



Hawaiian
Electric

Customer Energy Resources for Hawai‘i

A Customer-First CER Strategy for a 100% Clean Energy Future

Equity



Opportunity

Need

Preface

Hawaiian Electric's Customer Energy Resource Strategy provides our vision to expand customer energy resources as we move toward Hawai'i's goal of 100% renewable energy by 2045.

We are grateful for the guidance from the Public Utilities Commission and industry stakeholders' feedback which helped to shape this Strategy. This Strategy remains a living document that will evolve with the collective experience and expertise of our customers and industry stakeholders as we quickly and thoughtfully expand Hawai'i's customer energy resource opportunities.

Mahalo for your interest in our vision to achieve a clean energy future through the expansion of customer energy resources.

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Executive Summary

Empowering Hawai'i to Thrive Together, the theme of Hawaiian Electric's 2020-2021 Sustainability Report, inspires our commitment to customer energy resources (CERs), which are behind-the-meter technologies that can change a customer's energy use. This Strategy explains how we plan to increase the number of CERs to the scale needed to reach our clean energy commitments over the coming decades while providing value to all customers, whether they own CERs or not.

We envision a thriving Hawai'i steadily moving toward energy independence by responsibly using the islands' natural resources to power our lives while reducing our carbon footprint and eliminating dependence on imported fossil fuels. We can only achieve this vision with significant contributions from our customers and a healthy independent CER market.

This Strategy is ambitious, but so is the appetite of Hawai'i's people for greater clean energy independence. Our progress thus far is a testament to that. At the end of 2020, we achieved a Renewable Portfolio Standard of 35%, the percentage of the electricity used by our customers coming from renewable resources, much of which they generated themselves. This is well ahead of our 2020 state mandate of 30%; even discounting impacts of the COVID pandemic, renewable generation use would have been over 32%.

Hawai'i continues to be among the per capita national leaders in private, customer-sited rooftop solar, with 88,000 systems in use across our five-island service territory at the end of 2020. This notable achievement is changing how electricity is used and valued by the utility and our customers. Hawaiian Electric's relationship with our customers is evolving into a more complex interaction in which our customers are not just electricity consumers but producers who can support essential grid reliability for everyone. This support can be in direct partnership with the utility or through participation with an independent third party contracted with the utility.

This new utility-customer relationship means customer involvement is key to achieving our 100% Renewable Portfolio Standard goal by 2045 and the reason this Strategy centers around and depends upon our customers.

As a community, we must sustainably balance renewable energy with other vital needs including affordable housing, local food supply, cultural preservation and protection of the islands' natural resources and beauty. Our islands' limited land area, dense population and geographic remoteness explain why Hawai'i needs to maximize CERs to achieve energy self-sufficiency and resilience. And it is crucial that all customers can participate in this energy transformation, giving them opportunities to manage their electric bills as part of our clean energy future.

This Strategy includes the following dedicated sections:

Chapter 1 – A Customer-First Strategy describes the scale at which we plan to expand CERs and why customer-sited renewable resources are essential to achieving our 100% renewable energy goal by 2045. Our customer-first strategy's three guiding principles -- *Need, Opportunity and Equity* -- are defined in this chapter. It also touches upon how Hawaiian Electric's Grid Modernization Strategy is essential to the success of this CER Strategy.

Chapter 2 – CER Strategic Framework explains how we are creating customer-focused opportunities. It introduces the Three C's concepts of the strategic framework -- *Choice, Coordination and Collaboration*. These concepts are enabled through paths of participation, the Three P's -- *Pricing, Programs and Procurement*. Our Integrated Grid Planning process is also discussed here since it directly affects many aspects of the framework.

Chapter 3 – Choice: Pricing Structure discusses how customer participation is encouraged through *Pricing*, that is, retail electricity rates. Advanced rate design, streamlined solar interconnection and standardized export requirements are some fundamental areas of opportunity for customer choice. This section emphasizes the importance of electricity rate reform so all customers can manage their bills, and the utility can ensure the costs to operate and maintain the grid are equitably shared by all customers.

Chapter 4 – Coordination: CER Programs explains how *Coordination* increases customer interaction with the utility and electric grid through utility offered *Programs*. Customers with CER technology will receive compensation by using their CERs to provide additional grid services beyond basic interconnection requirements.

Chapter 5 – Collaboration: CER Procurement describes the most complex engagement of the Three C's, *Collaboration*, which employs independent, third-party aggregators to deliver grid services to Hawaiian Electric while offering our customers ways to participate and benefit from their CERs. *Procurement* opportunities are managed through a competitive process where aggregators must meet performance requirements like those required of a traditional independent power producer.

Chapter 6 – The Modern Grid Hawai'i Needs highlights Hawaiian Electric's Grid Modernization Strategy. It describes the type of technologies that will increase the connectivity and accessibility needed to create CER opportunities. The modern grid will enable about half the electricity needs of our customers to be met from *the edge of the grid* (from our customers) instead of from *the center of the grid* (large, central power plants that have historically pushed power out to customers.)

Chapter 7 – Conclusion recognizes this Strategy is a living document that will continue to evolve to complement and utilize CERs now and in the future. It calls on our regulators, stakeholders and industry experts to help Hawai'i remain in the vanguard of this national utility transformation for the benefit of customers and our communities.

In sum, as this Strategy explains how we plan to increase CERs to the scale needed to reach our clean energy goals over the coming decades while providing value to all customers, whether they own CERs or not, we must keep in mind basic principles that include:

- *Equity and fairness must guide everything we do.*
- *The customer comes first; and no customer can be left behind.*
- *Maximizing customer participation in clean energy generation and use is essential to maintain a safe, stable and reliable grid and to reach our 100% renewable goal for electricity.*
- *We need a strong independent marketplace for solar contractors and grid services aggregators.*
- *We must be firm in our goals and intentions but flexible in the way we achieve them.*

###

1 | A Customer-First Strategy

As an island society, we must care for our home by balancing how it supports vital needs such as affordable housing, local food production, cultural preservation and conservation of our islands' natural beauty and resources. Because of these interconnected needs, a balanced portfolio of large-scale renewable systems and the maximum attainable private rooftop solar is necessary to meet Hawai'i's future renewable energy goals.

This is why our customers' willingness to use their rooftops to support renewable energy is key for CER opportunities in Hawai'i. Our vision is for most customers to power their own homes while supporting the reliability of the grid to benefit all communities. Our Customer-First Strategy is laid out to create CER opportunities customers want and need, while ensuring the solutions support grid reliability and equitably shared utility costs.

Defining Customer Energy Resources

What is a CER?

Hawaiian Electric defines a customer energy resource as **a behind-the-meter technology or device that can alter a customer's energy use**. Customer energy use in the electricity world is often referred to as "energy load" or simply "load." CERs allow customers to both consume utility produced electricity as needed and also generate their own electricity which is physically distributed or dispersed throughout the islands and can be a resource to the grid.

