Climate Adaptation Resilience Program

Topic Area 1: Grid Resilience Grants (BIL Section 40101(c))

Applicant: Hawaiian Electric

Entity Type: Electric Utility

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Project Locations: Honolulu County, HI; Maui County, HI; Hawai'i County, HI

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Project Overview

1.1 Background

The state of Hawai'i faces a diverse set of threats and disruptions to the energy system and economy including hurricanes, tsunamis, wildfires, and lava flows, of which their effects are compounded by the isolation of Hawai'i's island grids. There are no interconnections between the five small, separate island grids that Hawaiian Electric (HE) operates and no interconnection to the mainland US, located 2,400 miles away. Due to the state's isolation, mutual aid from mainland utilities and material re-supply poses significant logistical complexity and long lead times. To make matters worse, Hawai'i's volcanic islands have some of the most extreme topography found in the nation, with critical transmission lines running across steep, rugged terrain with limited access requiring heavy lift helicopters.

As described in detail in the "Resilience Investments" attachment, HE has recently conducted several initiatives to address these increased threats as part of its asset sustainment program (e.g., wood pole replacement, underground cable replacement, 138kV structure replacements). These projects have been successful at targeting some of the most vulnerable parts of the grid and these projects continue today. HE also organized a Resilience Working Group (RWG) that included other key stakeholders in the state to gather additional community input on the investments needed to bolster resiliency in the power system. However, while these asset sustainment investments have been beneficial, there is still significant need to proactively invest in system-wide resiliency and address a greater number of Hawai'i residents, businesses, community lifelines, and strategic military infrastructure at a scale appropriate for the magnitude of climate-driven risk facing the state.

1.2 Project Goal

In the face of increasing climate change, compounding the likelihood and effects of the existing resiliency challenges, Hawaiian Electric recognizes the need to make a major, direct, and targeted effort to develop more resilient grid infrastructure, beyond its day-to-day asset sustainment and reliability initiatives. The proposed project is a comprehensive and transformative hardening of the electric transmission and distribution (T&D) system across HE's entire service territory that will limit damage from severe events such as hurricanes, or prevent failures that could lead to severe events (e.g., wildfires). The hardening scope addresses these severe events, which are expected to increase in frequency and duration due to the effects of climate change, through seven different solutions across the transmission, sub-transmission, distribution, and grid operations facets of the electric infrastructure. In addition to building resiliency against these direct threats, these investments will also lay the foundation for future renewable energy and microgrid development in certain regions.

The goal of this project is to transform Hawaiian Electric's grid resilience strategy through significant investments that drive system-wide benefits while ensuring commensurate benefits are realized in the state's disadvantaged communities. These benefits include:

- Decreased likelihood of outages to critical customer facilities and community lifelines
- Decreased restoration times, resulting in fewer customers being out of power for extended periods of time, allowing for a faster economic and quality of life recovery

- Decreased risk of wildfire events caused by electric power lines and faster response times and mitigations if an event were to occur
- Increased grid operations resilience during both severe events and blue-sky conditions

1.3 DOE Impact

If conducted, this project would be a significant proactive investment specifically to support the enhanced resilience for the company's T&D infrastructure against the increasing and more severe natural disasters resulting from climate change. From a national security perspective, this investment will help ensure reliable and resilient service for the numerous DOD facilities in the state across all branches of the armed forces. Finally, Hawai'i must achieve fair and stable pricing for its customers in its aggressive pursuit of a clean and sustainable energy future. Despite outpacing its renewable energy portfolio standard goals, Hawai'i remains dependent on imported fossil fuel and the state's electricity costs remain amongst the highest in the nation. The need and cost to import energy supply resources leads to high energy burdens and inequities for communities across isolated systems. Federal support through this program can bolster Hawai'i's efforts to enhance grid resilience in a manner that helps manage customer cost impacts and maintain reliable energy resources.

