Decision Support Services to the Hawai‘i Public Utility Commission

BACKGROUND: The Hawai‘i Public Utility Commission (PUC) is the regulatory body tasked with reviewing and deciding on investment decisions, rates, and long-term planning of Hawai‘i’s investor owned utility, Hawaiian Electric Company (HECO). They are also tasked with reviewing the reliability of the electric power system and its customers. At any point, there may be dozens of dockets under review by the Commission, many of which are based on highly technical and detailed analyses.

The topics under review by the PUC are diverse and multi-faceted. In the past, the PUC has been short-staffed and does not have access to the same modeling tools and skillsets typically deployed by the utility for their long-term planning and docket filings. As a result, having the ability to draw on the expertise of HNEI, and their contractor Telos Energy, provides independent third-party technical expertise to augment the analyses being conducted at the Commission. The flexible nature of this support ensures that work can be deployed in a timely and low cost manner relative to the use of other third-party consultants. This collaboration with HNEI provides a flexible option to quickly analyze both near-term and long-term questions posed by the Commission.

A number of issues related to the integration of renewable energy technologies are discussed in more detail in other project summaries located under the **Energy Policy** section. Other examples of past support included a review of HECO’s distributed energy resources (DER) Grid Service definitions and the economic merits of HECO’s standalone battery proposals.

This paper briefly discusses four recent examples of HNEI support to the PUC support:

- Lifecycle analysis of greenhouse gases for Hawai‘i relevant generating technologies;
- Review of proposed conversion of AES power plant to biomass;
- Analysis of Kapolei storage project economics; and
- Analysis of the emergency DR program

PROJECT STATUS/RESULTS:

Lifecycle Greenhouse Gas (GHG) Analysis: Hawai‘i has been in the forefront of integrating renewable energy technologies into its energy mix. In 2008, the state launched the Hawai‘i Clean Energy Initiative (HCEI) with the goal to substantially reduce the use of fossil fuels. Since then, there have been a number of modifications leading to the current RPS goal of 100% fossil free energy use by 2045.

Recently, life-cycle analyses (LCAs) for GHG emissions in Hawai‘i has become more important. The PUC, as part of its decision making, is required to consider GHGs. A number of lawsuits have emerged that require these types of analyses. In late 2019, the PUC requested that HNEI evaluate net life cycle GHG emissions for Hawai‘i relevant energy technologies and resources to provide the PUC with a quantitative assessment of emissions from these systems. These analyses will then be used to support the Commission’s decision making. HNEI has completed a comprehensive literature review of existing LCA studies and conducted further evaluation of those applicable for Hawai‘i.

While some renewable energy generation technologies do not emit CO_2 at the point of use, there may be embedded emissions that are created during the full life cycle of the technology. A full accounting of emissions requires that emissions that arise from these other steps, such as production (mining and manufacturing), operation and maintenance, and disposal/reuse, be included. In other words, the life-cycle of all energy technology will have some GHG emissions, even if the actual production of electricity does not produce any GHGs. Based on the literature and additional analysis conducted by HNEI, the range of estimates for lifecycle emissions was found to be wider than expected. Even for well-defined technologies, such as PV, substantial ranges were found, partly due to variations in the technology but largely due to variations the manufacture of the components.

For other technologies, such as biomass and biofuels, existing studies can provide general guidance, but variation in the type of feedstock, the conversion technology, and the final disposition of waste – for example, the re-growth of new biomass resources – requires comprehensive site-specific studies. For biomass and biodiesel combustion, large amounts of CO_2 may be emitted at time of generation, but depending upon the biomass source, operations, and life-cycle assumptions, considerable offset of these

emissions is possible through new plantings or sequestration. Recently, some publications offer contradictory conclusions regarding biomass emissions and their timing. HNEI is evaluating these analyses and will incorporate the findings in this deliverable to the PUC.

Following the development of the draft deliverable, HNEI will convene a meeting of stakeholders from Hawai‘i and experts from the U.S. Department of Energy’s (DOE) national laboratory system. HNEI expects to convene this expert panel in early 2022 with a final report to the PUC by June 2022.

Review of AES Proposal to Convert Coal Facility to a Biomass Combustor: The AES coal-fired power plant is scheduled to be closed in September 2022. Recently, the Hawai‘i State Energy Office asked AES about the possibility to convert this facility to a biomass combustion unit. HNEI conducted an initial analysis into the feasibility of such a conversion.

The resulting analysis showed that this conversion warranted a more comprehensive review. The advantages included:

- Utilizing the existing transmission system;
- Increasing the renewable portfolio percentage by an additional 20%;
- Effective use of existing industrial lands;
- Providing firm renewable power to the grid; and
- Replacing oil-fired without impacting future solar development.

The cost of electricity from this facility relative to that of displaced oil is dependent on the cost of oil and warrants a closer examination over the expected life of the plant.

In 2021 addition to briefing PUC staff, HNEI briefed the PUC, the utility, and members of the Senate Ways and Means and the Energy and Commerce Committees on these results.

Kapolei BESS Analysis: HNEI conducted an analysis of the efficacy of the Kapolei system. The preliminary findings indicated that direct fuel savings were not enough to compensate for Kapolei’s annual PPA price of $24 million, even in a conservative scenario where Stage 1 & 2 solar + BESS projects provided no grid services. However, other factors were identified that could increase both net savings and overall value of the Kapolei system. These included near capacity to help ensure system reliability in the case of delays of the proposed Stage 1 and Stage 2 projects; and future capacity that could help facilitate additional oil-fired generation retirements and higher reserve margins to allow increased solar and/or wind development.

The HNEI analysis showed that integration of Stage 1 and Stage 2 hybrid solar-storage plants and retirement of AES results in very little curtailment limiting the energy arbitrage benefits of the Kapolei BESS. However, inclusion of Kapolei was found to reduce oil consumption regardless of what resources charge the battery (renewable or fossil), even after accounting for round-trip energy losses. Addition of Kapolei BESS to the O‘ahu energy mix was also found to reduce cycling of the PV-connected storage offering potential opportunities for additional grid-connected or rooftop solar with or without storage.

Distributed Energy Resources (DER) and Demand Response (DR) as Replacement Capacity for AES Coal-Fired Power Plant: HNEI examined the use of DER and DR as capacity replacements following the retirement of the AES coal-fired power plant. Of particular concern was the need to evaluate the closure, planned for September 1, 2022, during months of peak load (August - October) immediately following the plant closure.

At current levels of solar and wind penetration; standalone storage, DER with storage, and DR were shown to provide capacity equivalent to other firm resources and to grid-scale solar + BESS resources. While the DER and DR can be an important component of the 2022 transition, the need after Stage 1 and Stage 2 are fully deployed has not been well characterized.

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