This Strategy aims to provide a path for all CER technologies such as rooftop solar, battery storage, electric vehicles, controllable devices (i.e. grid-interactive water heaters) and any future technologies, systems or devices that become available to be a distributed resource that harmoniously interacts with the electric grid.

What is a Grid Service?

A grid service **supports the reliable operation of the electric grid**. Grid services may be provided by a grid-scale resource like a power plant or by CERs either individually or in aggregate. Grid services can be valued at the higher bulk system level, or at the transmission and distribution level. For example, grid services help maintain the quality and proper flow of electricity; balance electricity generated and consumed; or stabilize the grid after an unexpected adverse event.

Historically, grid services were mostly provided by firm-power centralized fossil-fuel plants. But with the gradual closing and reduced use of these plants and widespread adoption of CERs under the framework presented in this Strategy, customers are being empowered to choose if they want to provide grid services for compensation.

Customer-First Guiding Principles

This Strategy explains how we plan to increase CERs to the scale needed to reach our clean energy future and how they provide value to all customers whether they own CERs or not. It is shaped by stakeholder and customer feedback and built upon prior initiatives including Hawaiian Electric's Grid Modernization Strategy¹, Integrated Grid Planning² and the Electrification of Transportation Roadmap³. Several years prior to the opening of the present Public Utilities Commission dockets, Hawaiian Electric was in discussions with and collected pertinent information from customers and the solar industry stakeholders. That interaction has been greatly expanded and refined under Commission leadership. This Strategy builds on these interrelated initiatives that are vital to achieving a 100% renewable energy future.

As shown in Figure 1 on the next page, the customer-focused principles that anchor this CER Strategy are **Need, Opportunity and Equity**. These principles directly support the utility's primary obligation to serve all customers equitably by operating a safe, reliable, resilient and affordable grid. They also recognize that the utility cannot create a clean energy future on its own and must work with communities and the CER industry to create a grid that benefits all customers.



Figure 1 | Customer-First Strategy

Need Principle: CERs are essential to achieve a 100% clean, renewable energy future

Driven by...

- The need for a 100% renewable energy portfolio that can stabilize customer bills and,
- Land to support renewable energy projects and other essential needs such as housing, local agriculture, cultural preservation, resource conservation and other public interests.

Opportunity Principle: Opportunities for cost-effective CERs must be expanded

Driven by...

- The goal to expand opportunities for all customers to participate in CER at some level,
- The need for a sustainable CER market -- that is, CER developers and providers -- in Hawai'i,
- The need for the utility to invest in cost-effective grid technology and infrastructure that reduces costs for all customers and
- The rapid pace of technology advancement.

Equity Principle: *Expansion of CERs must benefit all electric utility customers*

Driven by...

- *The need to provide affordable electricity, especially during challenging economic times, to all customers, expressly those with moderate or fixed incomes and*
- *The need to equitably allocate utility costs among customers based on the benefits they receive from or provide to the grid.*

These customer-focused principles aim to ensure the broadest possible participation in this evolving CER market. This means both costs and benefits related to a significant increase of CER integration must be equitably shared by all customers. These principles lay the foundation for customers, the CER industry and Hawaiian Electric to support a sustainable and robust expansion of CERs in Hawai'i. This Strategy is grounded in the belief that a paradigm shift is needed to achieve the CER growth necessary to meet the State's renewable energy goals in a way that is efficient and fair.

A Modern Grid for Hawai'i

Our Grid Modernization Strategy is crucial to the realization of this Strategy, because the grid we have today is not the grid Hawai'i needs to achieve our clean energy goals.

The Grid Modernization Strategy states:

*"By working together with customers and stakeholders, the Company firmly believes it can improve operational efficiency and reduce the dependence on fossil fuels that contribute to global warming while moving Hawai'i to a sustainable energy future. The future of Hawai'i's energy is based on a model that approximates half of the required renewable resources coming from customers' distributed resources. At its core, this modern grid will serve as a platform that provides flexibility, reliability, and greater value for all customers. It will provide access to lower-cost renewable energy for customers who do not have distributed resources. It also enables greater value for customers (who) have the opportunity to employ distributed resources. This is because modernization enables customers to adopt distributed resources and the potential to monetize additional value through selling [grid] services to the utility to contribute to meeting the needs of all customers."*⁴

Our Grid Modernization Strategy was initially influenced by a grid architecture discipline developed by the Pacific Northwest National Laboratory.⁵ Three key aspects of their approach are: Layered Architecture, Platforms and Extensibility to Enable Proportional Deployment.

The Grid Modernization Strategy highlights enabling technologies to manage the impact of CERs on the grid. It also recognizes the need for an integrated grid planning process that:

- Identifies technologies and solutions to address specific issues being encountered on the distribution grid and
- Coordinates replacement of aging infrastructure with equipment compatible with Hawaiian Electric's grid modernization plans.⁶

An efficient implementation of the Grid Modernization Strategy will ideally be done in concert with a comprehensive resource planning process. With a revived focus on comprehensive resource planning, Hawaiian Electric proposed an Integrated Grid Planning process we believe will benefit customers by identifying the best resource investment options that affordably move Hawai'i toward a safe, reliable, resilient, affordable clean energy future while minimizing risk.

Energy Efficiency's Complementary Role

Energy efficiency remains a crucial component to achieve clean energy for Hawai'i. We support the philosophy that customers should implement conservation and energy efficiency while investing in other CER solutions. Energy efficiency appliances and technology that alters a customer's energy use are also considered a CER. That said, temporal and locational aspects of energy efficiency -- that is, when and where energy efficiency load reduction occurs on the grid -- are becoming more critical to overall utility planning cycles and grid management.

Hawaiian Electric continues to collaborate extensively with Hawai'i Energy, the Public Utility Commission's independent entity that administers the state's energy efficiency programs. The Commission recently added a Performance Incentive Mechanism for Hawaiian Electric through the Performance Based Regulation Proceeding⁷ that encourages the utility to increase and formalize collaboration with Hawai'i Energy to deliver energy savings, especially for low-to-moderate income (LMI) customers. This aligns well with the Equity Principle that supports inclusion of CER opportunities for moderate and fixed-income customers and inherently includes energy efficiency opportunities.

We will also continue to incorporate in our resource planning the achievement of the Energy Efficiency Portfolio Standard, the state's current energy efficiency impact goal, which targets a continuing 30% electricity sales reduction by 2030.⁸ Any changes to this standard passed by the State Legislature will be incorporated in our integrated grid planning process.

Hawaiian Electric's Organizational Alignment

In November 2019, to align with this Strategy, Hawaiian Electric merged two divisions traditionally known as Distributed Energy Resources or "DER" and Demand Response or "DR" to form a new Customer Energy Resources Department. This change emphasizes the CER

Department's customer focus and recognizes the evolution of DER and DR from the perspective of both customers and the market. (For regulatory purposes, the older DER and DR designations are still used.)

