Hawaii's Path to Decarbonization: Keeping the Lights on as the Last Coal Plant Turns Off

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ABSTRACT

In 2015, Hawaii became the first U.S. state to pass a law to decarbonize its electricity system, calling for a 100 percent renewable target by 2045. By fall of 2022, the state's last coal-fired plant on Oahu will retire. Unlike power grids on the mainland, Oahu is not able to shift to gas power or tap into other power grids as each island operates its own system. Considering that Hawaii residents already incur the nation's highest electricity prices, increasing imports of oil and diesel into the State is not feasible. Instead, investments in renewables and battery storage paired with energy efficiency and demand reduction are the best options.

Bringing the coal plant offline requires key collaboration from stakeholders to ensure Oahu ratepayers do not experience brownouts and blackouts, especially during peak evening hours. To offset the coal plant's power generation, solar energy projects and utility-scale battery systems are under construction or being planned. Supply chain challenges from the ongoing pandemic and uncertainties surrounding federal government tariffs caused delays and increased project costs; in some instances, resulting in stalled construction or project termination and creating great pressure for stakeholders.

This paper explores how the state's energy efficiency program administrator, Hawai'i Energy, is responding to focus on peak-load reduction efforts. It also examines the outcomes of collaboration with the electric utility, state agencies, and the Hawaii Public Utilities Commission, so that Oahu can avoid power disruptions in the short term and reach its decarbonization goals by 2045.

Hawaii's Energy Landscape

Clean Energy Transition on a Remote Island

With a goal to achieve 100 percent electricity generation from renewable sources by 2045, Hawaii is a leader among U.S. states advancing clean energy and greenhouse gas (GHG) reduction goals. The transition away from imported fossil fuels is not only an environmental and utility cost-saving priority, but it is also critical to diversifying an economy that is heavily dependent on tourism, an industry that was hit hard by the COVID-19 pandemic.

Hawaii has a unique set of energy challenges not experienced by states in the continental U.S. As the most isolated population center on Earth, the Hawaiian Islands are some 2,500 miles from the U.S. West Coast. Plus, each island is its own electric grid, as there is no interconnection between islands.

While Hawaii has a promising portfolio of natural resources that could be used for energy generation, such as solar, geothermal and wind, the state does not yet fully take advantage of

these resources when generating energy. Further, the state does not produce any crude oil (EIA 2022). Therefore, Hawaii is heavily reliant on imported fossil fuels, predominately liquid petroleum, to meet both its electricity and transportation needs. In 2019, the state imported more than six million tons of petroleum, making it the most petroleum-dependent state in nation. In 2020, Hawaii relied on imported petroleum for 60 percent of total electricity generation (EIA 2022).

In an effort to reduce its dependence on imported fossil fuels, Hawaii was the first state in the nation to sign a 100 percent renewable energy mandate into law in 2015. The mandate institutionalized goals set in 2008 by the Hawaii Clean Energy Initiative (HCEI), which established the State's initial renewable portfolio standards (RPS) and energy efficiency portfolio standards (EEPS). HCEI also set an interim goal of 70 percent clean energy by 2030 – 30 percent from energy efficiency and 40 percent from renewable energy – as a milestone on Hawaii's path to achieving the target of 100 percent clean energy by 2045 (Hawai'i Energy 2020).

In 2020, the state reached a total RPS of 36 percent, with Kauai's co-operative utility grid operating at the highest RPS level of all islands at 67 percent, and even achieving an RPS of 100 percent on some days (HSEO 2021). Solar power contributes nearly 17 percent of the state's total electricity, with the majority coming from distributed photovoltaic (PV) systems, such as customer-sited rooftop PV systems (EIA 2022).

Due to its reliance on imported petroleum, Hawaii has the highest electricity retail price of any state, nearly triple the U.S. average rate (EIA 2022). In 2019, the average monthly electricity bill was $162, with the residents on the island of Lanai paying an average of $195 per month (HSEO 2020). When the temperature rises, the Hawaiian Electric Companies (HECO) report that energy use for homes without rooftop solar tends to increase about 10 percent during the months of June through October, as many households ramp up their use of air conditioners (Wu 2021a).

The electricity system in Hawaii is in a period of dramatic transition, evolving from centralized fossil-fuel-based generation to renewable energy. This transition will require increased adoption of distributed energy resources (DER) and customer-sited grid services, which will allow for more active engagement with the grid through smart buildings and devices. In particular energy efficiency, when paired with the grid-smart devices, will help to aid in the energy transition.