Without the availability of the federal funding, there is an increased risk that this project will be delayed due to the magnitude of the cost. Given the ever-increasing risk of resilience issues due to climate change, DOE federal funding can enable and accelerate this program to ensure HE can integrate these foundational investments as soon as possible. Once these foundational investments are in place, HE will have the opportunity to explore the innovative, transformative approaches to addressing resilience that are being developed industry wide.

1.4 Community Benefits Plan Overview

HE is committed to providing high-quality jobs in collaboration with our labor partners, thus ensuring our development programs maintain a high-quality workforce, as detailed in our Community Benefits Plan (CBP). Approximately 48% of HE's workforce is represented by the International Brotherhood of Electrical Workers (IBEW) Local 1260. For this proposal, we will utilize union labor for all high-voltage work in accordance with this collective bargaining agreement. In addition, HE and IBEW have entered into a user agreement that ensures all contractors for high-voltage work are signatories with the union, thus ensuring these contractors are union members. These agreements are a cornerstone in HE's commitment to providing "quality jobs" that are safe, provide competitive wages, dignified, productive and free of harassment and discrimination. As a result, union, direct, and contractor cumulative contributions to the local economy, families and surrounding businesses are substantial. HE is committed to attracting talent from Hawai'i's diverse communities and sees this commitment as imperative to the project's success. HE has developed a series of programs and initiatives that proactively identify and seek talent statewide from Hawai'i's diverse communities, including disadvantaged communities, to ensure access to skills/professional development and to contribute to the growth and economic development of the state, as detailed further in the CBP.

HE's summary of benefits that will accrue to DACs has been described in the following section, "Maximizing Benefits Across DACs".

1.5 Maximizing Benefits Across DACs

Given that HE's service territory comprises small islands, investments such as hardening critical transmission lines within an island, or hardening distribution lines serving critical community lifeline facilities (which themselves often serve an entire island or the entire state), will in many cases benefit the entire island or large portions of the island, including disadvantaged communities. For example, the largest major hospitals on Oʻahu serve not only the entire island of Oʻahu, but also residents of other islands, who often need to travel by plane to Oʻahu hospitals for certain kinds of procedures not available at hospitals on other islands. Hardening distribution infrastructure serving these types of highly critical, central facilities on each island therefore benefits the entire island and beyond. Similarly, the transmission lines to be hardened on each island were selected because of their criticality to either the integrity of the entire transmission system of the island, the delivery of power to major load centers (including all disadvantaged communities therein), and/or the delivery of power to major community lifeline functions that serve entire islands or the entire state (such as the state's largest airport). The types of investments proposed are therefore critical to supporting community resilience for Hawaiʻi's small, vulnerable islands, including each island's disadvantaged communities.

According to the state's annual ALICE (Asset Limited, Income Constrained, Employed) reports, a dataset widely used by Hawaiʻi state agencies for tracking disadvantaged communities and project planning, 15% of the state's residents live below the federal poverty level and an additional 29% of residents have an annual income above the poverty level but below the calculated basic cost of living. Therefore, approximately 44% of the benefits from any system-wide improvements will serve economically disadvantaged populations.

Given the state's high cost of living and concentration of both high-income and very low-income populations within the same census tracts, the usage of the additional data sources was critical as many national disadvantaged community identification tools do not adequately take these factors into account. These additional data sources were used to help inform the development of the project's scope to ensure the project optimizes addressing communities that suffer from poor electric reliability and historically disadvantaged communities in Hawaiʻi.

In advance of this application, HE has done extensive community engagement with various groups to lay the foundation for the development of a community benefit agreement. These efforts are detailed further in the Community Benefit Plan but include engagement with a broad coalition representing a wide range of community representation from the workforce, environmental justice, and social justice to ensure the benefits of the proposed project meet the needs of our local communities,[1] all of which HE has collaborated in the past. HE will also perform community and stakeholder scoping sessions to listen and solicit input into decision

[1]Letters of support have been received from the Mayor of Hawaii County, Ulupono Initiative, University of Hawaii Natural Energy Institute, Vibrant Hawaii, Sustainable Energy Hawaii, Leeward Empowerment Initiative, Hawaii Island Chamber of Commerce, Hawaiʻi Green Infrastructure Authority

making. When soliciting input, HE will seek diverse perspectives early on and explain how information provided by stakeholders will be used going forward. The project team will carefully piece together information gathered and demonstrate the ideas of others in the planning process to ensure the project is providing optimal benefits to the communities.