The unification of these areas enables Hawaiian Electric to implement this Strategy with a refreshed purpose. In the wake of a global pandemic, the CER Department is keenly focused on expanding CER opportunities to the underserved, including LMI customers and renters. The CER team's collective experience working with the solar industry on previous solar tariffs, designing and deploying our own DR programs and procuring grid services through aggregators all enable us to execute this customers-first Strategy quickly and thoughtfully.

DER Proceeding

On April 9, 2020, the Commission provided guidance to frame and define the scope of its investigative proceeding for DERs.⁹ The Commission identified three main tracks: Program Track, Advanced Rate Design Track and Technical Track. Since then, working group meetings and technical conferences were held to address the issues and concerns the Commission identified. This Strategy will continue to be influenced by all three tracks, notably aiming to frame our vision for long-term, equitable CER solutions to meet our clean, renewable energy goals for Hawai'i.

A Year Plus of COVID-19

Early in 2021, at the start of the COVID pandemic, there was understandable concern that one impact would be a drastic reduction in the uptake of new rooftop solar systems and batteries and a corresponding devastating blow to the solar contractors and developers serving Hawai'i. This did not happen in large part because of the intensified level of consultation and cooperation among Hawaiian Electric and solar industry stakeholders under the supervision of the Public Utilities Commission. In a series of letters, technical conferences and filings, all parties discussed what could be done to avoid a CER downturn.

The result was a series of steps that further smoothed and speeded the interconnection process and removed perceived and real barriers to customers quickly getting the benefit of a new rooftop solar system and energy storage. For example, Hawaiian Electric instituted Quick Connect, to allow customers installing new rooftop solar systems to see their electricity costs reduced faster.

With Quick Connect, customers on O'ahu, Maui and Hawai'i islands installing most new systems on virtually all circuits do not need the standard approvals before activating their systems. This is a return to the policy in place a decade ago, when solar contractors could get county planning approval and install a new system before informing the utility.

An approval process that typically took several weeks or months for each step to be completed can now be handled after the system is built and turned on, substantially reducing the

wait for many new solar customers to see savings on their bills. If successful, Quick Connect may be extended beyond one year.

Through a series of news releases, social media messages, updates on hawaiianelectric.com and other outreach, customers were informed of these changes and advised that this was a good time to act on plans to add rooftop solar and energy storage.

In 2020, nearly 6,000 new rooftop solar systems were installed across Hawaiian Electric's territory, a 55% increase from 2019, a "normal" year.

###

2 | CER Strategic Framework

Customers have clearly expressed that what they need most is reliable electric service and ability to manage and ideally lower their electric bills through access to renewable energy.¹⁰ Currently, residential CERs are not available to everyone in Hawai'i and we believe they should be. This drives our commitment to expand opportunities in a way that is fair and equitable. This section introduces the CER Strategic Framework we are using to develop the CER opportunities. These opportunities will evolve with Hawai'i's changing energy landscape and the need to adapt to technology advancements, customer preferences, a sustainable industry and grid needs.

Framework Conceptualization & Participation

Three C's and P's

The CER Strategic Framework is built upon the Three C's -- *Choice, Coordination and Collaboration*. The Three C's are enabled through the Three P's -- *Pricing, Programs and Procurement*. The Three C's and Three P's are our building blocks to design, evolve and implement CER opportunities equitably for all customers.

The general options customers may select within this framework are shown below in Figure 2, from a basic to complex levels that require greater involvement from customers and more than one participation mechanism. The figure mainly describes a residential customer's choices but is applicable to commercial customers as well. By offering options, we can diversify CER opportunities for all customers and include those who do not have easy access to renewable

Choice is at the entry level where customers determine what rate choice works best for them based on their pattern of energy use. In accord with the Equity Principle, the goal of our advanced rate design **pricing** structure is to provide ways for customers to manage their electric bills whether they have direct access to CERs or not. In Figure 2, this is indicated as Option 1.

Some examples are a residential customer who installs rooftop solar and signs up for a CER Tariff, or a residential customer who does not have rooftop solar but is on a time-of-use (TOU) rate or a residential customer without rooftop solar who chooses to opt-out of a TOU rate. Any customer who takes electric service from Hawaiian Electric fits somewhere in Option 1.

Coordination is the next level of participation where customers first chose a rate and then can additionally enroll in a Hawaiian Electric administered CER **program**. These customers will be compensated in exchange for allowing the utility to directly control the operation of their CER with the grid. Direct utility management of CERs enables coordination among CERs, grid-scale resources and grid-protective devices to benefit the grid and ultimately all customers.

Figure 2 illustrates this “stacking” with Option 2. Some examples of Option 2 include a customer on a TOU rate who is enrolled in a CER program that pays a monthly credit for allowing the utility to turn off the customer’s water heater at certain times with the goal that it goes unnoticed by the customer. Another example could be a rooftop solar customer who signs up on a new CER tariff but also enrolls in a CER program to receive credit for grid services that support the grid.

Collaboration is the highest level which involves an independent aggregator contracted with Hawaiian Electric through a competitive procurement process to provide additional offerings to customers. The aggregator is responsible for managing the three-party “*customer + aggregator + utility*” collaboration to ensure the aggregated CERs provide the grid services contracted for delivery to Hawaiian Electric. In some cases, a large commercial customer may qualify as a “self-aggregator” to directly contract with Hawaiian Electric to deliver grid services.

Figure 2 captures this “stacking” aspect as Option 3 and Option 4. An example of Option 3 is a customer on a TOU rate who then enrolls their air conditioner with an aggregator contracted with Hawaiian Electric. Option 4 is the most complex level of participation with a pathway for customers to participate in more than one program via the utility and with a third party. At this point, Option 4 requires more in depth development, but it is a option we are striving for to use CERs to their greatest potential.

Collectively, the options illustrated in Figure 2 provide an overview of this system as seen from the utility’s high-level point of view. This is necessarily a complicated view, as it includes multiple customers with multiple options. When choices are presented to customers via information and marketing, they will look simpler, as the customer knows his or her own circumstances, including how their household uses electricity in a typical day, what technologies (rooftop solar, electric vehicle, etc.) they have or intend to own and their own level of interest and tolerance for complexity. In effect, the customer will be looking from the wide end of the telescope at a narrower perspective.