Coal Plant Closure

On Oahu, which is home to over one million residents, the transition to clean energy must address economic, environmental and health concerns. The Hawaii Department of Health reported that in 2017, GHG emissions "from the energy sector accounted for the largest portion (86 percent) of total emissions in Hawaii (HDOT 2021, 10)," and the island's coal-fired plant contributed 7 percent of the state's total GHG emissions (HSEO 2022).

Operated by AES, the 180-MW coal power plant is the island's largest electricity generator, meeting 16 percent of Oahu's peak electricity demand (HSEO 2022). AES has a power purchase agreement (PPA) with HECO that is set to expire in September 2022 (Miyashiro 2020).

Plans to deactivate the coal-fired plant have been included in previous docket filings with the Hawaii Public Utilities Commission (PUC), dating back to 2014:

- In 2014, HECO filed a Power Supply Improvement Plan (PSIP) that mentioned a potential for the AES PPA to be renegotiated to provide a 50/50 mix of coal and biomass for fuel (HECO 2014, 68).
- HECO updated the PSIP in 2016, offering renewable generation solutions to replace the coal plant's capacity upon its deactivation (HECO 2016, 99).
- In 2018, with the PUC's support, HECO issued a competitive request for proposals (RFP) for utility-scale projects to help the state achieve its clean energy goals and selected seven projects to move forward.

With the coal plant retirement date looming and utility-scale renewable projects in various stages of development, the State stepped up its clean energy commitment. In 2020, Gov. David Ige signed a bill into law that prohibits the PUC from approving "any new or renewed power purchase agreement that proposes to burn or consume coal to generate electricity; or a modification of a coal power purchase agreement that proposes to extend the term or increase the amount of generation that is allowed to be produced under the existing agreement" (SB 2629 2020). Under this law, the coal plant is required to shut down in September 2022, when its PPA expires.

HECO has continued to develop utility-scale solar and battery storage projects to replace capacity from the coal plant, with nine projects in various stages of planning. The largest is the 185-megawatt, 565-megawatt hour Kapolei Energy Storage (KES) project. Slated as the largest stand-alone battery in the state, the $500 million project broke ground in August 2021, and at that time, KES announced a completion date of summer 2022. However, the state's Consumer Advocate Dean Nishina (2021) noted "that there is no certainty that KES will go online as scheduled in June of 2022 and, even if it does, given the magnitude of KES' anticipated contribution to capacity and the need for Hawaiian Electric to better understand the operation of the unit in conjunction with its system, the Consumer Advocate contends that contingency planning would be prudent to offset potential risks associated with delayed installation … as well as unknown operating issues that may occur."

Further, according to HSEO (2022), many of the utility-scale projects, including KES, are experiencing delays. In February 2021, the PUC opened Docket No. 2021-0024 to review the status and address gaps in the interconnection process of various HECO renewable projects. This included a heated status conference in March 2021, where PUC Commissioners "grilled HECO representatives…amid concerns that without adequate planning, the facility will be replaced with oil-fired generation after it is retired in 2022" (Balaraman 2021a). It was at this hearing where PUC Chair James Griffin told utility representatives "[y]our plan to me amounts to a shift from one fossil fuel to another. We're going from cigarettes to crack" (Balaraman 2021a).

All Hands-on Deck to Find Solutions

Identifying the Capacity Gaps

Regulators' first step was to better understand the challenges facing Hawaii's grid by commissioning an independent analysis from the Hawaii Natural Energy Institute (HNEI) to compare to HECO's analysis. The PUC does not typically "have access to the same modeling tools and skillsets typically deployed by the utility for their long-term planning and docket filings," so access to expert, low-cost technical analysis from HNEI, which is a research unit at

the University of Hawaii at Manoa, has been a crucial ingredient in enabling Hawaii regulators to evaluate utility proposals and alternative options (HNEI 2021).

While the focus for regulators, HECO, and stakeholders has been the September 2022 coal plant retirement date, PUC Commissioner Jennifer Potter says the big test will not be in the months immediately following the deactivation but rather in 2023, when Oahu will be faced with the biggest capacity shortfalls. Due to the urgent need for capacity, regulators sought behind-the-meter (BTM) solutions to address the capacity gap.

The PUC commissioned HNEI to examine the use of DER and demand response (DR) as capacity replacements following the retirement of the coal-fired power plant, particularly during months of peak load (August - October) immediately following the plant closure. HNEI's analysis found that "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 + battery energy storage system (BESS) resources" (HNEI 2021).

