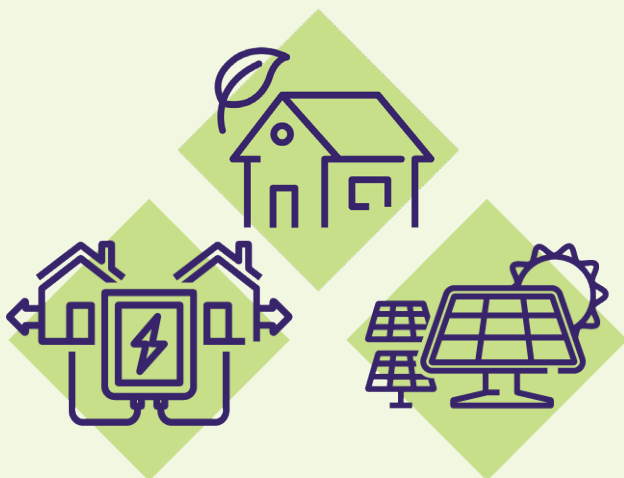


1. Executive Summary

Hawaiian Electric and our customers are rapidly transforming the ways we generate, transmit, and use electricity. Together, we are creating a resilient clean energy grid powered by resources from Hawai'i, for Hawai'i. By 2045, our energy system will use 100% renewable resources and produce net-zero carbon emissions, meaning whatever small amount of emissions we emit will be captured or offset. Our work to modernize and decarbonize the grid has never been more urgent as the effects of climate change escalate and existing electrical facilities and infrastructure age. The world is watching as we innovate to scale up clean energy on islands with abundant resources but no option to import renewables from neighbors.

We envision a clean energy future where customers have more choices, more reliable power, and more stable rates. By 2045, clean energy will be there when we need it: behind every light we turn on, each meal we share, and all the ways we get around. Electric cars and buses will get us where we need to go, with a backbone of vehicle chargers at the workplace and community centers. At home and at work, energy-efficient appliances and equipment will electrify our daily lives.



This clean energy transformation will advance social equity and benefit all customers and communities. Enhanced grid capacity will support growth in residential and commercial development, empowering a statewide expansion in affordable housing. In places with new energy facilities, host communities will thrive with benefit packages from developers.

The future grid will look unlike any before, with customers playing a vital role in generating and storing energy. Customer-scale generation and battery storage in customers' homes and communities will seamlessly connect to large-scale generation through a modernized transmission system, providing a consistent stream of energy that can adapt to fluctuations in use. Sourcing energy from a diverse array of local, renewable resources will fortify Hawai'i against global swings in oil prices, stabilizing utility costs for customers.

How can we bring this vision to life?

It is possible to live out this vision if we work together and act now.

Hawaiian Electric is pleased to present the Integrated Grid Plan: a pathway to a clean energy future. The Integrated Grid Plan proposes actionable steps to decarbonize the electric grid on the State of Hawai'i's (State's) timeline, with a flexible framework that can adapt to future technologies.

The Integrated Grid Plan is the culmination of more than 5 years of partnership with stakeholders and community members across the islands. Together, we forecasted future energy needs and identified strategies to meet Hawai'i's growing energy demand with 100% renewable resources. Hawaiian Electric is grateful for the collective time, efforts, and insights of the many people involved in Integrated Grid Planning, and we look forward to continued collaboration with customers, community members, and stakeholders as we move beyond planning into implementation.

This report shares our action plan and summaries of the technical analyses and community engagement. It also underscores the urgency of action needed to achieve this future. We hope the findings help drive or supplement other action plans beyond Hawaiian Electric. The Integrated Grid Plan shows that every industry and individual will need to play a role in decarbonizing Hawai'i's economy. This plan can help customers, organizations, and agencies understand the scope of the challenge and their role in meeting it. It's everyone's kuleana to create a sustainable future for Hawai'i.

The Integrated Grid Plan is an important starting point for focusing efforts and measuring progress. Now, it's time to take collective action to create a Hawai'i Powered future where everyone will thrive.

1.1 Customers Are at the Heart of the Energy Transformation

Again and again throughout the planning process, we heard that affordability and reliability are of top concern and interest to our customers, echoing the comments in multiple customer surveys and focus groups conducted for the company.

It is imperative that our future grid delivers on this fundamental need for pricing and power that people can count on.

The Integrated Grid Plan balances our commitment to clean energy with our commitment to stabilizing rates and improving reliability for customers.

The Integrated Grid Plan also shows that **customer and community participation is essential to decarbonizing Hawai'i's economy.** Our analysis reveals that we cannot meet projected demands on the grid without customers and communities generating and storing energy and practicing greater energy efficiency (EE). Read more about the role of customers in Section 1.5.2.