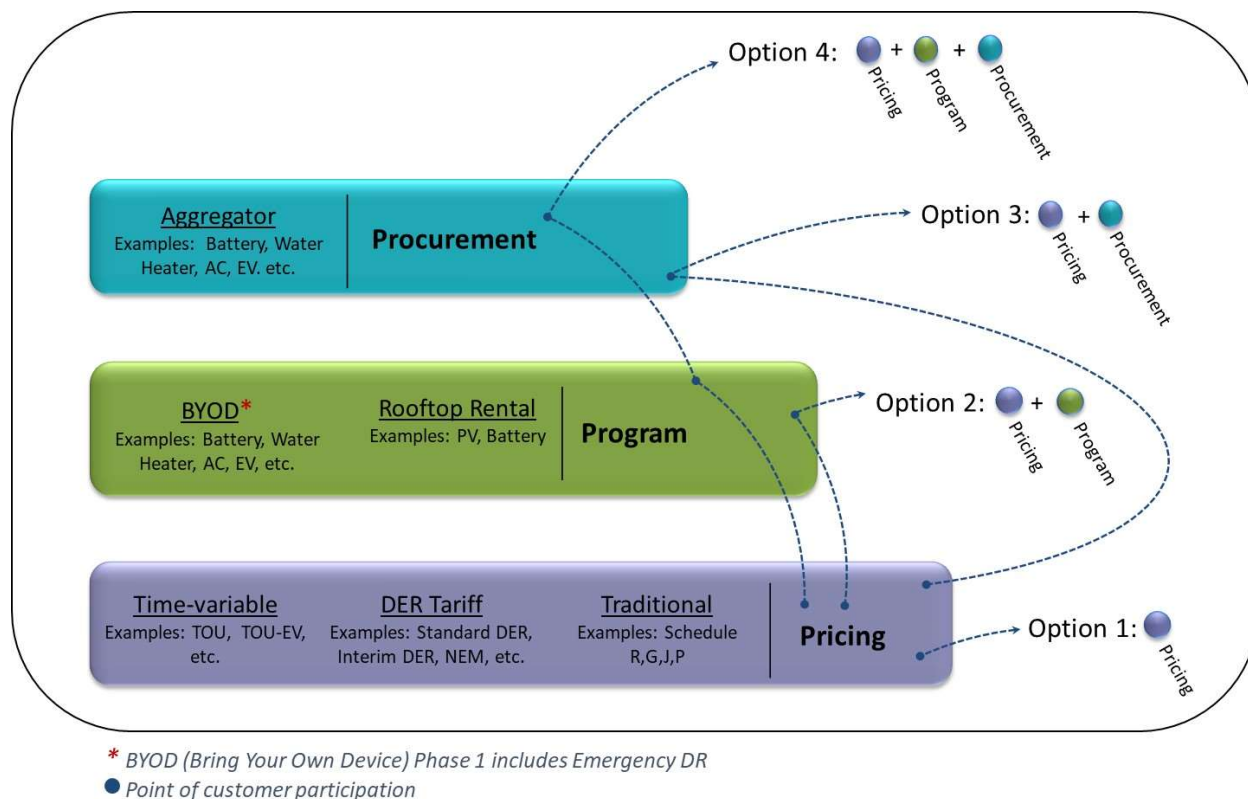


Figure 2 | Customer Participation Options

The Integrated Grid Planning process shown on the next page in Figure 3, directly informs the CER Strategic Framework by identifying grid needs and seeking solutions through customer energy resources and/or grid-scale providers. Customers would benefit by providing services to the utility either through direct customer engagement via pricing and programs or through contracts with aggregators selected via competitive procurements. This planning process benefits customers because it allows Hawaiian Electric to identify cost-effective solutions while maintaining reliability and minimizing risks.

IGP also engages stakeholders early in the process, so the end solutions consider the interests of customers, communities, stakeholders and industry. Figure 3 illustrates the iterative, five-step process of IGP. Through these steps, we seek to harmonize generation resource, transmission and distribution needs and create customer value with input from customers, industry and our own utility planners to select the most cost-efficient solutions to present to the Commission for review and approval.

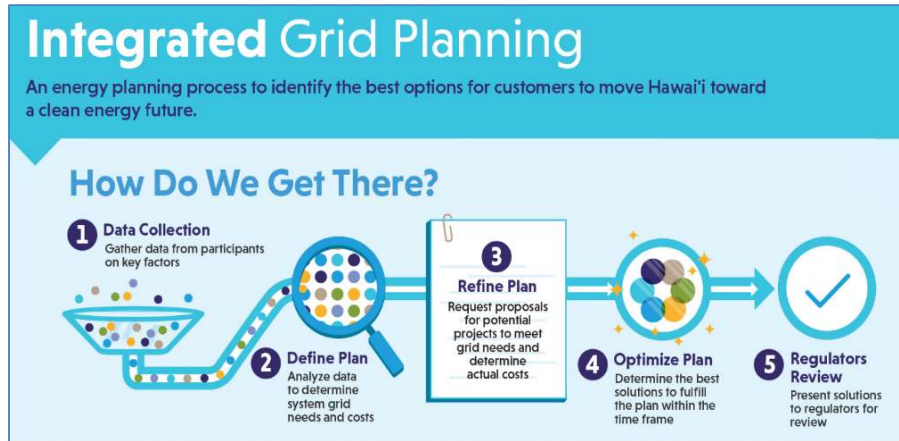


Figure 3 | Integrated Grid Planning Process

This iterative (meaning repeating not static) process will guide each level of CER participation to create more opportunities for customers and industry. The next three chapters of this Strategy expand on our strategic approach for each level of the CER Strategic Framework.

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3 | Choice: Pricing Structure

We are committed to a clean energy future that supports customer choice. This begins with providing opportunities at an entry level with a retail rate that enables customers to manage their pattern of use and their bills if they choose. Information and assistance must be available to customers since advanced rate design pricing structures can influence how customers use energy and add complexity to their rate choices.

To this end, we recognize this challenge and the need to keep simplicity at the forefront of advanced rate design. We plan to create a standard tariff that simplifies rooftop solar interconnection and export compensation as a long-term CER offering to support continued, sustainable growth of CERs in Hawai'i. As shown in Figure 2 above, as a default, customers who take electricity service under Hawaiian Electric at minimum must select Option 1.

Additionally, microgrids will be another option of customer choice and are further discussed in *Chapter 5*.

Existing Tariffs

Existing tariffs allow customers to interconnect their rooftop solar and battery storage systems to the grid, in many cases with compensation for excess electricity they export to the grid. Most are interim (offered for a limited time) tariffs with pricing fixed for five years and capped participation. We recognize the continuing need to simplify interconnection and compensation in the program enrollment process. To accomplish this, we propose a Standard CER Tariff to eventually replace Hawaiian Electric's existing interim tariffs described below.

Standard Interconnection Agreement (SIA)

Allows large commercial customers to offset their electricity bills with on-site renewable or conventional generation. A customer can export electricity to the grid but is not compensated for it.

Net Energy Metering (NEM)

Allows customers to export electricity from their rooftop solar systems to the grid and receive compensation at the full utility electricity retail rate. This offering is now closed.

Net Energy Metering Plus (NEM+)

Allows existing NEM customers to add panels to their rooftop solar systems, but not to export electricity from that additional capacity to the grid.

Customer Self-Supply (CSS)

Allows customers to install private rooftop solar systems with all electricity generated used by the customer or stored for later use on-site. Energy storage devices like batteries are permitted.

Customer Grid-Supply (CGS)

Allows customers to receive a pre-set credit for electricity exported to the grid. Customers are billed at the retail rate for electricity from the grid.

