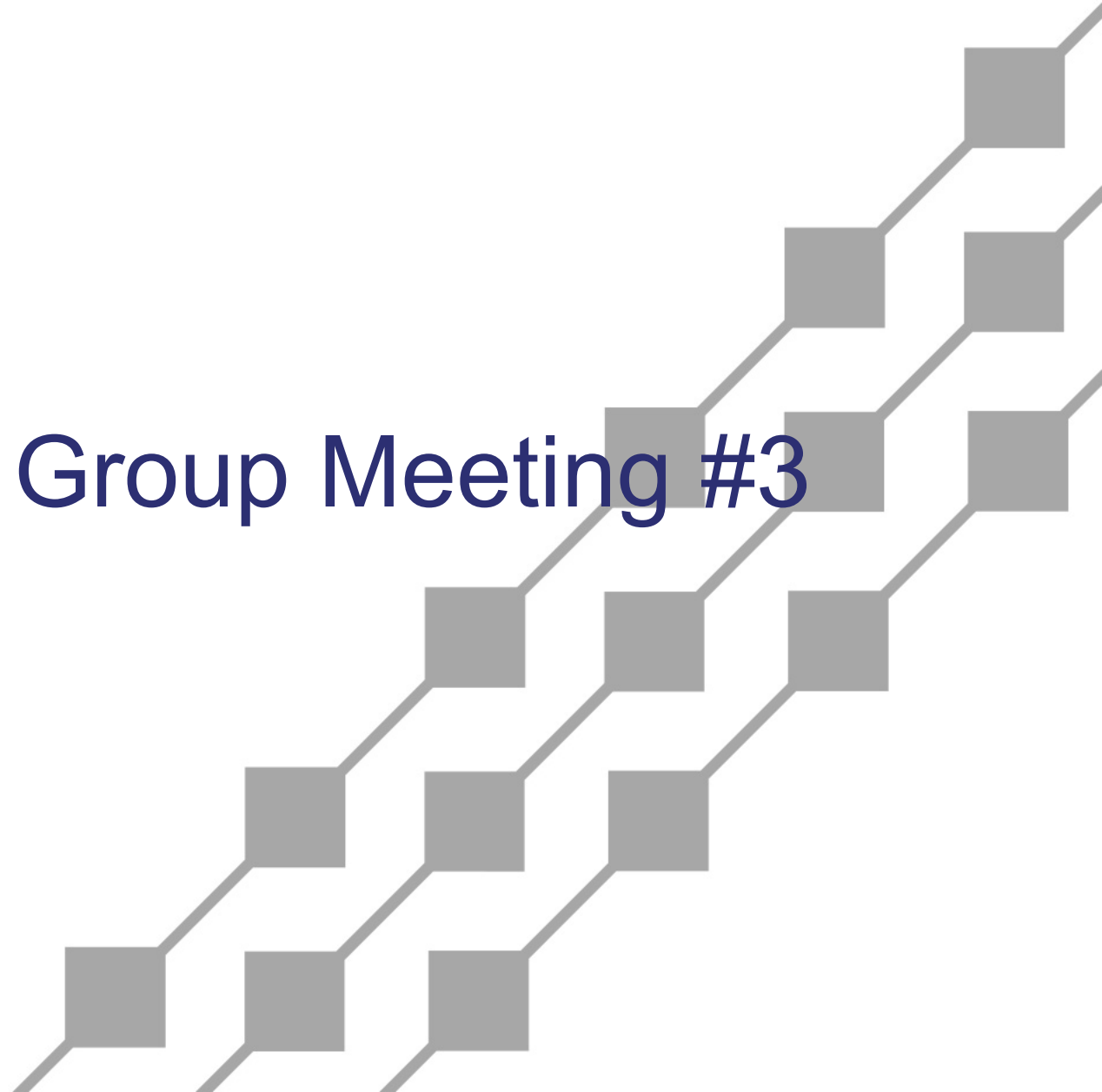


**Hawaiian
Electric**

CBRE Order 37592

Stakeholder Working Group Meeting #3

March 11, 2021



Agenda

- ◆ Grid Services
 - Definitions
 - Translating to Grid Needs
- ◆ Bid Evaluation
 - Levelized Benefit Calculation
 - Non-Wires Alternatives