Meaningful and sustained engagement with customers, communities, and stakeholders has been central to Integrated Grid Planning. Since planning began in 2018, we have worked to foster partnerships with communities that we are a part of and serve by sharing transparent information and listening, learning, and incorporating their feedback. We are grateful for the involvement of thousands of community members throughout the planning process, and we appreciate the opportunities we have had to collaborate on potential solutions. See Section 4 for more information about outreach activities and how we have incorporated public input.

1.2 Our Commitment to Customers

At Hawaiian Electric, customers are at the heart of our work today and our vision for the future. We are deeply rooted in our communities, and we strive to serve the energy needs of each person in Hawai'i with purpose, compassion, empathy, and aloha for our fellow humans and our natural environment. We are committed to empowering our customers and communities with affordable and reliable clean energy, and providing innovative energy leadership for Hawai'i.

1.2.1 Climate Change Action Plan

Decarbonizing the electric grid is ultimately about service: caring for our customers and the environment by creating a more prosperous and sustainable Hawai'i. To that end, Hawaiian Electric announced a bold Climate Change Action Plan in 2021. Our Climate Change Action Plan sets the ambitious goal of reducing electricity-sector greenhouse gas emissions in 2030 by as much as 70% compared to 2005 levels and reaching net-zero carbon emissions by 2045.

DECARBONIZE:



To reduce, offset, or eliminate all carbon-producing sources contributing to climate change. Decarbonization is a comprehensive approach to climate resilience that considers all sources of carbon emissions, including electricity generation, transportation, shipping, waste management, agriculture, manufacturing, and land management.

This commitment by Hawaiian Electric represents a significant down payment on the economy-wide reduction Hawai'i will have to achieve to align with nationwide and global greenhouse gas reduction goals. Statewide decarbonization will require collaboration across sectors, with transportation, agriculture, and other industries working to reduce and offset emissions.

1.2.2 Hawai'i Powered

A key strategy to reaching net-zero emissions is generating 100% of our energy from renewable resources. In 2015, Hawai'i became the first state in the nation to direct its utilities to generate 100% of their electricity from renewable energy sources by 2045. Hawaiian Electric is dedicated to partnering with customers, communities, and other stakeholders to reach this energy goal.

Hawai'i Powered



We call our vision for using 100% renewable resources "Hawai'i Powered." Clean energy for Hawai'i, by Hawai'i:

- Supports our Climate Change Action Plan and the State's decarbonization goals
- Achieves energy independence
- Expands energy choices for customers and helps stabilize rates

1.2.3 Ensuring an Equitable Energy Transformation

We are committed to creating an equitable energy future. As the cost of living in Hawai'i continues to rise, we must make electricity affordable and ensure that we ease the burden of the renewable transition on customers with low to moderate income (LMI). We must also ensure that communities that bear the burden of hosting energy infrastructure, both in the past and future, receive benefits.

The Public Utilities Commission recently opened a proceeding to investigate energy equity in response to legislative resolutions. The areas for exploration include:

- High energy rates in Hawai'i
- High percentage of people with low and moderate income
- High energy burden
- Lack of universal access to renewable energy initiatives
- Need for utility payment assistance
- Historical siting of fossil-fuel infrastructure
- Land constraints
- Regulatory process burdens

The benefits and burdens of the transformation to a clean energy grid must be equitably shared. All customers stand to benefit if everyone is able to afford electricity and participate in the transition. See Section 10 for more information about our ongoing efforts to address energy inequities and offer solutions for the future.

We use the following definitions from the Public Utility Commission to guide planning for energy equity:



Equity refers to achieved results where advantages and disadvantages are not distributed on the basis of social identities. Strategies that produce equity must be targeted to address the unequal needs, conditions, and positions of people and communities that are created by institutional and structural barriers.

Energy equity refers to the goal of achieving equity in both the social and economic participation in the energy system, while also remediating social, economic, and health burdens on those historically harmed by the energy system.

People with low to moderate income are those whose income is at or below 150% of the Hawai'i federal poverty limit.

Energy burden is the percentage of a household's income spent to cover energy costs.

1.3 Renewable Energy and Reliability Risks Today

Hawaiian Electric has the privilege of serving as Hawai'i's largest electric utility. We serve 95% of Hawai'i's 1.4 million residents on the islands of Hawai'i, O'ahu, Maui, Lāna'i, and Moloka'i, each with separate grids. Since 2010, we have nearly tripled the amount of renewable energy we generate, due in large part to the contributions of our customers. We are proud of the progress we have made, but we still have a long way to go.

1.3.1 Our Current Renewable Energy Portfolio

Today, approximately 32% of our total energy generation comes from renewables. Our renewable energy comes from many local sources with wide-ranging technologies, and each island has a unique composition of clean energy generation. Figure 1-1 shows the 2022 composition of clean energy generation on Hawai'i Island, O'ahu, and Maui, and the consolidated proportions across all three.