Customer Grid-Supply Plus (CGS+)

Allows customers to receive a pre-set credit for electricity exported to the grid. Customers are billed at the retail rate for electricity from the grid. A CGS+ system must include grid support technology and allow the utility to remotely monitor system performance, technical compliance and, if necessary, to control the system for grid stability.

Smart Export

Allows customers with rooftop solar systems and battery storage the option to export electricity to the grid at a pre-set credit from 9 p.m. to 4 a.m. with no compensation for electricity exported at other hours. Customers are billed at the retail rate for electricity from the grid.

Shared solar

Also known as Community Based Renewable Energy (CBRE) or "community solar," shared solar provides an option for a customer unable to own a private rooftop system to benefit from electricity generated by a renewable energy facility in their utility service territory. Customers are billed at the retail rate for electricity from the grid but get a credit on their bills based on the size and output of their contracted portion of the facility. An expanded phase two is expected to open in 2021.

Under today's tariffs, customers who install CERs such as rooftop solar and storage can lower their electric bills by first using electricity their system generates on-site. These customers can significantly reduce or nearly "zero out" the portion of their bills that would fund the maintenance and operation the grid. When customers significantly reduce this portion of their electric bills, their share of grid maintenance and operation costs are inequitably paid by customers who do not have rooftop solar. This outdated pricing structure is neither fair nor sustainable. It is the reason the energy industry is undergoing a fundamental reform in rate design and tariffs for distributed energy resources.

Future Tariff Opportunities

Modern Rates for a Modern Grid

The exponential growth of private rooftop solar in Hawai'i has profoundly changed the way residential and commercial customers use electricity and interact with the electric grid. In 2020 alone, 5,965 new rooftop solar systems were installed across O'ahu, Hawai'i Island and Maui County, up 55% from the 3,840 systems in 2019. Of new systems, 4,624, or 78% included battery storage.

At the end of 2020, nearly 88,000 private customer solar systems were connected to Hawaiian Electric's five island grids, including 9,751 with energy storage. The generating capacity of customer-sited systems and grid-scale solar projects totaled 968 megawatts in 2020, an increase of 7% from 902 MW in 2019. In total, nearly 4 million panels are in use.

What has not kept pace with this growth is a rate structure that reflects how customers self-produce, store and use electricity. Over the years, the dollar per kilowatt-hour rate fluctuated due to local and global factors, especially the price of oil. But the fundamental method used to calculate the rate has not changed, nor has the concept of a single, bundled rate that includes grid operation costs and energy costs.

Since Honolulu's city lights were first lit with electricity in 1888, that electricity has mostly been powered by fossil fuel with energy flowing in one direction from centralized utility power plants to customers. This one-way flow over a shared grid is why a simple flat electric rate was acceptable for so long. But with the advent of CERs, perpetuation of this outdated pricing structure has resulted in a tangible inequality for non-CER customers, many of whom are on fixed or moderate incomes. Cumulatively, this amounts to millions of dollars per year.

Advanced Rate Design

We believe customers should be fairly compensated for the benefits and grid services their CERs provide, but they should also pay their fair share to operate and maintain the grid that their CERs use to export energy to it. Jurisdictions around the world have already implemented or are considering electricity rate reform.¹¹ The impact of distributed, renewable energy on their systems has prompted a need to examine their current rate structures.

Hawaiian Electric has evaluated different time-variable rates and price signals that are meant to encourage customers to reduce or increase their energy use at certain times of day. Setting price signals give customers more ways to manage their electric bills. The intent of time-variable rates is to properly align electric rates with the changing cost of providing electric service throughout the day. Time-of-use and critical-peak-incentive rates, or a combination of these, are some examples.

Time-of-use (TOU) rates set a different price per kilowatt hour (\$/kWh) for different times of day. If customers change their electricity use to reflect the TOU price signals, costs to operate the grid decrease, which in turn reduces customer bills across the board. While critical-peak-incentive options are not technically an “advanced rate” they can still encourage efficient customer energy use by giving customers the option to allow the utility to request a reduction of load when the grid needs it.

A Standard Tariff

The compensation customers currently receive through interim tariffs for the electricity they export to the grid has evolved to better reflect the true value of the electricity the CERs provide. Industry stakeholders say this change in tariffs complicates customers' decision-making and the industry's ability to easily market CERs to new adopters.

We recognize that simplifying compensation under a Standard CER Tariff could create a more customer-friendly, streamlined option for the future. Our end goal for a standard tariff is to compensate customers in a way that accurately reflects the true value of the electricity exported at that time of day and adheres to the Equity Principle that new tariffs must ultimately be cost effective, benefit all customers and not penalize any.

###

4 | Coordination: CER Programs

Coordination empowers customers to actively participate in the clean energy movement through CER programs offered by Hawaiian Electric that help to harmoniously coordinate distributed generation and loads. CER programs allow customers to install technology and receive compensation for benefits to the grid above and beyond the basic interconnection requirements. Our CER programs will be designed so they are easy to understand and offer more ways customers can be compensated for the benefits their CERs provide to the grid.

Current Programs

Hawaiian Electric's Demand Response programs historically focused on compensating customers (usually as a bill credit) in exchange for their permission allowing the utility to directly control a home device such as a water heater, or a system such as commercial HVAC (heating, ventilation and air conditioning). The number of demand response activations was lower prior to the integration of renewable energy because large fossil-fuel power plants historically provide firm generation which does not fluctuate significantly.

Traditionally, with large fossil-fuel plant generation, the utility could better predict when it might need to activate a demand response program to reduce system load due to a loss of power generation. Generally, there are limits on the frequency and length of activations allowed in each category. The current demand response programs below provide one or more grid services used by our system operators today:

Commercial Industrial Direct Load Control (CIDLC)

Compensates participating commercial customers with monthly incentives for being available to provide peak load reduction. CERs include behind-the-meter generators, pumps, HVAC, water features such as in hotels and non-emergency lighting. Customers are compensated at a fixed monthly rate with additional credits based on how often load control is activated.

Small Business Direct Load Control Program (SBDLC)

Compensates participating small-business customers with monthly incentives to be available to provide grid services. CERs include water heaters and HVAC systems.

Residential Direct Load Control Program (RDLC)

Compensates residential customers with a fixed monthly bill credit to be available to provide multiple grid services. CERs include water heaters and air conditioning.

Fast Demand Response (Fast DR)

Compensates a commercial customer with monthly incentives to respond within 10 minutes of an event activation from Hawaiian Electric. CERs include behind-the-meter generation and storage and HVAC systems.