Ground Rules

- ◆ Chatham House Rules will apply – no personal or organizational attribution will be made to any comments/feedback provided during the meeting by any participant nor in written documentation.
- ◆ Working group meetings, and other information exchanges are intended solely to provide an open forum or means for the expression of various points of view in compliance with antitrust laws.
- ◆ Under no circumstances shall engagement activities be used as a means for competing companies to reach any understanding, expressed or implied, which tends to restrict competition, or in any way, to impair the ability of participating organizations to exercise independent business judgment regarding matters affecting competition or regulatory positions.
- ◆ Proprietary information shall not be disclosed by any participant during any industry engagement meeting or information exchange. In addition, no information of a secret or proprietary nature shall be made available to industry engagement participants.
- ◆ All proprietary information which may nonetheless be publicly disclosed by any participant during any industry engagement meeting or information exchange shall be deemed to have been disclosed on a non-confidential basis, without any restrictions on use by anyone, except that no valid copyright or patent right shall be deemed to have been waived by such disclosure.

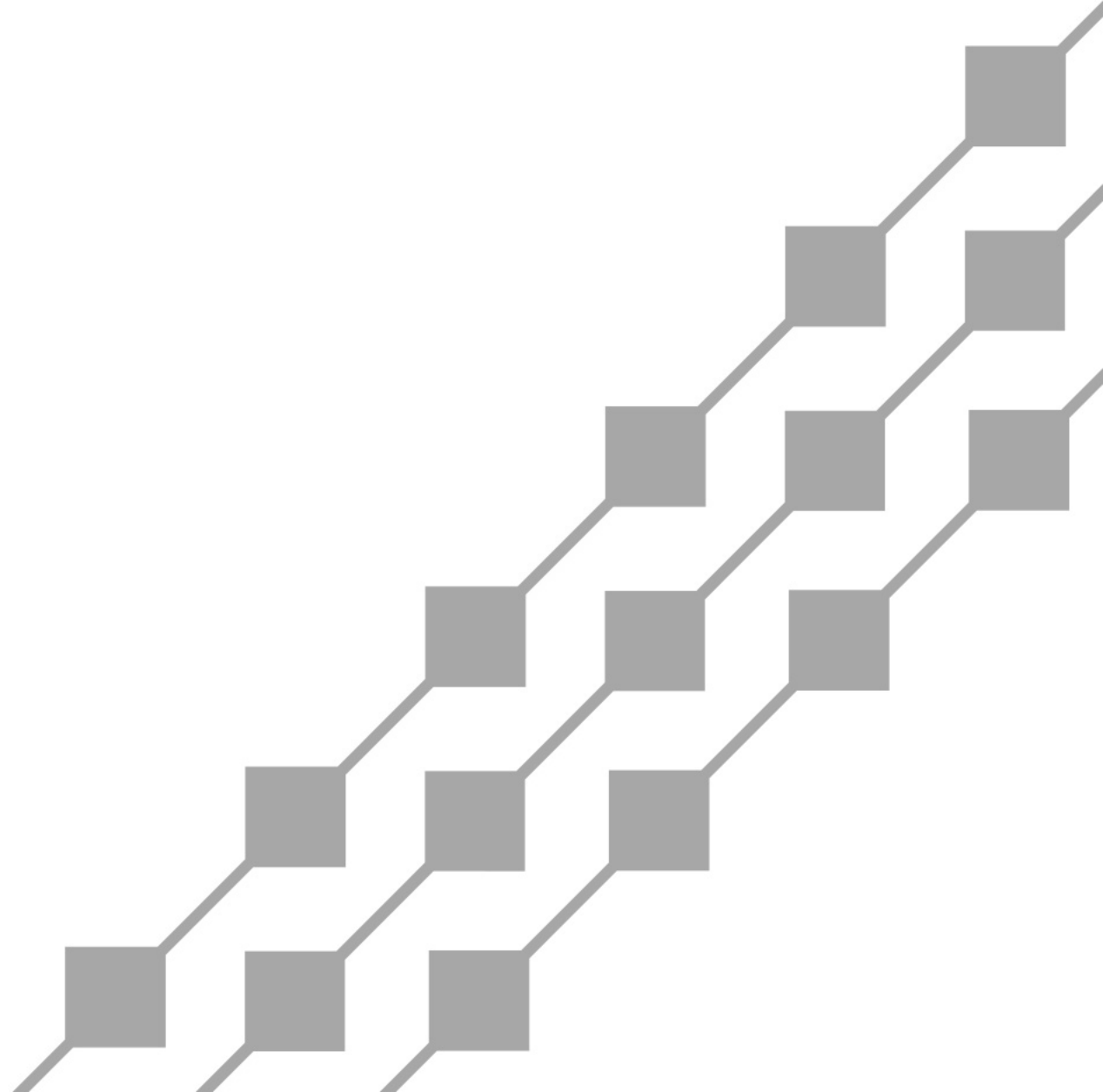


Commission Discussion

- ◆ Grid Service needs did not have sufficient specificity as to the quantity and types of grid services sought. Location of services needs also not clear.
- ◆ Not clear how Hawaiian Electric plans to use RESOLVE to evaluate the benefits of CBRE Phase 2 projects, nor is it clear how Hawaiian Electric will articulate the value of the grid services such projects may provide on each island.
- ◆ Develop a document that clearly describes the models and methods employed, and transparently explains how they provide a grid services valuation. These discussions will help Hawaiian Electric develop a values assessment for grid services that has not yet been available.
- ◆ Provide significantly more transparency regarding methods, inputs, and assumptions.



Grid Services



Grid Services for Integrated Grid Planning

- ◆ The Company proposed a set of grid services as part of the grid needs identified in the Integrated Grid Planning (IGP) process.