The PUC identified BTM storage and energy efficiency as the solutions that can be deployed most quickly and assigned them the highest priority in addressing the capacity shortfall. Regulators have worked aggressively with "DER parties" – including HECO, Hawai'i Energy, and DER project developers – to bring solutions online. In June 2021, the PUC approved an emergency demand response program that would include a scheduled dispatch program of up to 50 MW (Balaraman 2021b). The following month, HECO announced its scheduled dispatch program, known as Battery Bonus, which offers a cash incentive of up to $850 per kilowatt — or $4,250 for 5 KW — to Oahu customers who agreed to add a battery to their existing or new rooftop solar system for ten years (Wu 2021c).

However, Battery Bonus program implementation has been stalled by delays in permit approvals, which are required and processed by the City's Department of Planning and Permitting (Wu 2021c). Delays in both utility-scale and distributed solar and storage activities, including the Battery Bonus program, have created even greater urgency for energy efficiency to step up as a solution to support Hawaii's electric grid and fill the capacity gap.

Coordinating Multiple-Agency Response

To coordinate efforts, Hawaii Gov. Ige created the Powering Past Coal Task Force (PPCTF) by Executive Order, led by Chief Energy Officer Scott Glenn (HSEO 2022). The invitation-only task force meets monthly and consists of state and county agencies, HECO, renewable energy developers, and community representatives including environmental groups such as the Sierra Club and Life of the Land. The state was able to pay for the first two years of the PPCTF by repurposing State Energy Program (SEP) funds from the U.S. Department of Energy (DOE) to hire a full-time staff person and a consultant.

The PPCTF was specifically structured to convene stakeholders to increase collaboration, align goals, and monitor project status to speed development of both utility-scale and distributed resources. The PPCTF does not make policy or replace any regulatory work already handled by other agencies. As such, it did not aim to change policies or rules, but rather to make the current process work better.

The PPCTF initially focused on getting large utility-scale solar and storage projects on track. It provides a central clearinghouse and tracker to monitor the progress of each project through PUC dockets and project permitting, with enough detail for a member of the public to understand the status of each project (S. Glenn, Chief Energy Officer, HSEO, pers. comm.,

March 15, 2022).[1] Through these coordination efforts, the PPCTF was able to identify opportunities to streamline and speed permit reviews.

In an important marker of progress, the first utility-scale projects, two solar projects in Mililani and Waiawa, broke ground in 2021 (Wu 2021b). Notably, Mililani I will achieve commercial operations earlier than its guaranteed original commercial operations date before the coal plant retires. The PPCTF is continuing its work and recently expanded its focus to include DER and energy efficiency solutions by inviting Hawai‘i Energy to join the Task Force.

Energy Efficiency Rising to Meet the Challenge

While renewable energy gets the headlines, energy efficiency is a fundamental part of Hawaii's clean energy transition. It is cheaper than many renewable projects and can be faster to implement, often not requiring manufacturing or interconnection or lengthy permitting processes. Energy efficiency is also broadly accessible to all Hawaii residents and businesses, not only homeowners and those with the land or roof area required for solar projects. According to HECO, "without continued delivery of energy efficiency, and meeting the targets associated with EEPS, it will be difficult if not impossible to achieve the 100 percent RPS. At a minimum, without efficiency being promoted and maximized, the system would need to procure even greater amounts of renewable energy than the current Power Supply Improvement Plans contemplate. This leads to higher costs and would also push the limits of land availability required for those resources to be developed." (HECO 2019)

To achieve Hawaii's EEPS goal of a 4,300-GWh reduction in electricity use, the Hawai‘i Energy program was created in 2009 as a third-party program implementer, funded by electric utility ratepayers in the counties of Honolulu, Maui and Hawaii. As the Public Benefits Fee Administrator (PBFA), Hawai‘i Energy is tasked with accelerating energy efficiency and clean energy technologies by raising awareness and inspiring action to reduce energy use across the state. The PUC relies on Hawai‘i Energy to develop feasible programs and recognizes its positive connections and widespread reach through its work with local communities. In its Program Year 2020, which ran from July 1, 2020 through June 30, 2021, Hawai‘i Energy helped its customers save 116 million kWh and $33.7 million in one year (Hawai‘i Energy 2021, 4).

Energy Efficiency's Role in the System

Energy efficiency programs can support electricity system reliability in several ways. Under LBNL's analytical framework grouping DR services into four categories – Shape, Shift, Shed, and Shimmy – energy efficiency plays a crucial role in both Shape and Shift.