Future Program Opportunities

A report by Lawrence Berkley National Laboratory (LBNL) defines “controllable demand response opportunities” as, “[p]rograms that provide a utility or ARC [aggregators of retail customers] with the opportunity to directly control (via radio, internet, telemetry or other remote means) various customers’ electricity consuming end-uses (e.g., electric water heaters, pool pumps) or some portions of their load which could be increased, decreased or even physically disconnected from the grid with little to no notice.”¹²

This forward-thinking definition expands the perspective of CER programs. Unlike traditional load-reducing demand response programs, LBNL’s definition recognizes the importance of load flexibility, or the need for the utility to not only decrease load but to also increase or shift load on the grid when supply is cheaper than other periods of high demand. Hawaiian Electric has already engaged the market in the idea of flexible load building through an on-going grid service procurement process mentioned in this Strategy.

The definition of a CER program will evolve with experience and input from customers and stakeholders. Legacy demand response programs will need to migrate to options under the CER Strategic Framework. Migrating legacy demand response programs could possibly mean transferring customers to a new CER program, or as discussed in Chapter 5, encouraging customers to participate through collaboration with an aggregator.

CER Programs: Bundled Grid Services

As CER programs evolve and expand the CER market, our grid operators will need load flexibility to maintain a reliable grid. We call the capability of a CER to deliver multiple grid services at the discretion of our grid operators Bundled Grid Services. Figure 4 illustrates the customer selection process to participate at the program level. When customers participate in a program, they would select Option 2 which includes choosing a rate or DER Tariff and then enrolling in a program where the utility compensates the customer for allowing it to control an appliance such as a water heater or air conditioner.

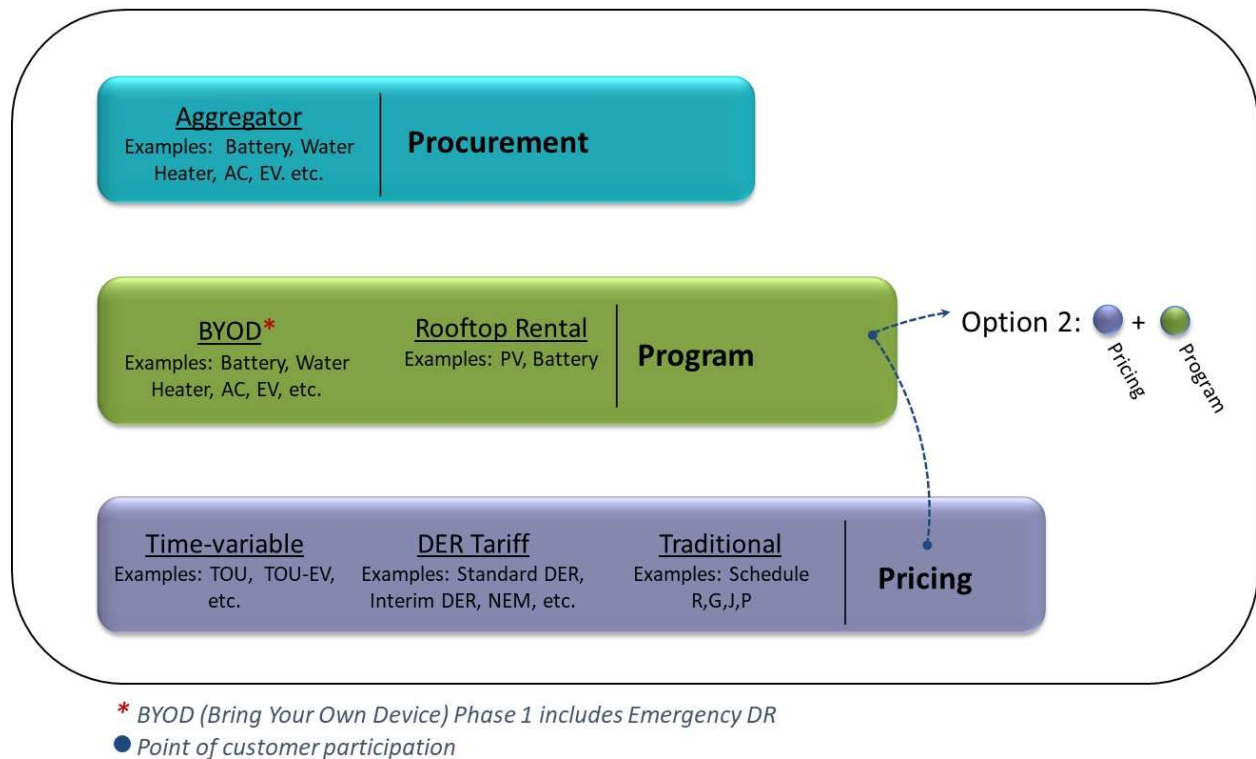


Figure 4 | Customer Participation - Option 2

Under Option 2, a customer will be able to participate in different combinations of rates/tariffs. This is how the CER Strategic Framework provides choices at each participation level to create the most attractive solutions. Figure 4 also includes the option to participate through an aggregator that is further described in *Chapter 5*. As this strategy evolves with feedback from our customers, stakeholders and the Commission, we will continue to expand the menu of options under each level of CER participation to bring the most value to all customers.

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5 | Collaboration: CER Procurements

Collaboration is the most complex level of participation because it includes aggregating or combining the benefits of customer CERs to create “firm” grid-service resources provided via third-party companies with contractual obligations to Hawaiian Electric. These third parties are selected through competitive procurement and the CER opportunities they offer customers must, in total, achieve the same operating performance as traditional, grid-scale resources to ensure that our electricity system is safe, reliable and affordable. At the procurement level, Hawaiian Electric's interaction is mainly with CER providers, aggregators and large commercial customers. The purpose of this level of participation is to provide more CER opportunities to meet individual customers' needs and desires.

Current Procurement Efforts

Bulk System Grid Services

Hawaiian Electric's existing Grid Services Purchase Agreement (GSPA) employs a market-like procurement model that contracts with independent aggregators to enroll, enable and manage portfolios of CERs to deliver committed levels of bulk system grid services. The current five-year GSPA commitment includes capacity (load building and load reduction) and fast frequency response. Although the GSPA is technology-neutral, recently awarded aggregator contracts include grid-interactive water heaters, rooftop solar and battery storage devices, all customer-owned, behind-the-meter CERs.

Transmission and Distribution Grid Services

CERs also can defer transmission and distribution investments (the “wires” solution), for example, a new substation needed for distribution capacity or reliability to serve load growth.

The industry uses the term “non-wires” alternative (NWA), which is generally defined as a project on the grid that uses non-traditional transmission and distribution solutions, such as

rooftop solar, battery storage, energy efficiency, demand response and grid software controls to defer or avoid the need for conventional, utility-owned transmission and distribution infrastructure.¹³

Looking to the future, NWA's could include CERs that deliver grid services at the transmission and distribution level as an alternative to infrastructure upgrades. Hawaiian Electric issued its first Soft Launch Request for Proposals¹⁴ on November 8, 2019 to evaluate and procure two distribution grid services (distribution capacity and reliability back-tie) through non-wires alternatives. Our plan is to procure NWA's through the Integrated Grid Planning process.