- ◆ These grid needs would be solved for in the grid needs assessment phase of the process to evaluate the resource, transmission, and distribution needs of the system.



Proposed Grid Services for CBRE

Grid Service	Definition	Marginal Costs Output by RESOLVE
Energy	A continuous, controllable, and predictable supply of megawatt-hours to serve system load needs in response to Company Dispatch[1].	Yes
Energy Reserve Margin	A guideline to minimize risk of insufficient generation capability from a diverse mix of generating resources available to the system in long-range generation expansion studies.	Yes
Load Reduce	Capacity that can be provided by a generator, storage or controlled load to reduce system load in the required timeframes and durations in response to a remote dispatch signal.	Yes, by evaluating marginal cost of energy results
Load Build	Capacity that can be provided by storage or controlled load to increase system load in the required timeframes and durations in response to a remote dispatch signal.	Yes, by evaluating storage charging in dispatch results
Regulating Reserves	A reserve capacity provided by generating and load resources to allow continuous energy balance over the next 1 minute and 20 to 30-minute time interval due to the variability in renewable resources and load that can be called upon in response to Company Dispatch[1].	Yes

[1] See RDG PPA, Att. B

Proposed Grid Services for CBRE

Grid Service	Definition	Marginal Costs Output by RESOLVE
Inertia	Contribution to the capability of the power system to resist changes in frequency by means of an inertial response from a generating unit, network element or other equipment that is electromagnetically coupled with the power system and synchronized to the frequency of the power system.	Yes
Fast Frequency Response	An autonomous and predictable capacity to limit the frequency drop resulting from a frequency disturbance.	Yes
Distribution Capacity	A supply and/or a load modifying service that DERs provide as required via the dispatch of power output for generators and electric storage, and/or reduction in load that is capable of reliably and consistently reducing net loading on desired distribution infrastructure in response to Company Dispatch[1].	No
Distribution Reliability	A load modifying or supply service capable of improving local distribution reliability under abnormal conditions (i.e., substation N-1) in response to Company Dispatch[1].	No