Shape "captures DR that reshapes customer load profiles through price response or behavioral campaigns" that change demand in the long-term (LBNL 2017). Unlike other highly temporal load management tools, such as load shifting (Shift) or load curtailment (Shed), a fully realized energy efficiency plan can shift generation requirements downward in a near uniform fashion across all hours of the day. This translates to a definitive reduction in load requirement, rather than what could otherwise be just a shift in dispatch timing, bringing dependable and long-lived benefits with minimal consequences. And with the increasing insight into measure

[1] Each project requires permits from at least three state agencies, the PUC, the Hawaii Land Use Commission, and the Department of Land and Natural Resources State Historic Preservation Division, as well as city permitting and planning commissions.

loadshapes enabled by advanced metering infrastructure (AMI) and other data tools, traditional "passive" energy efficiency efforts can also be targeted to alleviate energy consumption during peak times and help flatten out peaks in system load. For example, Hawaii's peak demand occurs in the August through October period during the evening between 6:00 p.m. and 8:30 pm. Energy efficiency reductions targeted to measures such as residential lighting and water heating that coincide with this peak period are particularly valuable.

Energy efficiency programs like Hawai'i Energy can also play a pivotal role in advancing Shift DR strategies. Because energy efficiency programs are actively engaging with residential, commercial, and industrial customers, they are well-positioned to identify opportunities for these customers to shift their energy consumption "from times of high demand to times of day when there is a surplus of variable renewable energy (VRE) generation" (LBNL 2020). Efficiency programs can also play a pivotal role in supporting customer adoption of connected, controllable products and equipment, such as smart thermostats, grid-interactive heat pump water heaters, and smart building controls. These high-efficiency technologies both directly reduce energy consumption and can flex – usually in automated and unobtrusive ways – to align consumption with VRE generation and flatten peaks in system load. In this way, energy efficiency programs can contribute to the creation of a fleet of distributed resources that can be enrolled in Bring Your Own Device (BYOD) DR programs.

Figure 1 below illustrates the energy efficiency potential for Oahu. The solid line depicts Oahu's system peak sales forecast for 2030 (AEG 2020). The sales forecast (solid line) illustrates the impact of PV generation creating daytime "valleys" followed by a steep ramp to evening peak demand. Situated just below is a dotted load shape that shows what the resulting load requirement would be if energy efficiency potential is realized with 85 percent market adoption by 2030 (AEG 2020). The Shape effect of energy efficiency shaping load over time leads to a nearly uniform reduction in demand through the day, including during evening peaks and shoulders, which is hugely valuable to the system as a whole. Energy efficiency delivers even greater benefit when paired with targeted Shift DR strategies that further flatten peaks (indicated by the dashed line) (AEG 2020).

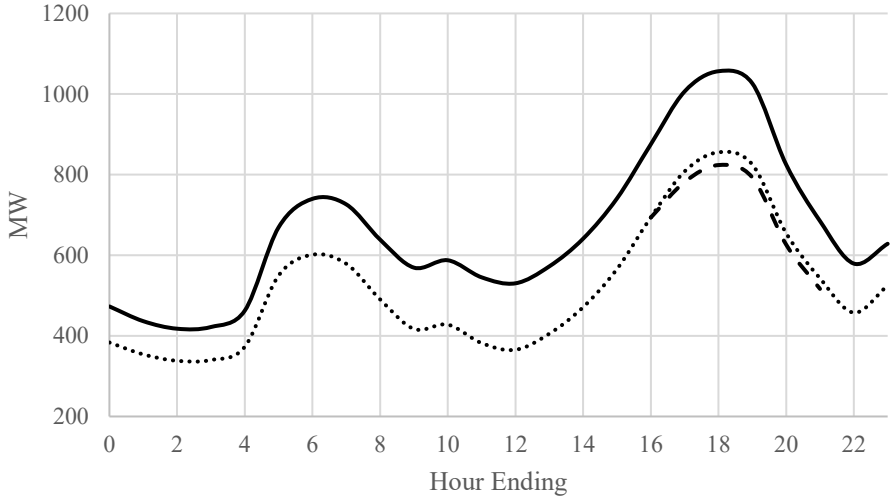

Figure 1. Oahu's peak sales forecast for 2030 (solid line), the resulting load requirement if energy efficiency potential is achieved with 85 percent market adoption by 2030 (dotted line), and how Shape and Shift strategies can help further flatten peaks (dashed line). *Source: AEG 2020*

Hawai‘i Energy's Emphasis on Peak Demand Reduction

Hawaii regulators and stakeholders have explored the potential for energy efficiency, as a Shape and Shift resource, to address the capacity shortfall due to coal plant closure and delays in utility-scale solar and storage projects. The Hawaii Consumer Advocate suggested in a filing "that Hawai‘i Energy should be engaged to determine whether there are existing energy efficiency programs that can be quickly expanded to bring about load reduction on a 24/7 basis but there should also be exploration of any energy efficiency measures that could provide dispatchable capacity and/or load shifting benefits" (Nishina 2021, 8).