Further, the Hawai'i Public Utilities Commission (HPUC), the regulatory agency in Hawai'i responsible for overseeing the activities of HE, recently opened a docket (No. 2022-0250) to investigate "how to better integrate equity and justice considerations across Commission proceedings."[2] HE plans to engage in discussions with this and other stakeholders to integrate a diversity of perspectives into its work.

1.6 Environmental Mitigation Efforts

The proposed project will have no impact to the community's access to natural resources and there will be no burden imposed on local communities to clean up waste from this project.

1.7 Climate Resiliency Plan

This proposed project is a significant part of HE's climate resiliency plan as this project has been constructed to address climate impacts unique to the state. Hawai'i faces a diverse set of threats to the energy system and economy from extreme climate events including hurricanes, tsunamis, wildfires, and lava flows, and their effects are amplified by the isolated vulnerabilities of the islands. HE actively plans and prepares for climate resiliency by publishing a Climate Change Action plan & Sustainability Report.

In addition to the proposed project, HE continuously invests in infrastructure maintenance and upgrades to strengthen the electrical grid. HE has mapped at-risk areas to its infrastructure for current and future weather and climate related hazards. HE is also developing a performance-based resilience model in partnership with the Pacific Northwest National Laboratory to help it evaluate investments for resilience enhancements, vis-à-vis system damage and recovery in severe event scenarios.