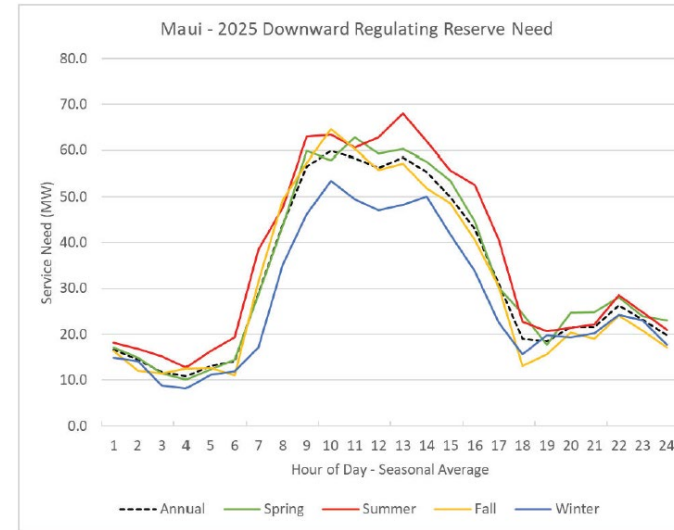
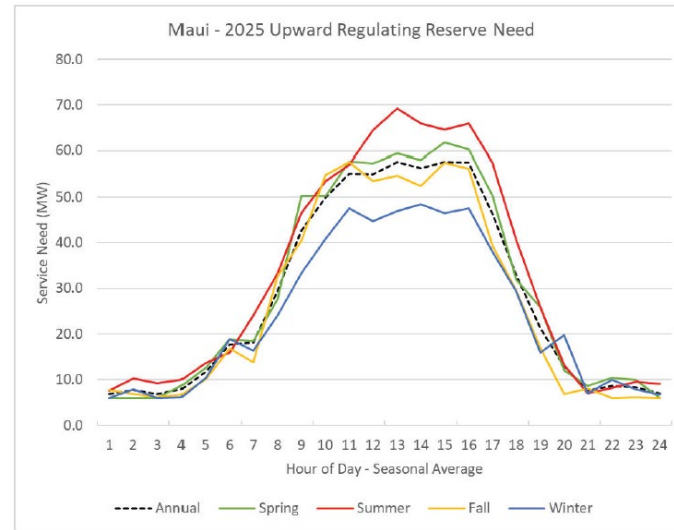
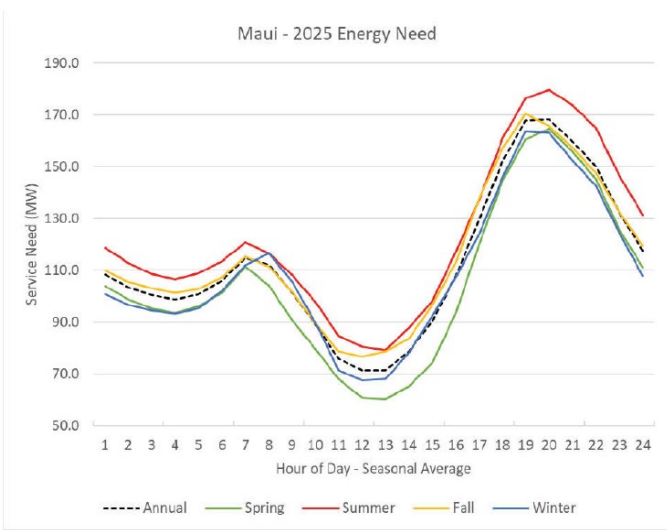
[1] See RDG PPA, Att. B

Translating to Grid Needs

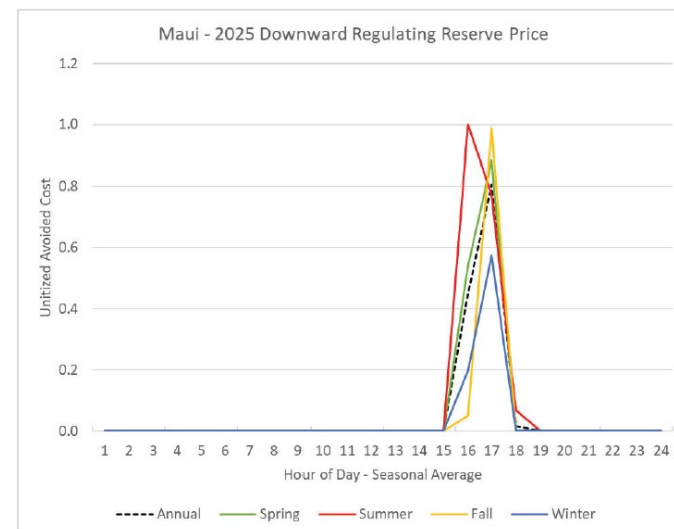
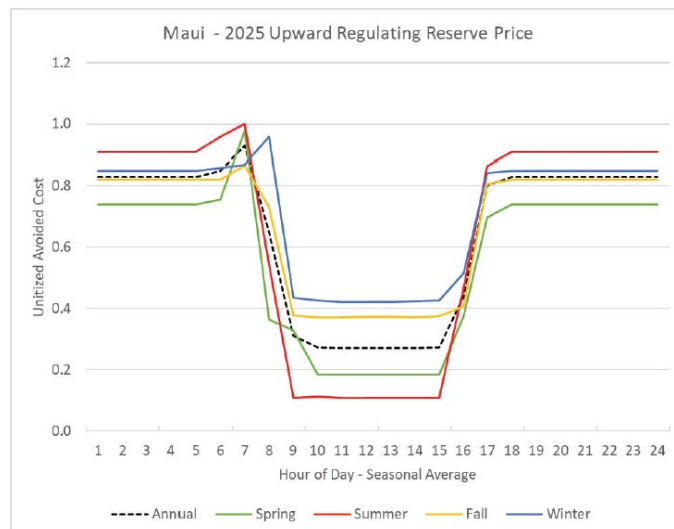
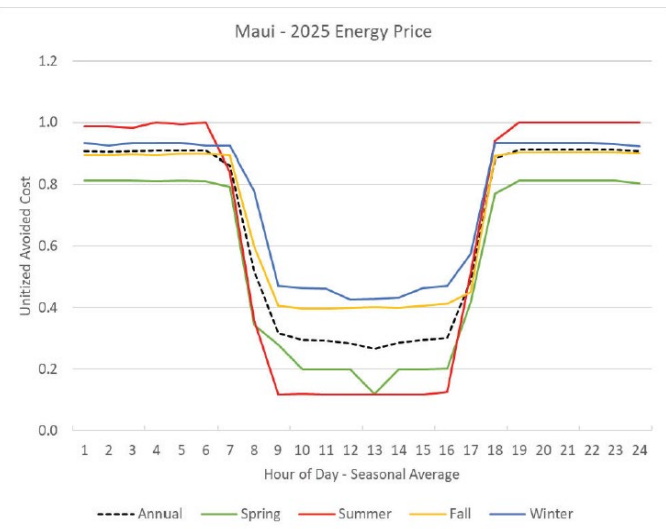
- ◆ Appendix O provided the system needs for grid services and unitized avoided costs to identify the times of day where services are most needed and most valuable.
- ◆ This is further refined by the specific resources selected by RESOLVE.