On March 9, 2021, the Commission posted a notice into the PBFA docket (2007-0323) encouraging written submission of additional stakeholder ideas to address the capacity gap. Although Hawai‘i Energy is not a party to nor had been actively following the AES Coal Plant proceedings at that point, it provided comments and ideas to the PUC as initial ideas for the Commission's consideration. In its March 25, 2021 letter, Hawai‘i Energy offered two programmatic areas from its approved 2019-2021 Triennial Plan that could help with closing the gaps. "These areas are 1) increased load reduction through energy efficiency and demand reduction, 2) energy optimization initiatives (which includes demand response ready, grid services, and energy storage). Often customer-sited solutions bridge both areas. This can present synergies in program design and implementation while also providing value stacking for customers when making purchasing decisions (Kealoha 2021)."

In February 2022, Hawai‘i Energy proposed a suite of programs designed to address the capacity shortfall by reducing load during peak evening hours. Programs were designed to achieve the following objectives:

- Prioritize a portfolio approach to deliver capacity reductions through both traditional energy efficiency programs and energy optimization initiatives for demand flexibility and grid-interactive efficient buildings (GEBs).
- Address near-term opportunities while scaling up to greater investment in 2022-2023 to for maximum impact.
- Collaborate to boost participation in DER programs, rate offerings, and emergency DR initiatives offered by partners like HECO.

Hawai‘i Energy's proposed peak demand reduction portfolio comprises three program categories that are designed to deliver nearly 20.9 MW of peak reduction in PY22, as shown in Table 1.

Table 1. Estimated impact of Hawai‘i Energy peak reduction programs*

	MW Reduction		
Program Type	PY21	PY22	PY23
Enhanced Programming: Traditional Efficiency	18.4	13.6	14.2
Enhanced Programming: Peak Demand Targeting • Smart Building Controls • HVAC optimization	2.2	2.3	1.3

• Residential Programs			
Power Move • Peak Demand Bonus • Commercial Energy Storage Program	0.3	4.4	2.0
Total*	20.9	20.3	17.5

*Estimates of customer-level savings

Enhanced Programming

Hawai‘i Energy first sought to enhance the peak demand savings from its traditional energy efficiency portfolio by targeting deployment in commercial sectors with high coincident peak demand with the system peak, such as hospitality and grocery. This enabled the program to raise its peak demand reduction targets by approximately 4 MW per year above what was initially planned.

Hawai‘i Energy also identified about 2.5 MW per year in peak demand reduction from supporting customer adoption of connected controllable products and equipment. An initial commercial-sector effort focused on enhanced incentives for DR-capable hotel guest room controls. Hotel guest rooms operate at 100 percent coincidence with the utility peak, making enhanced controls an excellent option for load reduction. They are also relatively low-cost when compared to other HVAC measures, so the increased incentives have a significant impact on buying power. Hawai‘i Energy also launched a Smart Device Grant Program with GridPoint to promote installation of smart building controls that optimize HVAC and refrigeration for energy efficiency and peak demand reduction in small and medium commercial buildings. Looking ahead, Hawai‘i Energy plans to expand HVAC optimization and retrocommissioning offerings to support peak reduction goals.

In the residential sector, Hawai‘i Energy is expanding programming for lighting and water heating, which are the largest coincident peak loads for most households. The lighting portfolio is evolving to emphasize specialty and smart lamps, while the water heating portfolio sharpens its focus on driving adoption of heat pump water heaters (HPWH). Hawai‘i Energy is also expanding a grid-interactive water heater pilot to test the potential of HPWH to support load reduction, emergency demand response, and fast frequency response while monitoring for customer satisfaction.

Power Move

The Power Move program is initially targeted to Oahu’s commercial customers Power Move has two components: 1) enhanced incentives for load shifting, primarily through energy efficiency measures with the highest coincident peak; and 2) commercial energy storage installations in support of the HECO Battery Bonus emergency demand response program.

Hawai‘i Energy launched the first phase of Power Move in November 2021, offering Demand Savings Bonus awards to Oahu businesses for facility upgrades that reduce energy demand (“kW”) during utility peak periods. This limited-time offer raises the custom rebate rate for peak demand savings from $125/kW saved to $400/kW saved. Energy savings rebate rate remains at $0.12/kWh saved. Target measure types include HVAC optimization, exterior and industrial lighting retrofits, refrigeration retrofits and controls, and transformer retrofits. The Power Move Peak Demand Savings program has already proven effective in enhancing customized projects, with over 15 project applications submitted since November. Participating

customer types include grocery, hotel, multifamily, warehouse and retail centers. On average, Hawai‘i Energy is seeing increases of 20-25 percent in total rebate amount.