Where we are today:

Our 2022 Renewable Energy Sources

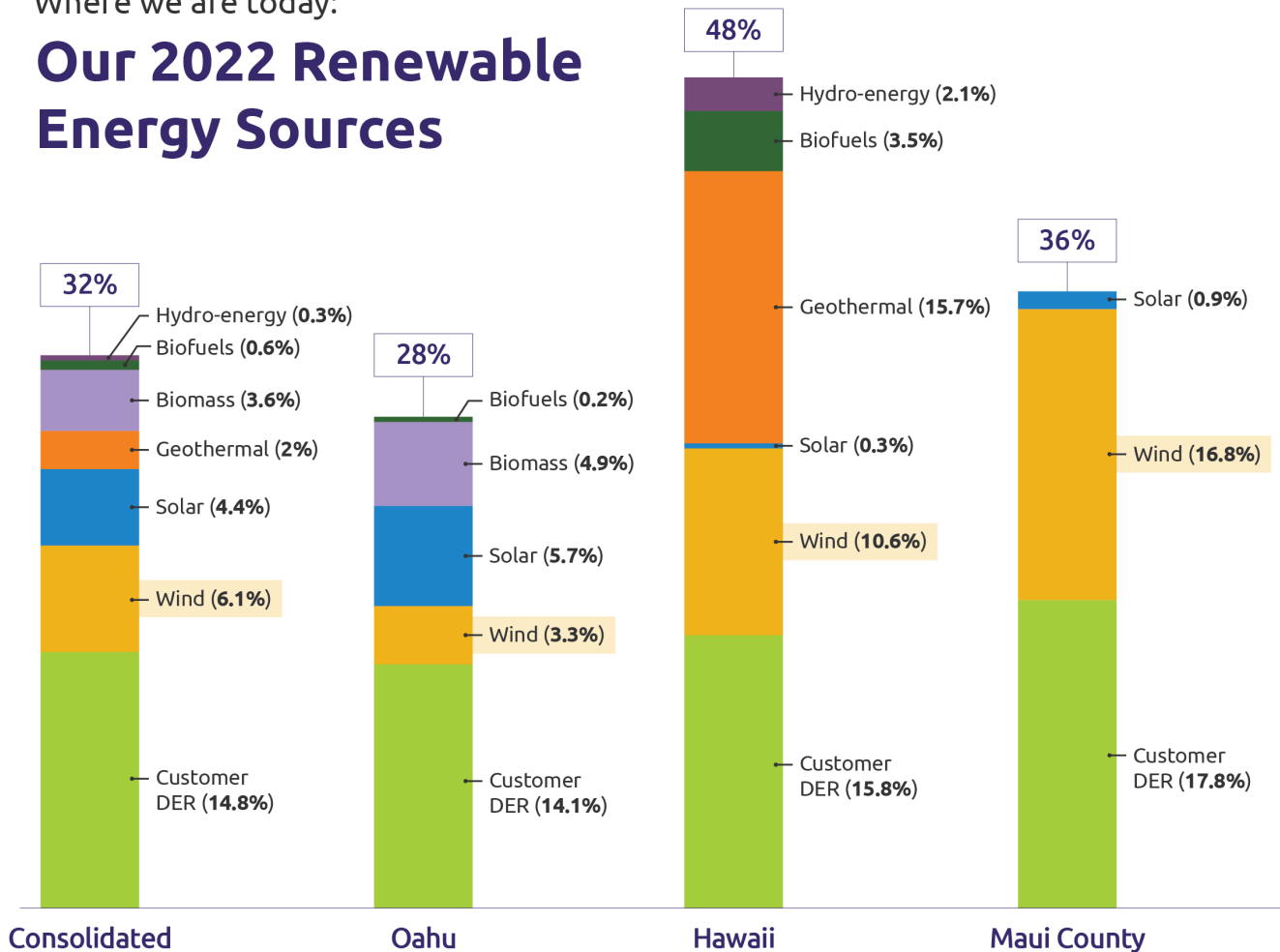


Figure 1-1. Renewable energy portfolios, 2022

1.3.2 Immediate Action to Meet Goals and Maintain Reliability

Creating a resilient, clean energy grid has never been more urgent as the effects of climate change escalate, existing energy infrastructure ages, and our timelines shrink. Customers are at risk of experiencing increasingly frequent outages unless we take immediate action to address threats to reliability.

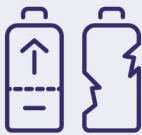
We must act now to bolster the reliability of our electric grid and prevent significant economic and social disruption for customers. Investing in renewable energy generation and updates to transmission infrastructure is an opportunity to address these risks. See Section 7 and Section 12 for more information about investments and actions to reduce risks to electrical infrastructure.