Appendix O Provides Total System Needs



◆ The top row shows the total system needs for energy and regulating reserve. These are needs that can be met by both planned resources and future resources selected by RESOLVE.



◆ The bottom row shows the unutilized marginal cost for those same grid services and indicates the times of day where those services are most valuable.

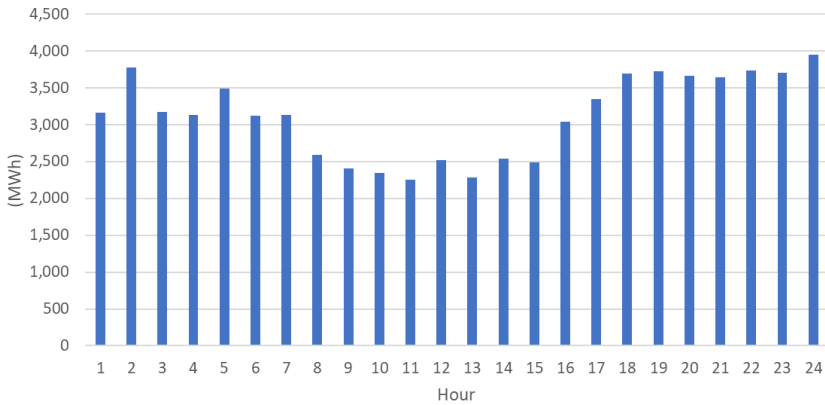
Translating to Grid Needs

- ◆ Resources selected by RESOLVE in a similar timeframe as the estimated commercial operations date as the CBRE Phase 2 RFP projects (2025-2026) provide a proxy for the grid needs that can be fulfilled by the prospective CBRE projects.

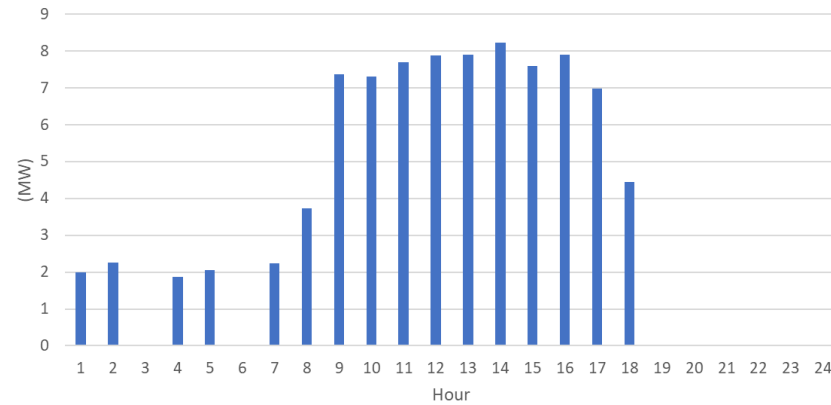


Illustrative Grid Needs Provided by Proxy Resource to Better Specify the Quantity and Types of Grid Services Sought