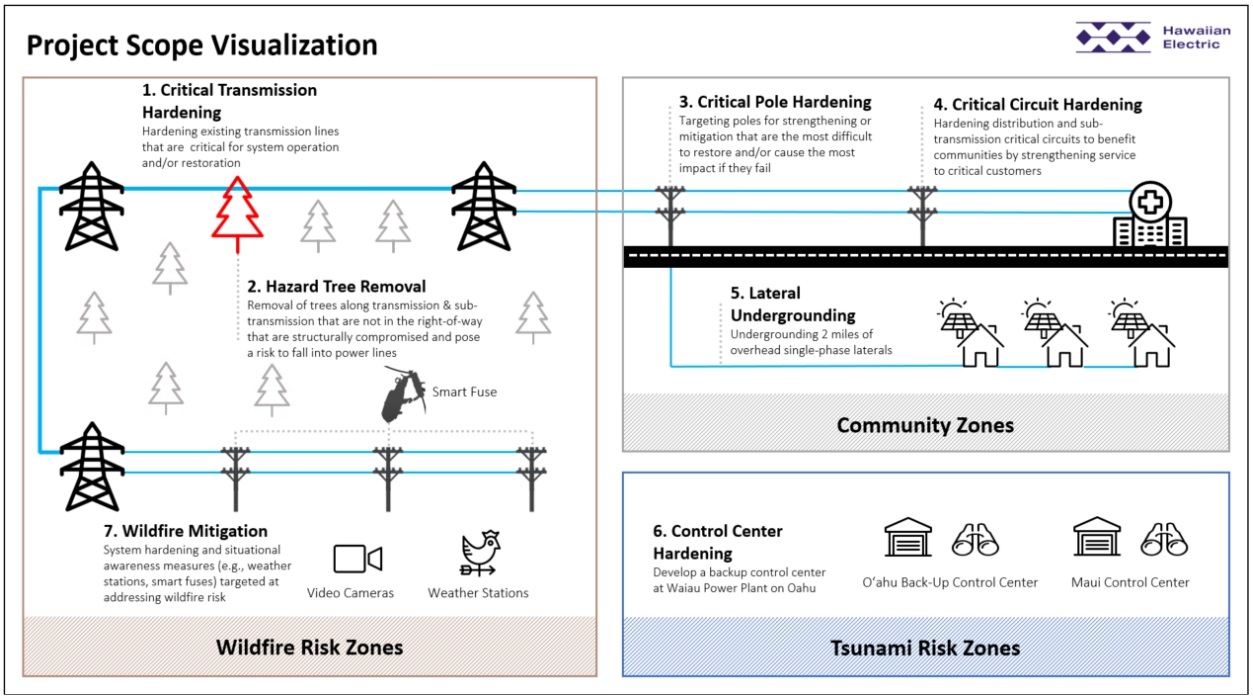
Technical Description

2.1 Relevance and Outcomes

The scope of the project includes both preventive and mitigation solutions, with a heavy focus on foundational hardening of the T&D system to benefit the largest number of customers, in an equitable manner, and connected energy supply resources. Hardening the T&D system will also facilitate the resilience value of DERs by enabling the output from multiple distributed resources to be combined and delivered safely and reliably within the system. The scope of the program consists of the following seven initiatives:

[2] Order No. 38759, Hawaii Public Utilities Commission, filed on December 13, 2022, in Docket No. 2022-0250.

- Critical Transmission Line Hardening
- Critical Customer Circuit Hardening
- Critical Pole Hardening
- Wildfire Prevention and Mitigation
- Hazard Tree Removal
- Lateral Undergrounding
- Control Center Facilities Resilience



To perform break-even cost analyses, HE developed a statistical model for the probability of hurricanes of different categories making landfall on one of the Hawaiian Islands based on historical data. HE used this model to estimate an annualized Gross Domestic Product (GDP) impact of tropical storms and hurricanes on the unhardened systems of today. An annualized revenue requirement for the project was then calculated for each of the operating companies to compare to expected annual benefits. Break-even values for total length of restoration (TLR) reduction were then estimated that would result in GDP savings exceeding the cost of the investment, while acknowledging that GDP savings due to TLR reduction after hurricanes is only one of many benefits of the resilience enhancement investments proposed, and the industry is still actively researching methods to quantify the value of resilience investment. The calculated break-even values for TLR reduction are 13% for O'ahu, 31% for Maui County, and 37% for Hawai'i Island.

As another way of comparing the benefits and costs of the project, HE sought to identify a single extreme event that would result in full economic cost recovery (in terms of GDP savings). Using an assumption that the resilience investments will result in a 20% reduction in TLR, it was estimated that the benefits from this level of TLR reduction for a single Category 2 hurricane making landfall on O'ahu would exceed costs for the O'ahu resilience investments, while the benefits from this level of TLR reduction for a single Category 3 hurricane would exceed costs for the respective Maui County and Hawai'i Island investments.

Project Sub-Initiative Description: Critical Transmission Hardening

For island grids such as those in Hawaiʻi, the lack of transmission interties makes the need for a robust, hardened, island-wide transmission system even more crucial for system resilience. Given that each island is unable to leverage interties to other neighboring grids, system resilience is heavily influenced by the extent to which critical transmission lines connecting intra-island disparate regions and resources on the grid can withstand extreme weather events and be quickly restored when failures occur.

This initiative focuses on hardening existing transmission lines that are critical for system operation and/or restoration following a severe event. HE's approach is to incrementally harden critical transmission lines such that the minimum strength of the line would meet or exceed National Electrical Safety Code ("NESC") Extreme Wind Loading criteria. All structures or spans that do not meet or exceed the NESC Extreme Wind Loading criteria will be designed to the stronger of the company's design policy or 100-year extreme wind loading criteria, which exceed NESC Extreme Wind Loading criteria. This is a significant advancement from HE's historic work on transmission poles, which has been largely limited to traditional asset sustainment activities.