We must move swiftly to:



Fortify the grid against extreme weather.

Extreme weather hazards are projected to increase in frequency, intensity, and duration because of climate change. Failure to prepare for such events could result in power interruptions, damage to electricity infrastructure, significant economic disruption, and disruption to critical government and private-sector services. Reliability is a matter of safety and state and national security, as our critical infrastructure—like hospitals, communication systems, and emergency services—depends on electricity.



Meet growing energy demands.

Existing fossil-fuel generators on Hawai'i Island, Maui, and O'ahu are 55 to 75 years old. These facilities were never designed to keep up with today's dynamic grid, which far outpace the needs of decades past and continue to grow. We anticipate that the demand for electricity will dramatically increase in the coming years, as other sectors reduce their carbon emissions, and as customers and businesses use more electricity for their transportation, work, and homes. We're in urgent need of more generation capacity to meet this demand.



Cut carbon emissions by 70% in 7 years.

2030 is just around the corner. We need to rapidly develop energy projects and the necessary infrastructure across the islands to meet our Climate Change Action Plan goal of cutting emissions by 70% (compared to 2005 levels). This will take efficient and effective coordination with communities, policymakers, stakeholders, and developers to bring renewables online as we deactivate fossil-fuel generators. Simply put: there's no time to waste.

1.4 Overview of Integrated Grid Planning

Integrated Grid Planning brought many people together to determine how to create a resilient and reliable grid that will meet future energy needs, stabilize costs for customers, and use 100% renewable resources. Hawaiian Electric began the planning process in 2018. Figure 1-2 displays the steps of Integrated Grid Planning.



Figure 1-2. High-level steps of Integrated Grid Planning

1.4.1 Engaging Communities and Stakeholders

We engaged four main stakeholder groups throughout the planning process:

The four main stakeholder groups:



Stakeholder Council. This group consisted of representatives from cities, counties, each island, the State, partner agencies, and developers. It helped align our planning with interests across the islands.

Working Groups. These specialized groups served in an advisory capacity and were focused on topics like social and economic resilience, transmission planning, and the sourcing and evaluation of contractors.

Technical Advisory Panel. This group consisted of experts in energy technologies and engineering who provided an independent source of peer assessment.

The public, including customers and community members across the islands.

The four Integrated Grid Planning stakeholder groups were not working alone—many others have been and continue to be involved in creating a clean energy future. These groups include policymakers, regulators, developers, and community organizations.

1.4.2 Key Considerations

Stakeholders helped us prioritize and connect five key considerations that shape our planning for a clean energy future:

- **Time.** How much time will it take to deliver new energy facilities, and how can we stay on track with our timeline goals?
- **Affordability.** How much will it cost to build and operate? What will resources cost in the future? How will costs affect customer bills?
- **Land use.** Where is there available land? How does this affect other land use priorities?
- **Community impacts.** How will new facilities affect surrounding communities, jobs, and the environment? How can the benefits of the transition to clean energy be equitably shared?
- **Resilience and reliability.** How can we plan for current and future energy needs? Needs evolve based on the number of electric vehicles (EVs), number of private and community-based solar projects, emerging technologies and industries, and preparation for extreme events.

Understanding energy needs of today and tomorrow required many technical analyses and input from stakeholders and community members. Together, we forecasted future energy needs and identified opportunities to meet growing demands.

See Sections 6 and 8 for information about the data and models we used to forecast grid needs. See Section 4 for an overview of outreach strategies and community input we received about potential future energy projects and key considerations.

1.4.3 Guiding Principles

The following principles guided our technical analyses and community conversations as we moved through Integrated Grid Planning.

- 1 *Renewable energy is the first option.*** We are pursuing cost-effective renewable resource opportunities that reduce carbon emissions and stabilize customer bills. Getting off imported fossil fuels removes Hawai'i from the volatility of world energy markets and gives future generations a tremendous advantage. It can also create a clean energy research and development industry for our state.
- 2 *The energy transformation must include everyone.*** Electricity is essential. Our plans, as well as public policy, should ensure access to affordable electricity, with special consideration given to LMI households. Meaningful community participation must be a key element of renewable project planning.
- 3 *The lights have to stay on.*** Reliability and resilience of service and quality of power are vital for our economy, national security, and critical infrastructure. Our customers expect it, deserve it, and pay for it. Our plans must maintain or enhance the resilience of our isolated island grids by relying on a mix of resources and technologies.
- 4 *Today's decisions must be open to tomorrow's breakthroughs.*** Our plans keep the door open to developments in the rapidly evolving energy space. We must be able to easily accept new, emerging, and breakthrough technologies that are cost-effective and efficient when they become commercially viable.
- 5 *The power grid needs to be modernized.*** Energy distribution is rapidly moving to the digital age. We are reinventing our grid to facilitate a decarbonized energy portfolio and to enable technologies such as demand response, dynamic pricing, aggregation, and electrification of transportation (EoT).
- 6 *Our plans must address climate change.*** Our Climate Change Action Plan set a goal to reduce carbon emissions from power generation by 70% by 2030 compared with 2005 levels. Our resilience strategy aims to minimize the impacts of climate change—rising sea levels, coastal erosion, increased temperatures, and extreme weather events—on the energy system.
- 7 *There's no perfect choice.*** No single energy source or technology can achieve our clean energy goals. Every choice has an impact, whether it's physical or financial. While we can mitigate those impacts, attaining our clean energy goals has major implications for our land and natural resources, our economy, and our communities. We seek to make the best choices by engaging with community members, regulators, policymakers, and other stakeholders.