The second part of Power Move is the Commercial Energy Storage program, which launched in early 2022. New to the efficiency portfolio, this program seeks to support enrollment in HECO's Battery Bonus program by incentivizing commercial battery storage installations on Oahu to reduce load during evening peak (5:00 p.m. - 9:00 p.m.), with enhanced incentives for load reduction between 6:00 p.m. and 8:30 p.m. Hawai‘i Energy had been carefully monitoring the Battery Bonus program since its initial roll-out in July 2021, to inform how to layer on Hawai‘i Energy's energy storage program offering to best maximize budget and impact. The objectives of the Commercial Energy Storage program are to:

- Reduce utility peak demand (5:00 p.m. - 9:00 p.m.) throughout the period of the coal plant retirement, with specific priority for 6:00 p.m. - 8:30 p.m. period.
- Target commercial storage opportunities as commercial customers remain an underrepresented market in existing demand response programs while possessing significant load shifting potential. Some commercial customers already voluntarily reduce their peak when called upon by HECO, but for planning purposes ensuring and increasing load shift potential though storage is critical.
- Utilize enhanced incentives to support commercial customer enrollment in HECO's Battery Bonus, as well as future BYOD programs.
- Keep program design simple to deploy funds in order to accelerate projects and maximize peak load reduction.
- Stack projects with additional energy efficiency upgrades wherever possible use data to inform long term energy planning.

Power Move is anticipated to run through the end of Hawai‘i Energy's Program Year 2023, which concludes on June 30, 2024, with a targeted deployment of all major kW reduction efforts by December 31, 2023. Across the effort, collaboration between Hawai‘i Energy and HECO has been critical – ranging from program designs that are complementary to aligning messaging to customers and pooling marketing resources.

This coordination has been particularly important since the PUC issued Decision & Order (D&O) 38196 for the Program Track of the DER Docket (No. 2019-0323) with the call for amendments to the Battery Bonus program to accelerate market uptake. Since the D&O, the docket parties have met multiple times to discuss modifications to existing program rules and remove disincentives to participation.

So far, Hawai‘i Energy's commercial energy storage rebate is looking to be most opportune for commercial customers with a Standard Interconnection Agreement with HECO. Hawai‘i Energy is optimistic that the addition of its rebate at time of installation will help to overcome any perceived disincentive to participate in Battery Bonus by adding additional upfront funding to "make the customer whole" on the cost of the investment. Moreover, the program has been leveraging commercial permitting data, specifically looking at commercial PV battery permits pulled from 2017-2021, to help with customer targeting. Hawai‘i Energy is also working to co-recruit customers with the Hawaiian Electric Customer Energy Resources team and has already identified one high potential opportunity.

Looking Ahead

While the general community is emerging as COVID-mandated restrictions are lifted in Hawaii, commercial customers continue to feel the economic impacts from the pandemic. Many in the business sector are delaying energy-related projects for a range of reasons, including cash preservation, increase in equipment costs, or other organizational priorities. Given the urgency of the coal plant retirement situation and the limited timeframe to execute energy efficiency solutions, the creation of new, limited time programming is helping to push customers who are sitting on the fence to move forward now. With the new programming in place, contractors and developers are quickly resurrecting proposals and updating financials with an urgency to move projects forward.

The economics of customer-sited battery storage is tricky given current utility rate structure. With significant demand ratchet penalties that persist for 11 months, counting on billing demand savings is impossible. This is the same challenge that stalled technologies like ice storage for air conditioning in the 90's and 2000's as one event will wipe out all the savings. Rates need to be modified to accommodate some flexibility in order to adopt technologies that focus more on load shifting over energy use, or incentives will have to be rich like they are now to generate activity.

Although there is excitement and activity, there are some significant challenges to deployment of distributed solutions in the current environment. A couple of examples include escalating equipment cost, permitting, and supply chain issues. This is further exacerbated being on an island in the world's most isolated center of population.

The collaboration between Hawai'i Energy and HECO has been critical, ranging from program designs that are complementary to aligning messaging to customers and pooling marketing resources. Both entities meet monthly with the PUC and coordinate on complementary projects that will benefit their shared customers.

On the State level, the work of the PPCTF is looking to continue beyond the coal plant retirement, as Hawaii's grids face the retirement of an additional 15 fossil generating units within three power plants by 2045. The PPCTF has also been able to identify areas of improvement in the ways projects are developed and plans are reviewed. Currently the process is linear; HSEO has been able to work with HECO to review plans concurrently to speed things along. HSEO has also emphasized the importance of efficiency for all parties involved to avoid unnecessary delays.