On Oʻahu, the company intends to harden approximately 80 structures across four lines: Kahe-Waiau, Kahe-Hālawa #1, Makalapa-Airport, and Hālawa-Iwilei. In the event of a system-wide blackout or wide-area outage, these lines are among the most critical for black-starting the grid and restoring the transmission system. Hardening these lines will reduce the time to restore power for the island of Oʻahu and its 1 million residents. Oʻahu is the state's central hub and includes the state's central port, the largest major airport, the state's emergency response headquarters, the largest and most critical major hospitals (residents from other islands need to travel to hospitals on Oʻahu for certain procedures), as well as the majority of U.S. Department of Defense installations in the state, including INDOPACOM (U.S. Indo-Pacific Command) headquarters. It also has the largest disadvantaged population in the state.

On Hawaiʻi Island, HE plans to harden the 6200 Line, which is one of four critical cross-island transmission ties connecting the island's two major load centers, located on opposite sides of the island (east and west). Power transfer capability provided by these lines is critical for system resilience, especially during severe operating scenarios, such as those caused by storms and hurricanes, where generation resources and power lines can be suddenly taken offline. There have been multiple storms affecting Hawaiʻi Island in the past that caused outages of multiple of the cross-island ties at the same time, resulting in precarious operating scenarios where the grid was saved by the ties that remained energized. For example, during Tropical Storm Iselle in 2014, power was provided to customers in East Hawaiʻi/Hilo from Keāhole facilities (in West Hawaiʻi) via the 6200 line (one of the cross-island ties running along Saddle Road) as most of the East Hawaiʻi generation was lost along with the other three cross-island ties.

In addition, a 7-mile portion of the 6200 Line is located in a critical habitat area, which causes challenges for linemen to gain access to perform troubleshooting, repairs, and restoration when the line is damaged. Hardening and relocating this section of line to the road will greatly improve restoration times if required after a severe event. The 6200 line is also one of the transmission lines that was identified for reconductoring to support future Renewable Energy Zones needed to interconnect additional grid-scale renewable energy to meet state RPS

goals. Hardening the 6200 line and upgrading to the standard conductor size will safeguard and improve the resilience value of this critical line for the present and future grid, while also providing synergies with other planning goals (e.g., 100% renewables/decarbonization).
As previously mentioned, the 6200 Line ties West Hawai'i and East Hawai'i together. East Hawai'i includes many disadvantaged communities, as well as a high proportion of Native Hawaiians and other historically marginalized groups. By hardening this line, if a scenario such as the 2014 Tropical Storm Iselle were to occur again, this line would safeguard the delivery of power to these East Hawai'i customers from West Hawai'i when it is needed most. The company plans to relocate 7 miles of the 6200 Line out of a critical habitat area and to the road, installing new hardened infrastructure. In addition, the company plans to harden and reconductor an additional 3 miles of the 6200 Line in its current place (including 30 structures).

For Maui County, HE plans to harden the Mā'alaea-Kuihelani and Kuihelani-Kanahā lines. This critical transmission path connects the island's largest power plant (Mā'alaea Power Plant), to Central Maui, the island's largest load center and most populous region which includes the island's largest airport, hospital, harbor, and other critical infrastructure. This region also hosts the island's disadvantaged communities.

Hardening this line is also consistent with the state's RPS and decarbonization goals, as this line will need to be upgraded to enable future renewable energy interconnection on the Maui system. The company estimates that about 86 transmission structures along the Mā'alaea-Kuihelani and Kuihelani-Kanahā lines will be hardened in place (e.g., to higher strength structures). In addition, 1.5 miles of the Mā'alaea-Kuihelani line that are currently sharing structures with another transmission line will be split into two separate pole lines, such that this 1.5-mile section of the Mā'alaea-Kuihelani line will no longer share structures with another transmission line.

Project Sub-Initiative Description: Critical Customer Circuit Hardening

This initiative of the project is designed to harden electric distribution circuits that serve critical customers, as identified and prioritized by the diverse collation of stakeholders in the RWG, led by Hawaiian Electric. It is crucial to ensure reliable and resilient power to customers that support the entire community and provide essential services. The RWG developed a framework for prioritizing customers and infrastructure sectors from the perspective of importance to supporting (1) national security and/or public safety and health and (2) power system recovery. The RWG's critical customer sectors have general alignment and overlap with other national constructs such as FEMA's Community Lifelines construct, Defense Critical Energy Infrastructure, and the Department of Homeland Security's ("DHS") Critical Infrastructure Sectors.