1.4.4 Energy Planning on Molokaʻi and Lānaʻi

We tailored our planning and community engagement strategies to each island, recognizing that they have unique energy needs and opportunities. Planning for a clean energy future on Lānaʻi and Molokaʻi was particularly distinct for the following reasons.

Lānaʻi

Much of our grid planning work on Lānaʻi happened in collaboration with the majority landowner on the island. The Hawaiian Electric team recently announced its selection of a developer to build and maintain the island's largest renewable energy project and the first to offer the Shared Solar program on the island. We completed contract negotiations with DG Development & Acquisition, LLC. However, we have not finalized the contract as the majority landowner, Pūlama Lānaʻi notified Hawaiian Electric of its intent to design and construct microgrids to supply the energy demands of the resorts on Lānaʻi, which would significantly impact the electric load and the size of the solar project.

Molokaʻi

Molokaʻi is preparing a Molokaʻi Community Energy Resilience Action Plan: an independent, island-wide, community-led and expert-informed collaborative planning process to increase renewable energy on the island. The Molokaʻi Clean Energy Hui by Sustainable Molokaʻi is coordinating the action plan. Hawaiian Electric is providing technical support to the Molokaʻi Clean Energy Hui in its planning process to develop a portfolio of clean energy projects to achieve 100% renewable energy for the island that is feasible, respectful of Molokaʻi's culture and environment, and strongly supported by the community. Learn more at sustainablemolokai.org/renewable-energy/molokai-cerap.

Hawaiian Electric and Hoʻāhu Energy Cooperative Molokaʻi are moving ahead with the State's first two community-owned and -designed solar plus battery projects. These projects could meet more than 20% of Molokaʻi's energy needs and serve an estimated 1,500 households on the island. The Hoʻāhu Community-Based Renewable Energy (CBRE) projects, Pālāʻau Solar and Kualapuʻu Solar, will be the first on the island to offer the Shared Solar program to help lower the electric bills of customers on Molokaʻi who are unable to install privately owned rooftop solar.

After the completion of a competitive bidding evaluation process, which accounted for the cost of the projects as well as non-price factors including community outreach, Hoʻāhu and Hawaiian Electric entered into negotiations. Once negotiations of the 20-year contracts are finalized, Hawaiian Electric and Hoʻāhu will submit the two applications for approval by the Public Utilities Commission.

1.5 Action Plan at a Glance

Meeting the energy needs of our customers up to and beyond 2045 requires an Integrated Grid Plan based on a short-term action plan and a long-term strategy. First, the Integrated Grid Plan requires us to take immediate action within the next 5 years to achieve our 2030 goals and set a path toward 2045 decarbonization. The proposed 5-year action plan identifies the next foundational steps toward meeting our decarbonization, affordability, and reliability goals for customers. Second, the Integrated Grid Plan also provides the flexibility we need over the long term to realize the benefits of technological advances, respond to changing customer and community needs, and adapt to evolving environmental conditions.

The following is an overview of the Integrated Grid Plan key findings and recommended actions for the short term. See Section 2 for details.

1.5.1 Key Findings and Recommendations

The Integrated Grid Plan points to four high-level actions we must take within the next 5 years to reach statewide decarbonization goals and future energy needs:



Stabilize utility rates and advance energy equity



Grow the marketplace for customer-scale and large-scale renewables



Create a modern and resilient grid



Secure reliability through diverse energy sources and technologies

The following is an overview of these actions. See Section 2 for details.

1.5.2 Action Plan for a Clean Energy Future



Stabilize rates and advance energy equity

Although utility rates will rise in the transition to clean energy, they will be lower and less volatile than if we continue to rely on fossil fuels. Our projections show that customer bills may remain relatively flat, despite growing demands for electricity, integration of renewables, and investments to modernize and strengthen the grid. The addition of customer-scale and large-scale renewable energy is expected to stabilize rates and insulate all customers from volatile fossil-fuel markets. Additionally, the electrification of transportation may drive benefits for all customers by putting downward pressure on rates. Increased electrification of transportation enables the cost of grid investments to be spread over more kilowatt-hours (kWh), reducing per-unit customer costs and introducing opportunities to provide grid services. See [Section 9](#) for more information about impacts to customer bills and the environment.