Shared solar

Shared solar, officially known as Community Based Renewable Energy (CBRE) and popularly called "community solar," provides a way for residential and small commercial customers without access to privately-owned rooftop solar to benefit from renewable energy. Shared solar customers can purchase a portion of the renewable electricity generated by a utility-scale facility on their island and receive credits on their existing electric bill by signing up with a Subscriber Organization. These stand-alone shared solar projects will vary in size and may be located on rooftops or over open space including parking lots and undeveloped land.

In addition to the energy and equity benefits, we believe a robust shared solar program will help reinvigorate Hawai'i's economy and support recovery from the COVID pandemic, creating investment, jobs and tax revenues, while advancing our clean energy goals.

We plan to launch the second phase of shared solar in 2021, pending final Public Utilities Commission approval. Unlike Phase 1, which was limited to 8 megawatts across five islands, Phase 2 will be open to over 235 megawatts of renewable generation from various sized projects across our service territory, including Moloka'i and Lāna'i.

The second phase emphasizes opportunities for low-to-moderate income residential customers, small businesses and organizations to participate as individual subscribers. Organizations whose mission includes helping people of moderate income will be able to participate as a Subscriber Organization and/or as an "anchor tenant" in a shared solar project, with proceeds from electric bill savings going to promote their community-building mission and services. In the future, Hawaiian Electric will also be able to develop shared solar projects and recruit subscribers under certain conditions, including a strict code of conduct and monitoring to insure competitive fairness.

The second phase, which will be accessed through an online portal, has been designed with no-money-down or pay-as you go as options for the Subscriber Organizations to elect for their project. We are seeking other financing options that will encourage broad participation by shared solar customers who cannot afford a large down-payment.

We are also seeking shared solar projects that can provide non-wire alternatives to reduce the need for expensive new substations, transformers, poles and wires when doing so

allows for reliable service for all customers at lower cost. Energy storage is also encouraged in the second phase.

Shared solar uses the request-for-proposals process to award capacity to developers who wish to become or partner with Subscriber Organizations that can recruit Hawaiian Electric customers as subscribers. Subscriber Organizations can be established renewable energy developers or organizations like civic clubs, environmental organizations, even churches and family associations. In addition, we have developed a simplified tariff for smaller (less than 250 kilowatts) projects to help get those projects to market faster through an application-based capacity award, so that customers can realize shared solar benefits sooner.

With shared solar's large second phase offering and intentional focus on underserved customers -- LMI customers, renters and apartment dwellers -- we believe shared solar is one of the most promising ways we will expand CER participation in the coming years.

Future Procurement Opportunities

IGP All-Resource Procurement

An all-resource procurement should be technology agnostic so that it results in the lowest-cost, best-fit solutions for customers. This means all CERs (whether utility- or privately-owned, in front- or behind-the-meter) that can meet the grid's needs should be eligible to bid into competitive procurement. Aggregated CERs that can provide bundled grid services through a Grid Services Purchase Agreement allows CERs to be evaluated against grid-scale resources based on several price and non-price factors.

Hawaiian Electric's GSPA process continues to evolve so we can procure bulk system or transmission and distribution grid services that may be newly identified through the Integrated Grid Planning process. This ongoing form of procurement, using a technology-neutral approach, was first introduced in our Integrated Demand Response Portfolio. In the future, when the need to upgrade transmission and distribution infrastructure is identified, we will compare traditional wired solutions (such as building a substation) with non-wire alternatives. If an NWA is selected, we will work with stakeholders to determine how customers can participate and benefit.

Figure 5 illustrates the two options by which customers could participate in the CER market procurement process. Under Option 3, a customer would take electric service from the utility, could be on a TOU rate and then be approached by an aggregator that will install a control device on the customer's water heater that will manage the water heater's usage to provide benefits to the grid in times of need.

Option 4 is the most complicated option we envision for customer CER opportunities. This is more conceptual than tested today and requires continued design and development to ensure that customers can easily understand the impact to them, the market understands the

requirements that must be met and the utility understands the full potential and value that a customer can provide under Option 4. For these three things to happen, customers will need to have an advanced meter that shows the customer's "load profile" or how much energy they use throughout the day, not just the total energy they have used at the end of the month.

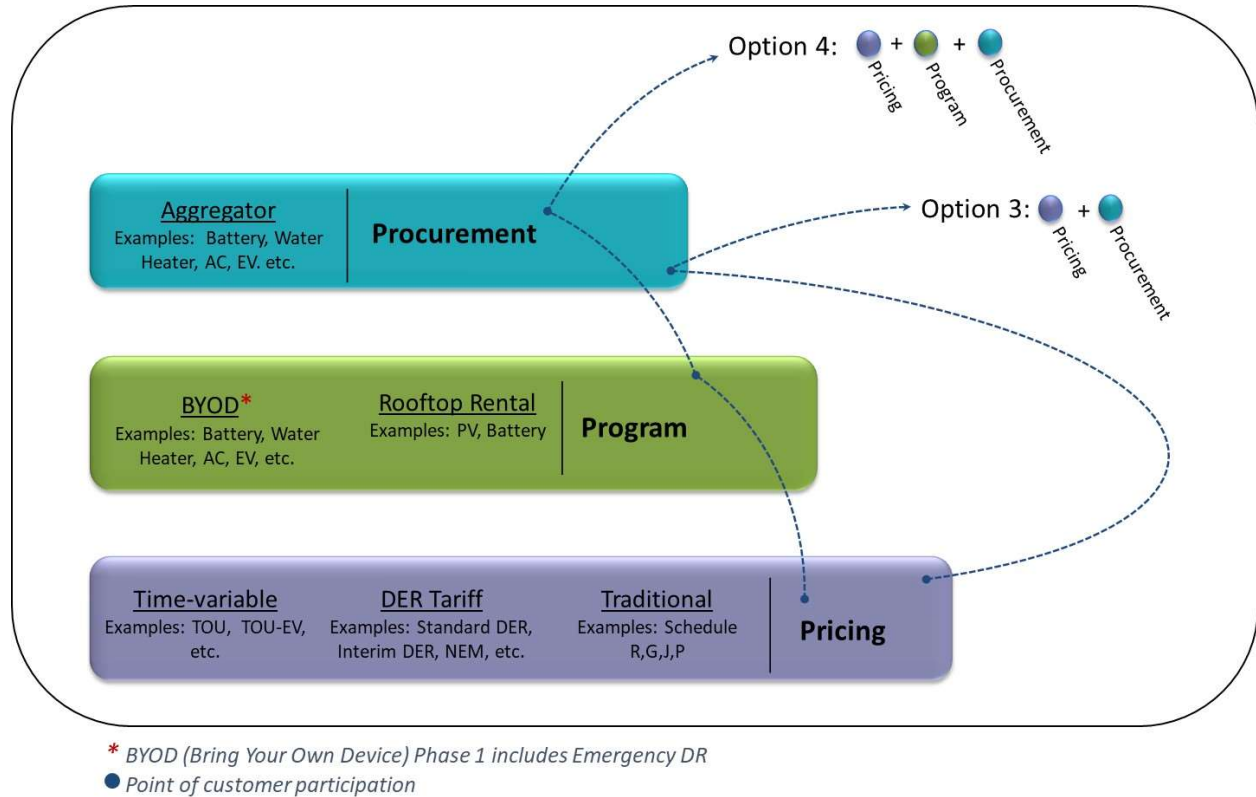


Figure 5 | Customer Participation - Option 3 & 4

Microgrid Services Tariff

The definition of a microgrid in the current proposed Microgrid Services Tariff is a group of interconnected loads and distributed energy resources (or CERs) within clearly defined geographic boundaries that acts as a single, self-governing, controllable entity with respect to the electrical grid. A microgrid should be connected to the grid at a point of common coupling to operate in grid-connected mode and be disconnected from the grid to operate in an island mode during emergency events.