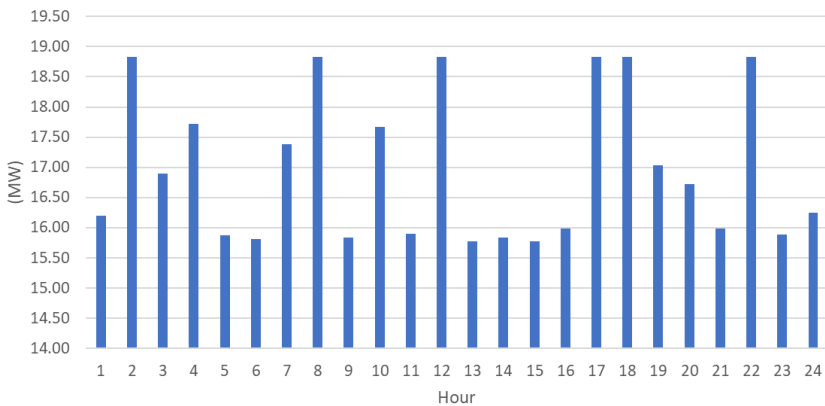
2025 Annual Energy Service



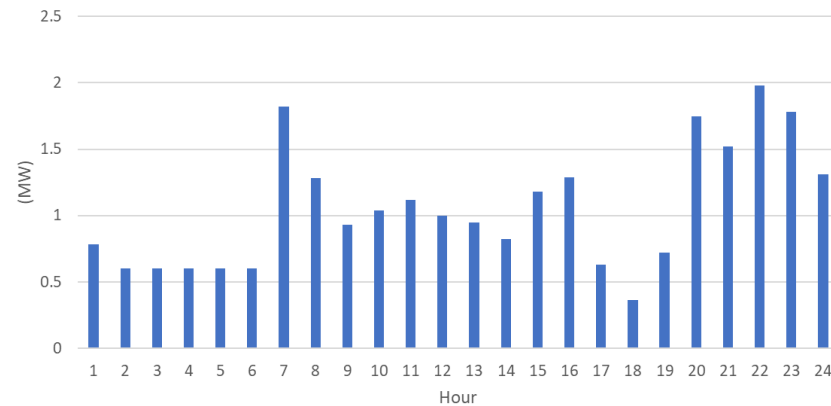
2025 Maximum Upward Regulating Reserve Service



2025 Maximum Energy Service



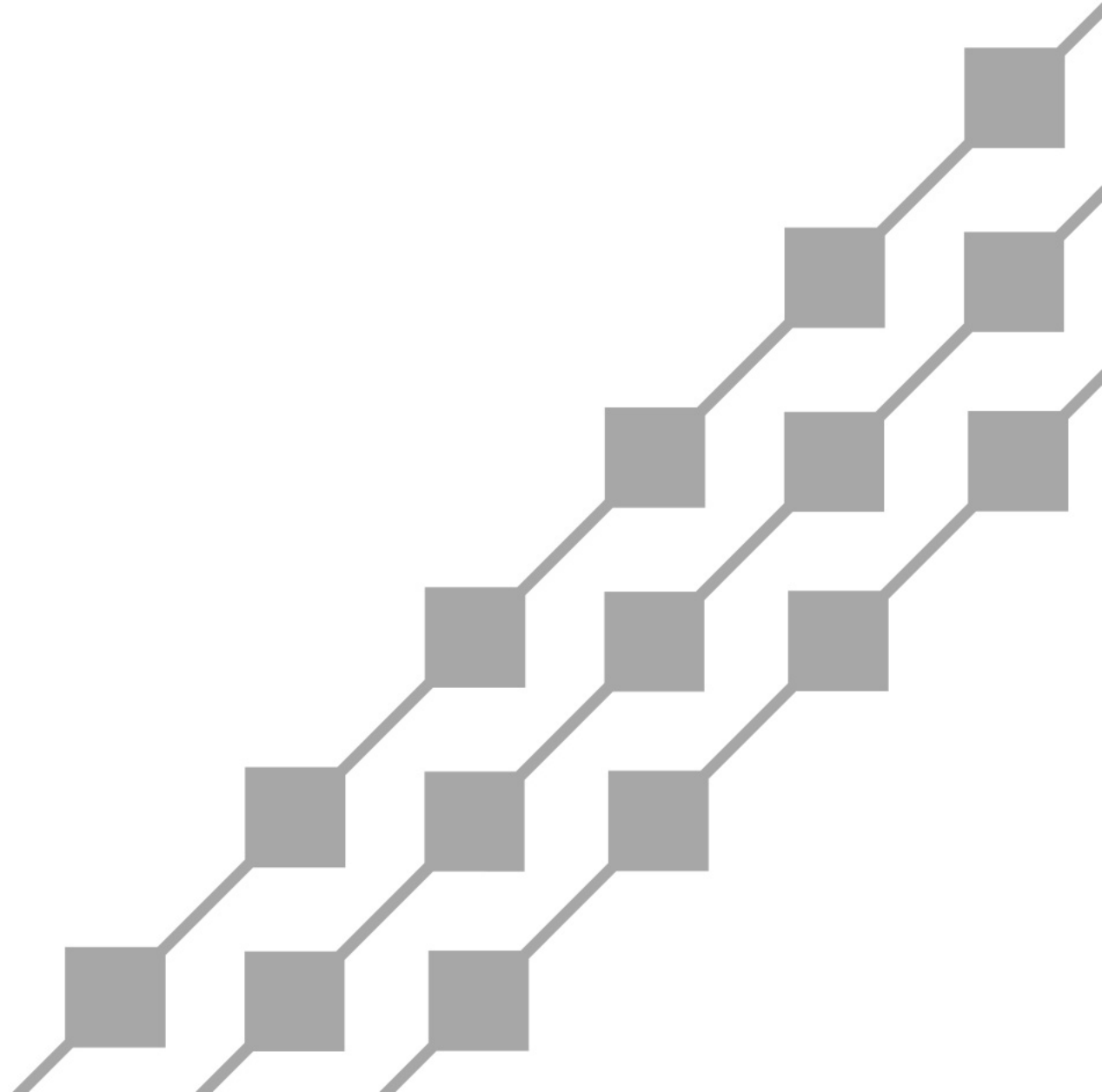
2025 Maximum Downward Regulating Reserve Service