While the Task Force supports collaboration, transparency, and process improvement to speed project development, HSEO, the PUC and other stakeholders are pursuing other avenues in parallel to help fill the capacity gap and keep Oahu from going dark. One area in energy efficiency that draws the PUC's interest is GEBs. GEBs feature sophisticated energy system controls and smart consumer technologies that "allow for two-way power flows and flexible management of both electricity demand and supply to improve the performance and service offerings of buildings and the electric power system" (NARUC 2022). The PUC and HSEO are part of a working group to identify potential GEB projects in the state.

Another important short-term and long-term opportunity for peak load reduction is changing customer behavior. As Commissioner Potter notes, it is important for customers to know how to heed the call when asked to conserve (J. Potter, Commissioner, PUC, pers. comm., March 14, 2022). Starting the education process now around not just how customers use energy, but also when, will set the foundation for customers to adopt time-of-use rates in the future. The PUC identified the state of California's behavioral modification campaign called "Flex Alert,"

which notifies customers about power supply scarcity and calls on them to conserve electricity, as a potential strategy for Hawaii (California ISO). Consumers can sign up to receive the alerts and the program is widely advertised and marketed throughout the state. Hawai'i Energy has begun engaging with HECO's marketing and communications teams to develop an Evening Peak Conservation Campaign to influence behavior over the long-term. Some ideas from the initial brainstorm include social media calls to action, contests, and ongoing education. Hawai'i Energy will continue to collaborate with HECO to ensure that short-term objectives around emergency response will lead to customer education and behavior change that shapes load in the long-term.

Looking ahead in the near term, Hawai'i Energy anticipates further evolution to its energy efficiency portfolio to deliver greater peak demand reduction and demand flexibility, to support grid reliability and climate goals in the state. Its plan for the next two- to three-program years reflects a significant increase in focus and incentives to align energy and demand savings with peak utility demand periods. As such, its Energy Optimization Initiatives (EOI) have taken on a greater role and importance in the program portfolio to better facilitate the integration of energy storage, demand response and clean transportation technologies to enable a more flexible grid.

Conclusion

When the State of Hawaii signed its historic renewable energy law, the energy industry sang its praises and continues to highlight the ambitious vision. This same solidarity is needed to actualize working solutions that will make that goal a reality. Coordination and communications are key, as evident in the Hawai'i Energy and Hawaiian Electric collaboration efforts and the state's Powering Past Coal Task Force. It also takes leadership that understands the "big picture," has the foresight to tap into the right resources, and the recognition of how energy efficiency can support a renewable-driven endeavor.

References

AEG (Applied Energy Group). 2020. "STATE OF HAWAII MARKET POTENTIAL STUDY." https://puc.hawaii.gov/wp-content/uploads/2021/02/Hawaii-2020-Market-Potential-Study-Final-Report.pdf

Balaraman, K. 2021a. "We're going from cigarettes to crack': Hawaii regulators grill HECO on fossil fuel transition plan." *Utility Dive,* March 17. www.utilitydive.com/news/cigarettes-to-crack-hawaii-regulators-blast-heco-fossil-fuel-transition-plan/596842/

Balaraman, K. 2021b. "Hawaii OKs emergency demand response to avoid energy shortfalls following AES coal plant closure." *Utility Dive*, June 10. www.utilitydive.com/news/hawaii-emergency-demand-energy-shortfalls-aes-coal/601573/

California ISO. 2022. "Flex Alert." Accessed March. www.flexalert.org/

EIA (U.S. Energy Information Administration). 2022. "Hawaii State Profile and Energy Estimates." www.eia.gov/state/analysis.php?sid=HI

HDOH (Hawaii Department of Health). 2021. "Hawaii Greenhouse Gas Emissions Report for 2017." health.hawaii.gov/cab/files/2021/04/2017-Inventory_Final-Report_April-2021.pdf

Hawai‘i Energy. 2021. “Finding the Bright Spots: Program Year 2020 Annual Report.” hawaiienergy.com/images/about/information-and-reports/annual-reports/ProgramYear2020_AnnualReport.pdf

Hawai‘i Energy. 2020. “Deepening Connections: Annual Report 2019-2020.” https://hawaiienergy.com/images/about/information-and-reports/annual-reports/ProgramYear2019_AnnualReport.pdf

HECO (Hawaiian Electric Company). 2014. *Hawaiian Electric Power Supply Improvement Plan.* Docket No. 2011-0206. files.hawaii.gov/puc/3_Dkt%202011-0206%202014-08-26%20HECO%20PSIP%20Report.pdf

HECO. 2016. *PSIP Update Report: December 2016.* Docket No. 2014-0183. cca.hawaii.gov/dca/files/2016/12/dkt_2014_0183_20161223_companies_PSIP_update_report_1_of_4.pdf

HECO. 2019. Comments on Hawai’i Energy PY2019-2021 Triennial Plan. Docket No. 2007-0323. May 31, 2019.