A Microgrid Services Tariff supports the development of microgrids and the provision of grid services that enhance value for customers connected to the microgrid. That said, adhering to our Equity Principle means we must ensure other customers are not unduly burdened by the development of microgrids that do not benefit them and the community as a whole.

Hawaii Act 200 (2018) recognizes that “microgrids would build energy resiliency into our communities, thereby increasing public safety and security.” It also recognizes that microgrids

“can provide valuable services to the public electricity grid” and receive *“fair compensation for electricity, electric grid services and other benefits provided.”*¹⁵ Hawaiian Electric believes a well-designed tariff must ensure safety, balance customer benefit and fairness, promote resilience and reliability and provide consumer protections. We are working with the Public Utilities Commission and stakeholders through a microgrid tariff docket on a system that will benefit customers, microgrid owner/operators and Hawai'i as a whole.

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6 | A Modern Grid for CERs

Our Grid Modernization Strategy describes the scope, purpose and estimated cost of the work required to update Hawaiian Electric's island grids in the near- and long-term to achieve a Renewable Portfolio Standard of 40% by 2030, 70% by 2040 and 100% clean energy for electricity by 2045. As mentioned in *Chapter 1*, a safe and reliable grid is an inherent necessity that the Need, Opportunity and Equity principles must unconditionally support. To ensure this, our grid operators must be able to monitor and manage grid elements such as CERs as the interconnection of variable, non-firm renewable resources continues to grow. This section focuses on the utility-owned grid platform components required to enable a safe and efficient expansion of CERs.

CER Grid Platform Components

Large-scale solar and wind facilities, grid-scale batteries, transformers, grid fuses, grid-protective devices and CERs are just some examples of the elements that must be interconnected and managed to maintain the reliability and resilience of the grid. Ideally, a modern grid platform could facilitate CERs as a system-level resource on par with larger grid-scale renewable projects.¹⁶

When significant amounts of energy are injected at the physical "edge of the grid" (nearest our customers instead of at central power plants), an assortment of novel challenges arise that the energy industry is working to resolve. A near-term goal of our Grid Modernization Strategy's first deployment phase is to mitigate existing electric service quality issues that arise from the rapid uptake of rooftop solar.

We have begun several industry-leading advancements that include implementing a Distributed Energy Resource Management System (DERMS) and are leading the effort to define interconnection standards for advanced inverters with transient overvoltage capabilities, voltage

and frequency ride-through, reactive power control and frequency responsive functions that have since been codified in IEEE 1547-2018. These efforts helped facilitate an unprecedented level of rooftop solar interconnection on our distribution system. **Error! Reference source not found.** depicts what a modern grid could mean for Hawai'i, with a specific focus on the enabling grid platform components that support the CER Strategic Framework.



Figure 6 | A Modern Grid for Hawai'i

Source: Adapted and modified from Figure 7 - "Run", Grid Modernization Strategy, p. 32

The Distributed Energy Resource Management System is a foundation of the grid platform that will allow system operators to manage CERs. It has enabled us to begin combining CERs into a single, flexible resource and engaging independent aggregators to deliver grid service resources. DERMS is designed to help operators use CERs for bulk system operations and is intended to integrate with additional grid modernization investments such as advanced metering infrastructure (AMI) and the Advanced Distribution Management System (ADMS). With respect to CERs, ADMS is a front-end interface with grid operators for analytics and system monitoring and control for operational decision making.

DERMS and ADMS must also communicate and coordinate with the Energy Management System (EMS) that manages the grid as a whole and provides grid operators with monitoring and control of transmission assets and utility-scale generation.

Lastly, granular-interval meter data delivered in a timely manner over an Advanced Metering Infrastructure will allow customers to see energy use via an online web portal and not just a lump sum on the monthly electric bill.¹⁷ That is why customers' access to AMI meter data is key to encouraging CER participation at all three levels of the CER Strategic Framework.

As we continue to modernize the grid, the incremental investments that we make must support this shift to a two-way flow of *electricity + data + communications*. CER grid connectivity must have a modern grid platform and foundational components such as the DERMS, ADMS, EMS and AMI that promote greater situational awareness and the active management of CERs.

These grid platform components, along with integrated aggregator systems, will form a unified CER portfolio sitting upon a vast *electricity + data + communications* network that will provide important benefits to customers and grid operators.¹⁸ The modern grid Hawai'i needs will have the technological capabilities to expand CER opportunities for customers and the CER industry while providing safe, reliable, resilient and affordable electric service in a clean energy future.

###

7 | Conclusion

We hope this Strategy illuminates Hawaiian Electric's initial vision and framework for a clean, renewable energy future for Hawai'i, that importantly is powered by our customers' active participation. This is a living document that will continue to evolve as the collective experience and knowledge of our customers, stakeholders and Hawaiian Electric expands the abilities and vision of CERs into the future.

As this Strategy evolves, we will adhere to its three principles of Need, Opportunity and Equity. This Strategy recognizes CER is no longer confined to passive, rooftop solar systems. CERs of the future will benefit all customers, not just some, and play an essential role in maintaining a safe, reliable, modern grid powered by clean energy. And as we push onward towards these ambitious goals, we take to heart the commitment to provide opportunities to all.

CERs of the future will be equitably accessible to all customers to help them better manage their electricity bills and contribute to our clean energy transformation. As we move forward, the voices of our customers, the community and stakeholders will continue to influence the evolution and implementation of this Strategy so we can empower Hawai'i to thrive together.

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- ⁷ Hawaii Public Utilities Commission, Decision and Order No. 37507, Instituting a Proceeding To Investigate Performance-Based Regulation, Docket No. 2018-0088, December
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- ¹⁵ House Bill 2110, H.D. 2, S.D. 2, 29* Leg. Reg. Sess. (2018), was signed by the Governor Ige on July 10, 2018 and assigned Act 200 ("Act 200").
- ¹⁶ Grid Modernization Strategy at 103.
- ¹⁷ Grid Modernization Strategy at 92.
- ¹⁸ Grid Modernization Strategy at 25.