- ◆ Similar charts can be provided for other grid services that RESOLVE dispatches a proxy resource to serve.
- ◆ Not all proxy resources may serve all grid services; the model may decide it is not needed and can be provided by other resources on the system or the underlying technology itself is constrained e.g. thermal units cannot provide FFR.



Bid Evaluation



Evaluation Process

- ◆ Initial evaluation to use an avoided cost-based screening process to develop a ranking of projects
- ◆ Detailed evaluation will use a combination of RESOLVE and PLEXOS to select optimal portfolios of proposals in RESOLVE which are then verified in PLEXOS



Initial Evaluation – Levelized Benefit

$$\textit{Levelized Benefit} = \frac{\$}{\textit{MWh}}$$

$$\textit{Levelized Benefit} = \frac{\textit{NPV of (Benefit – Cost)}}{\textit{NPV of Available Energy}}$$

$$\textit{Levelized Benefit} = \frac{\textit{NPV of } (\sum(\textit{Avoided Cost} \times \textit{Provision}) - (\textit{Lump Sum Payment}))}{\textit{NPV of NEP}}$$

- ◆ Considers both the costs and benefits provided by the proposal
- ◆ Divides by NEP to normalize the costs and benefits provided by small and large projects



Initial Evaluation – Levelized Benefit

$$\text{Levelized Benefit} = \frac{\text{NPV of } (\sum(\text{Avoided Cost} \times \text{Provision}) - (\text{Lump Sum Payment}))}{\text{NPV of NEP}}$$

- ◆ Avoided costs are the marginal costs output by RESOLVE for each modeled grid service requirement.
- ◆ Provision is provided by the MW dispatch of small (< 0.1MW) representative resources added to the resource plan to proxy the types of bids that could be proposed in the RFP.
- ◆ The benefit is calculated as the sum of the avoided costs for each service a proposal can provide. The grid service marginal avoided cost is multiplied by the dispatch of the representative resource (e.g. PV + 4hr BESS) for that specific service. Thus, the benefit of the proposal is to displace the marginal unit providing the service. If the marginal unit provides the service at a high cost, the proposal will see a greater benefit.
- ◆ Costs for the lump sum payment would be provided by the proposal.
- ◆ The difference between benefits and costs provides a cost effectiveness test of the proposal. Proposals that can provide greater benefits at reduced costs will rank more favorably using this methodology.