We are committed to an equitable energy transition that addresses the total energy burden on low- and moderate-income customers.

To that end, the Integrated Grid Plan may help to inform the Energy Equity proceeding that aims to examine forms of relief for LMI customers. Our projections show that the transition to clean energy may reduce the overall energy burden for the typical residential customer on each island through 2050, compared to today's energy burden. See [Section 10.3](#) for more information about affordability and the energy burden.



Grow the marketplace for customer-scale and large-scale renewables

We will need a marketplace for both customer-scale and large-scale renewables to achieve 100% clean energy by 2045. To grow the market for large-scale projects that also benefit host communities, we propose routine cyclical procurements with public input and community benefit packages from developers.

We also propose customer programs and options with incentives to increase customer participation in energy efficiency, rooftop solar, energy storage, and vehicle charging. Customer participation and early community outreach are instrumental to electrifying and decarbonizing the state's economy. Customer-scale generation is also an opportunity to promote energy equity by continuing to develop programs that expand access to a wider range of customers. Programs like Shared Solar (CBRE) are essential for all customers to benefit from generating renewable energy, not only those who own their homes and rooftop solar systems. See Section 11 for more information about customer programs and large-scale procurements.

The Integrated Grid Plan will benefit the environment by reducing carbon emissions by 75% by 2030, relative to 2005 levels. However, achieving net zero will depend on technology advancements.

We forecast that energy generation and storage by customers and communities can provide enough electricity to power the transition to electric vehicles, and it will also reduce the amount of land needed for large-scale renewables.



Create a modern and resilient grid

Renewable generation is just one piece of the energy transformation puzzle. We will also need a modern, resilient system of transmission and distribution (T&D) for customers to power their electric vehicles, connect rooftop solar systems and large-scale renewable generation hubs, support the expansion of affordable housing, and fortify the grid against extreme weather events. This will require investment in distribution, transmission, and grid hardening.

The State’s economic and policy goals include developing new housing and commercial development to expand our economy while addressing equity. These homes and businesses will be electrified with clean energy, increasing net demand on the grid. To support this effort, we estimate that over the next 10 years, up to \$59.4 million of distribution upgrades and \$1.33 billion in renewable energy zone (REZ) enablement and transmission network upgrades are needed.

We will be actively pursuing the opportunity to partner with our customers to shape energy use.



Secure reliability through diverse energy sources and technologies

A diverse grid is a reliable grid. We propose investing in many different resources at various scales, including large-scale renewable and firm generation to replace aging fossil fuel-based generators. A fleet of large-scale renewable and firm generation will ensure that we have a source of stable, consistent power on standby to supplement smaller-scale generation on customers’ homes and communities, as well as weather-dependent resources like solar and wind.

The sooner we modernize the generation portfolio with the right types of resources, the sooner we can retire or deactivate our older fossil-fuel plants.

LARGE-SCALE RENEWABLE GENERATION:



Large-scale generation facilities and transmission infrastructure produce and carry a large volume of energy. This includes wind turbines and solar and battery energy storage facilities, as well as electric substations, poles and wires.

FIRM GENERATION:

Firm generation provides a steady, reliable flow of energy because it uses resources that are not weather-dependent. Examples of firm generation are geothermal, waste-to-energy, and green hydrogen.

1.5.3 Timeline of Renewable Energy Procurement

The Integrated Grid Plan outlines the amount of energy generation we will need to procure to meet statewide decarbonization goals. Figure 1-3

displays a high-level timeline of adding renewable generation capacity, retiring fossil fuel-based generation, and reducing carbon emissions. Figure 1-4 shows our Integrated Grid Plan’s renewable energy portfolio.

