**BACKGROUND:** The Hawai‘i Public Utility Commission (PUC) is the regulatory body tasked with reviewing and deciding on key 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.

Additionally, under Hawai‘i Revised Statutes ("HRS") § 269-92, electric utilities in the state are required to reach increasing levels of renewable generation. Every five years, the PUC is required to publish a report, pursuant to HRS § 269-95, that monitors and measures compliance to the state’s Renewable Portfolio Standards (RPS) targets. HNEI is legislatively mandated to perform this analysis of the RPS status every five years for the PUC. HNEI has supported the PUC in a number of these types of analyses since 2017. A number of issues related to the integration of renewable energy technologies are discussed in other project summaries located in the Energy Policy and Analysis 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 discusses four recent examples of HNEI support to the PUC support:

- Tracking and analysis of the state’s RPS targets;
- The impact of COVID-19 on electricity use and potential reliability challenges;
- Lifecycle analysis of greenhouse gases for Hawai‘i relevant generating technologies; and
- Analysis of the effective use of the bio-diesel fuel contract at the new Schofield Barracks power plant.

**PROJECT STATUS/RESULTS:**

**RPS Analysis:** In December 2018, HNEI delivered its third RPS assessment to the PUC. The HNEI assessment was the basis for the PUC report submitted to the state legislature.

This report projected that HECO and Kaua‘i Island Utility Cooperative (KIUC) were both on track to meet, and likely exceed, the 2020 30% RPS target. In 2019, KIUC generated 56% of its electricity from renewable energy – already exceeding the 2030 target of 40% – and is on a plan to exceed the 70% 2040 target by the mid-2020s.

Hawaiian Electric Companies generated 28.4% of its total annual sales from renewable sources in 2019 – 25.2% by HECO (O‘ahu), 34.7% by Hawai‘i Electric Light Company (HELCO) (Big Island), and 40.8% by Maui Electric Company (MEO) (Maui County).

With the completion of the O‘ahu “Waiver PV” and West Loch PV projects (157 MW of utility-scale solar PV) and additional distributed rooftop PV, HECO was projected to increase generation by a further 3-4%, exceeding the 2020 target. This is despite the shutdown of the Puna Geothermal Venture plant that remains offline due to the 2018 lava eruption event. Lower than anticipated load due to COVID-19 and related quarantine restrictions should ensure compliance with the 30% target.

Based on the assumed completion of the HECO “Stage 1” and “Stage 2” solar + storage projects, HECO was also reported to be on course to exceed the 2030 RPS target of 40% by 2030. The percentages of renewables for the Hawaiian Electric Companies for years from 2008 and projections through 2025 are shown in Figure 1.
COVID-19 Impact on Electricity Use: In this analysis, HNEI concluded that COVID-19 emergency measures had a significant impact on electricity use in Hawai‘i. HNEI and Telos Energy reviewed hourly generation data to evaluate the effects of COVID-19 and quarantine restrictions on electricity demand. Using O‘ahu as an example, analyses showed that commercial and industrial use dropped, while residential use rose substantially. The results illustrate that, in March 2020, the electricity peak load on O‘ahu dropped from about 1000 MW to about 900 MW, a drop of 10% (Figure 2, below).

Outcomes included findings that: less electricity was used overall; less behind the meter generation was put into the grid; and the “duck’s back” became more pronounced due to the overall reduction of load. The analysis identified potential risk of distributed generation oversupply if rooftop solar generation was high and load under quarantine measures continued to drop.

The decrease in electricity demand during the middle of the day has the potential to exacerbate impacts on the grid related the “duck’s back.” That is, low loads during the middle of the day could drop to levels below minimum power operational requirements of HECO’s thermal units, which, in turn, would require significant changes in overall grid operations (Figure 3, on the following page).

While the Spring of 2020 saw numerous record-setting renewable penetration levels (as a percentage of load), grid reliability was not jeopardized. This is largely because there was not a confluence such as low load coinciding with peak renewable generation.
of events such as low load coinciding with peak renewable generation and HECO was able to manage dispatch of the steam oil fleet. However, this analysis was able to check, in a timely manner, if reliability would be challenged.

**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). The goal of this initiative was to substantially reduce the use of fossil fuels. Since then, there have been a number of modifications enacted leading to the current RPS goal of 100% fossil free energy use by 2045.

While some renewable energy generation technologies do not emit CO₂ at the point of use, there are embedded emissions that are created during the full life cycle of the technology. Therefore, a number of steps must be evaluated to determine the emissions that arise from the production (mining and manufacturing), operation and maintenance, and disposal/reuse of these technologies. In other words, every facet of the any energy technology and resource life cycle will have some GHG emissions, even if the actual production of electricity does not produce any GHGs.

For some renewable resources, like biomass and biodiesel, large amounts of CO₂ 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, the need to perform 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 a number of energy technologies and resources in order to provide the PUC with a Hawai‘i-specific 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 selected those applicable for Hawai‘i for further evaluation.

HNEI is completing the requested assessment and will soon convene a meeting of stakeholders from Hawai‘i and experts from the U.S. Department of Energy’s (DOE) national laboratory system. Based on available literature and additional analysis conducted by HNEI, a wider than expected range of estimates for lifecycle emissions was found. Even for well-defined technologies, such as PV, substantial ranges were found, partly due to variations in the technology but largely due to variations in the assumptions surrounding 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 site-specific studies.

HNEI expects to convene the expert panel in early 2021 with a final report to the PUC in the first quarter of 2021.

**Evaluation of Biodiesel Generator at Schofield Barracks:** In 2018, the Schofield Generating Station started operations. The plant is highly flexible, but has a fuel contract that requires a minimum biodiesel offtake each year and requirements on dual fuel operations. The PUC requested that HNEI review the fuel offtake requirements and evaluate potential operating practices that could be implemented to reduce system costs.

While the price of biodiesel is significantly higher than diesel, a requirement of the contract for this project is a minimum fuel offtake requirement. It was recommended that the cost should be treated as a fixed cost and not be considered when determining Schofield dispatch decisions. Additionally, Schofield is one of the most flexible and most efficient thermal units on the system. It is therefore more economic to utilize the entire biodiesel offtake and fuel blending requirements so that the plant can later switch to diesel fuel. This would allow HECO to capture all of the flexibility and efficiency benefits of the plant while meeting contractual requirements.

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