HECO (Hawaiian Electric Company). 2020. “New renewable projects submitted to regulators will produce lower-cost electricity, advance clean energy.” *Hawaiian Electric Company*, September 16. www.hawaiianelectric.com/new-renewable-projects-submitted-to-regulators-will-produce-lower-cost-electricity-advance-clean-energy

HNEI (Hawaii Natural Energy Institute). 2021. “Decision Support Services to the Hawai‘i Public Utility Commission.” www.hnei.hawaii.edu/wp-content/uploads/Decision-Support-Services-to-the-PUC.pdf

HSEO (Hawaii State Energy Office). 2020. “Hawaii‘s Energy Facts & Figures.” energy.hawaii.gov/wp-content/uploads/2020/11/HSEO_FactsAndFigures-2020.pdf.

HSEO (Hawaii State Energy Office). 2021. “Hawaii State Energy Office 2021 Annual Report.” energy.hawaii.gov/wp-content/uploads/2022/01/HSEO_2021_Annual_Report_1.4-3.pdf

HSEO (Hawaii State Energy Office). 2022. “Powering Past Coal Task Force.” Accessed March. energy.hawaii.gov/ppctf

Hurley, T. 2022. “Hawaii oil refinery suspends buying Russian crude oil.” *Honolulu Star-Advertiser,* March 4. www.staradvertiser.com/2022/03/04/hawaii-news/hawaii-oil-refinery-suspends-buying-russian-crude-oil/

Kealoha, B. 2021. *Docket No. 2021-0024 - Opening a Proceeding to Review Hawaiian Electric’s Interconnection Process and Transition Plans for Retirement of Fossil Fuel Power Plants Initial Status Update.* Hawaii Public Utilities Commission. dms.puc.hawaii.gov/dms/DocumentViewer?pid=A1001001A21C25B60011D00216

Lawrence Berkeley National Lab (LBNL). 2017. *2025 California Demand Response Potential Study*. eta-publications.lbl.gov/sites/default/files/lbnl-2001113.pdf

LBNL. 2020. The California Demand Response Potential Study, Phase 3: Final Report on the Shift Resource through 2030. https://eta-publications.lbl.gov/sites/default/files/ca_dr_potential_study_-_phase_3_-_shift_-_final_report.pdf

McInnis, B. 2021. "Plus Power breaks ground on Kapolei Energy Storage project." *Pacific Business News*, August 12. www.bizjournals.com/pacific/news/2021/08/12/kes-project-groundbreaking-plus-power.html

Miyashiro, M. 2020. "Hawaii puts an expiration date on coal." *Blue Planet Foundation*, September 21. blueplanetfoundation.org/coalfreehawaii/

NARUC (National Association of Regulatory Utility Commissioners). "Energy Infrastructure Modernization." Accessed March. www.naruc.org/cpi-1/energy-infrastructure-modernization/grid-interactive-efficient-buildings/

Nishina, D. 2021. *Division of Consumer Advocacy's comments on Hawaiian Electric's initial status update filed on March 5, 2021.* Hawaii Public Utilities Commission. dms.puc.hawaii.gov/dms/DocumentViewer?pid=A1001001A21C29A91547H00398

SB2629 (Senate Bill 2629 SD 2 HD1). 2020. *Relating to the Environment.* Honolulu, HI: The Senate Thirtieth Legislature, 2020, State of Hawaii. www.capitol.hawaii.gov/session2020/bills/SB2629_HD1_.htm

Wu, N. 2021a. "Electricity bills expected to rise with summer heat." *Honolulu Star-Advertiser*, June 13. www.staradvertiser.com/2021/06/13/hawaii-news/electricity-bills-expected-to-rise-with-summer-heat/

Wu, N. 2021b. "Construction begins on 2 utility-scale solar projects in Mililani, Waiawa." *Honolulu Star-Advertiser*, April 9. https://www.staradvertiser.com/2021/04/09/breaking-news/construction-begins-on-2-utlity-scale-solar-projects-in-mililani-waiawa/ wu

Wu, N. 2021c. "Oahu's solar battery program to boost clean energy stymied by permitting system." *Honolulu Star-Advertiser*, October 8. https://www.staradvertiser.com/2021/10/08/hawaii-news/oahus-solar-battery-program-to-boost-clean-energy-stymied-by-permitting-system/