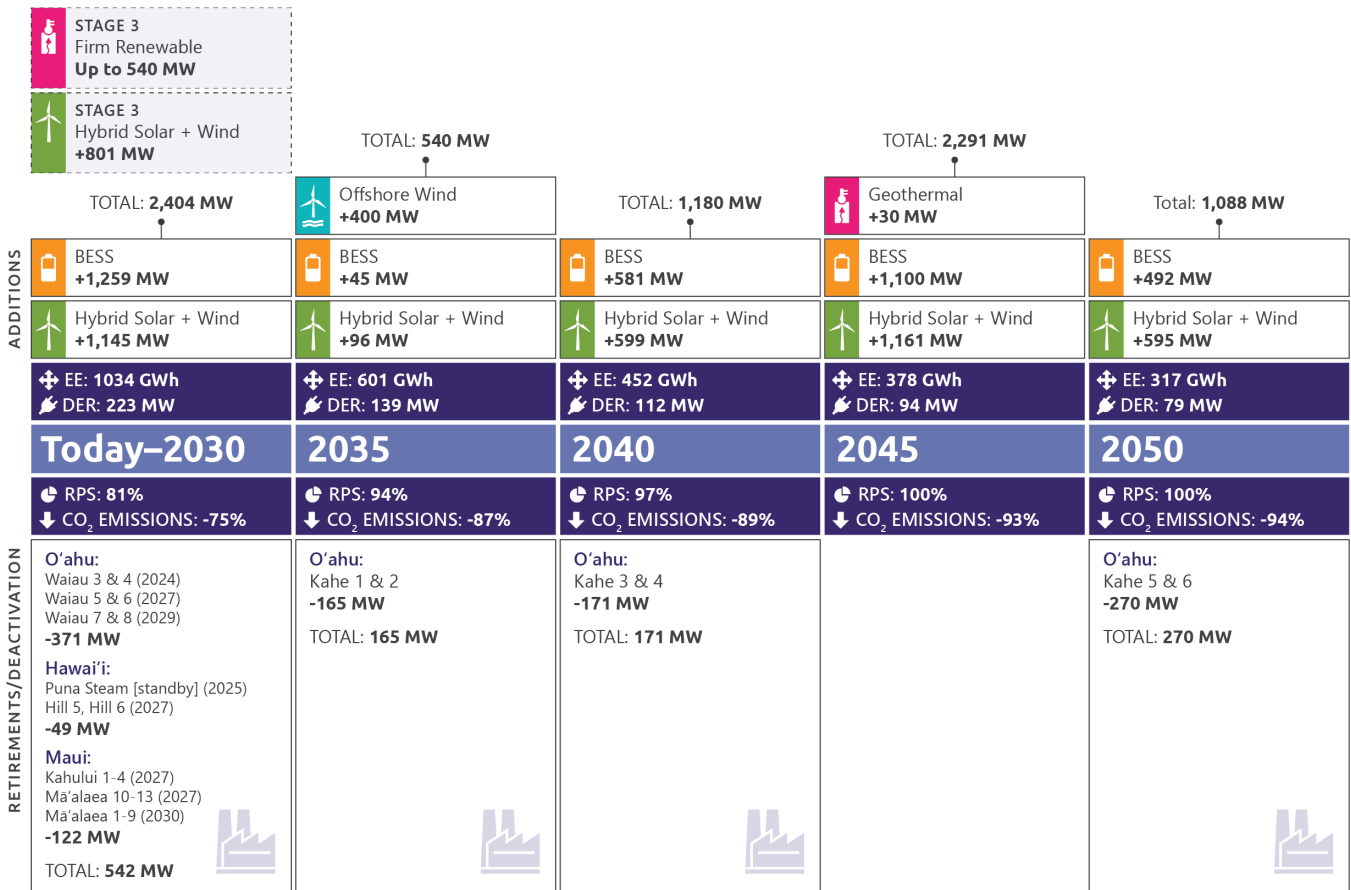


Figure 1-3. Proposed timeline of adding renewable resources, retiring or deactivating fossil fuel-based generation, and reducing carbon emissions