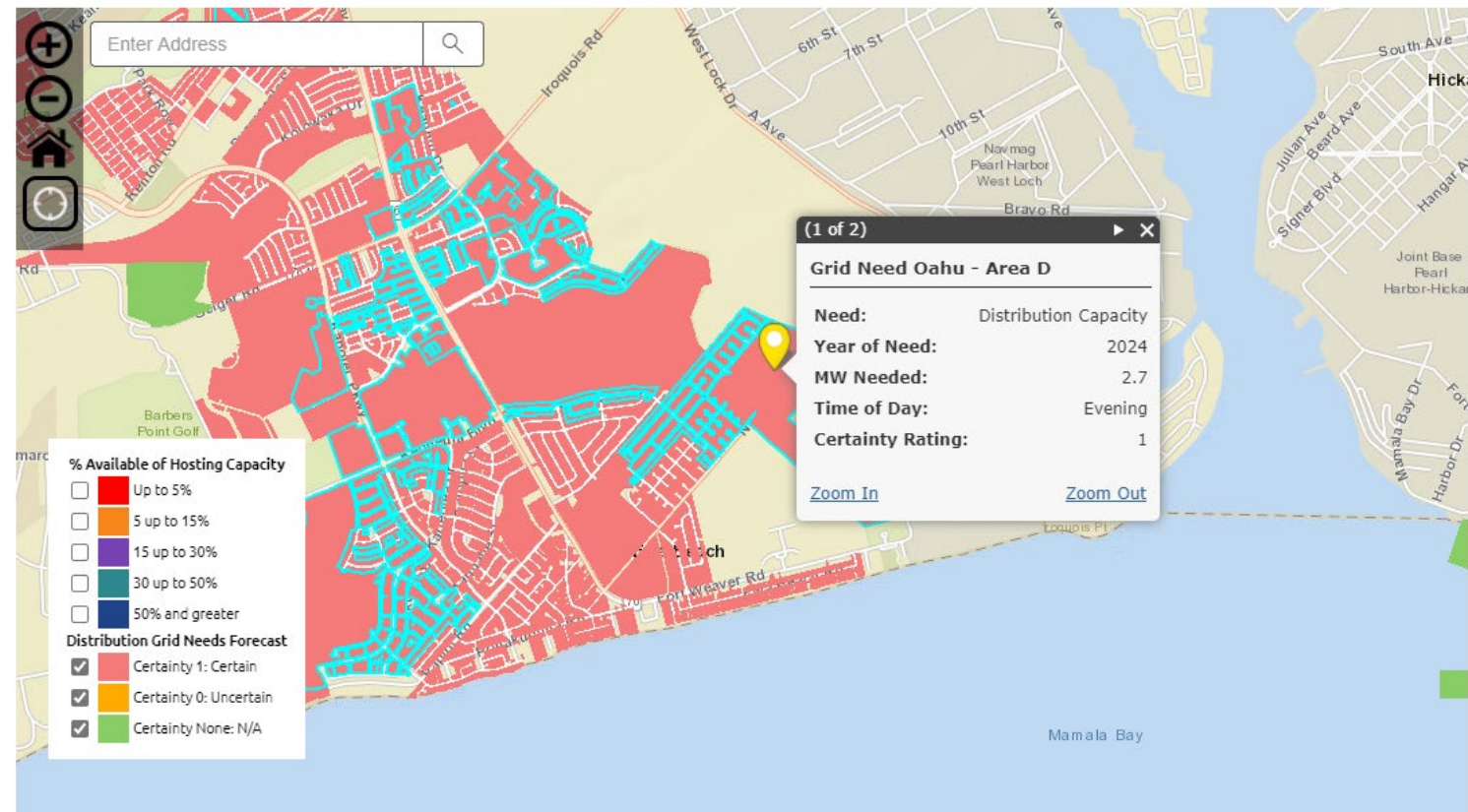
Detailed Evaluation – Portfolio Optimization

- ◆ Utilize RESOLVE to select proposals
 - May be done in tranches following the ranking developed in the initial evaluation, depending on the volume of proposals received
- ◆ Verify portfolio in PLEXOS as a feasibility check



Non-Wires Alternatives

- ◆ Consider the location of projects to meet distribution reliability grid needs identified in Appendix O
- ◆ Project proposals located on the same circuit can be scored more favorably in the non-price evaluation / can be given partial or full credit toward the cost of the wires solution they are avoiding in the initial evaluation



Next Steps

- ◆ Update Grid Needs (Appendix O) based on stakeholder feedback on IGP inputs and assumptions
- ◆ Revise the draft Grid Needs Assessment document based on stakeholder feedback that describes the models and methods employed, and explains how they provide a grid services valuation (Ref: https://www.hawaiianelectric.com/documents/clean_energy_hawaii/integrated_grid_planning/stakeholder_engagement/working_groups/solution_evaluation_and_optimization/20200602_wg_seo_deliverable_draft_v1.pdf and https://www.hawaiianelectric.com/documents/clean_energy_hawaii/integrated_grid_planning/dkt_2018_0165_20210304_HECO_reply_comments.pdf)
- ◆ Revise the draft Inputs & Assumptions document and post Inputs & Assumptions Workbooks for remaining islands on IGP website (Ref: <https://www.hawaiianelectric.com/clean-energy-hawaii/integrated-grid-planning/stakeholder-engagement/working-groups/forecast-assumptions-documents>)