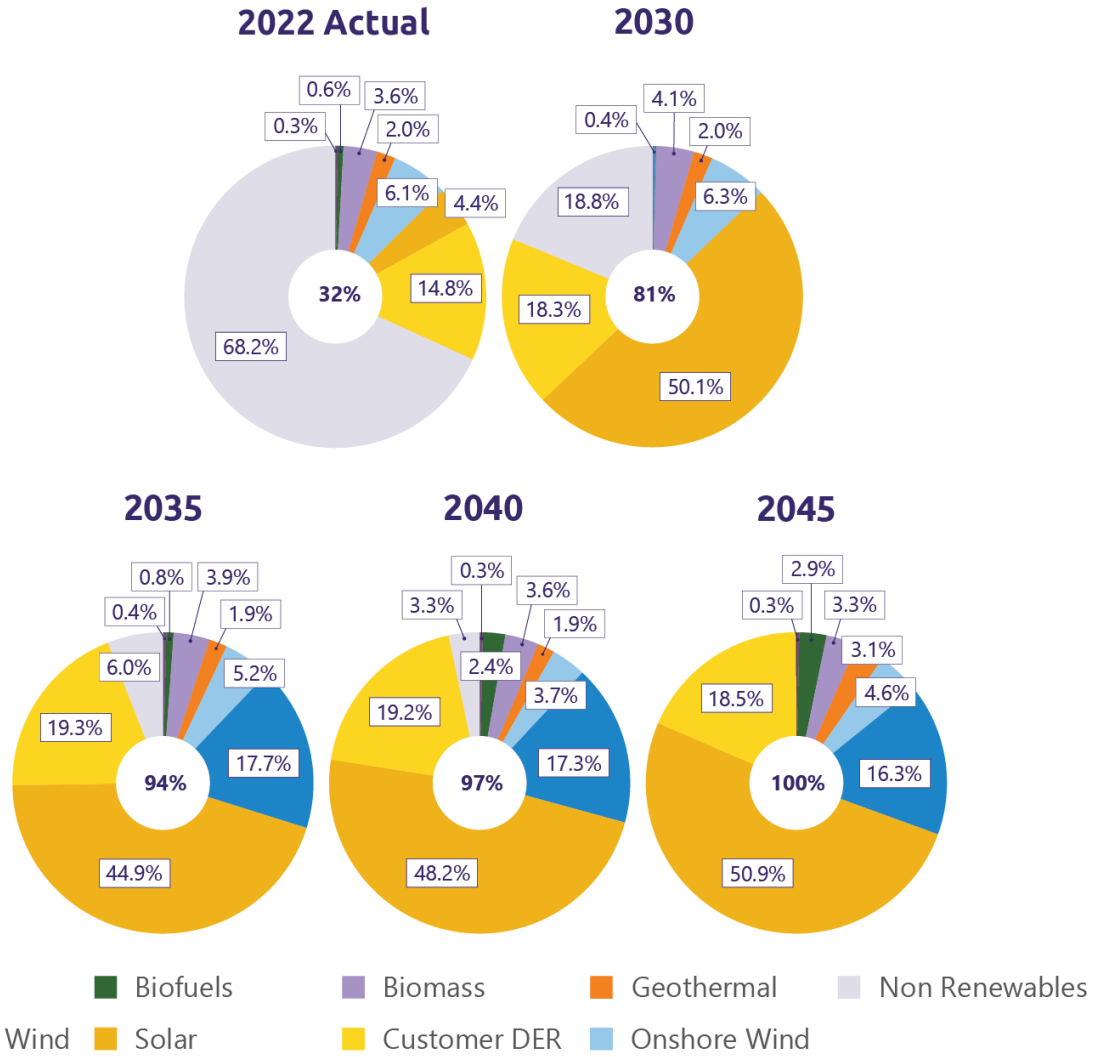


Figure 1-4. Consolidated RPS from today through 2045

Why is rooftop solar not enough?



We need a mix of customer-scale and large-scale renewable generation to supply enough power to meet future energy demands. As much as we value rooftop solar, it is not enough on its own to power the whole grid.

- **A diverse power system is resilient.** Generating electricity from a diverse portfolio of resources benefits our overall energy resilience and customer bills. Diversifying our energy generation to include customer-scale customer and community resources and large-scale renewables (including sources beyond solar) keeps us from depending on any one source for our electricity. This helps us bounce back faster from disasters and shields us from fluctuating costs of resources. For customers, this means reduced risk of outages and more stable utility bills.
- **We need customer-scale and large-scale resources to meet Hawai'i's energy needs.** As much as we value rooftop solar and distributed storage, they are not enough on their own to power the whole grid. This is especially true in a clean, electrified future. For example, to replace just one fossil-fuel generator on O'ahu, we estimate needing new wind and solar resources with a collective footprint 29 times the size of Aloha Stadium. Customer adoption of rooftop solar is not projected to reach the level and reliability to meet all customers' electricity needs. New, large-scale renewable resources will be a significant part of a Hawaii Powered future.
- **Clean energy must be affordable and equitable for all customers.** Electricity affordability is a critical factor to achieve Hawai'i's decarbonization goals. This requires careful consideration of energy equity and the cost-effectiveness of our collective customer, community and large-scale renewable resources and storage options. Each of these resource and storage options have benefits and challenges that need to be assessed. No single renewable technology solution addresses all of Hawai'i's needs. We need to develop a diversified renewable portfolio that is affordable, equitable, and reliable for all customers.

1.6 Moving beyond Planning into Action

Energy planning does not exist in isolation—it's interconnected with many other aspects of life and public policies. It is therefore imperative that any long-term plans for Hawai'i's energy future balance multiple State policy objectives, including affordable housing, food sustainability, land use, and economic development. Effectively implementing the Integrated Grid Plan will depend on:

- Enhanced energy policies and alignment with other State policy objectives
- Streamlined regulatory and county and State process

- Public, stakeholder, and community partnership
- Actions outside of and beyond Hawaiian Electric

None of us can implement the Integrated Grid Plan alone. It will take continued collaboration of customers, communities, utilities, counties, the State, and other industries to meet decarbonization goals and live out a resilient clean energy future.

The longevity of our beloved islands for future generations depends on our ability to come together, get creative, and get to work creating a more sustainable Hawai'i.

The time for action is now.