Critical Customer Circuit Hardening aims to incrementally harden distribution and sub-transmission circuits to benefit communities by strengthening service to critical customers (e.g., major hospitals, water and wastewater infrastructure, military facilities, emergency response, and other critical customers in alignment with the framework established by the RWG) by implementing cost-effective solutions (e.g., pole upgrades, storm guying, etc.) that address potential weak points and vulnerabilities along the circuit to improve the circuit's ability to withstand high winds and reduce post-storm restoration times. This effort will target hardening

to poles along these critical customer circuits that are difficult/time-consuming to replace or would otherwise have disproportionate impacts on restoration in the event of failure. Prioritizing critical customer circuits is an ongoing process with the RWG stakeholders, which includes a broad range of public and private agencies and critical infrastructure partners. Priority will be given to circuits serving critical facilities that provide benefits to disadvantaged or socially vulnerable communities. There are several methods that have been identified to determine how these communities could benefit from a specific circuit being hardened. The circuit that feeds the critical facility may also serve disadvantaged community populations who would benefit from the hardening on the portion of the circuit that goes to the critical facilities. This provides direct outage resiliency to the homes and businesses in these communities. Another method of targeting benefits towards disadvantaged communities will be identifying priority circuits that host critical facilities that support disadvantaged populations.

The Critical Customer Circuit Hardening initiative will also help to provide the necessary backbone for future mini-grid and community microgrid solutions. Many critical customer circuits may be good candidates for community microgrids. In order to implement a community microgrid for resilience purposes, the component distribution infrastructure (i.e., wires, poles, switches, etc.) upon which the microgrid operates must remain intact and be hardened to withstand the type of resilience threat the microgrid is intended to mitigate. Therefore, hardening critical customer circuits will complement any future microgrid implementations in these areas.

By identifying and hardening no-regrets critical circuits, critical customers, including community lifeline facilities, will be less likely to lose power in a severe event and quicker to restore if utility power is lost (minimizing the amount of time these facilities would need to rely on backup generators and fuel, while also reducing total length of restoration and restoration costs). In addition, hardening these circuits complements and facilitates potential future mitigation solutions such as microgrids to further enhance resilience. HE is currently estimating it will harden roughly 700-900 critical poles across 40-80 critical circuits over the course of the proposed project. HE has developed a list of 224 critical loads across its service territories, of which a portion will be targeted for critical customer circuit hardening. HE determined that 81% of the critical loads identified either 1) serve the entire island on which the facility is located, including all disadvantaged communities, or 2) directly serve a specific region that includes disadvantaged communities. HE commits to ensure that a *minimum* of 50% the critical loads to be targeted for distribution hardening serve either an entire island (including its disadvantaged communities) or specific intra-island regions with disadvantaged communities and will strive to exceed this target.

<u>Project Sub-Initiative Description: Critical Pole Hardening</u>

This initiative aims to perform targeted hardening of poles for which failure would have a disproportionate impact on system restoration, emergency response, or society following a severe event. Specifically, the focus of is to harden poles at electric power spans crossing major roadways on the Oʻahu, Maui, Hawaiʻi Island, Lānaʻi, and Molokaʻi islands. If a pole or conductor falls in a major roadway during a storm or hurricane, vehicles in traffic (e.g., ambulances, emergency response, general population, DoD troops and equipment) will be impeded and significant efforts will be required to make the repairs needed to restore egress. HE is

prioritizing crossings along each island's most important roads leading to and from areas with a high density of community lifelines infrastructure such as hospitals, ports, military bases, National Guard facilities, airports, etc., and further prioritized based on impacts to disadvantaged communities (e.g., by prioritizing crossings on major roadways to and from these communities). Because these are small islands, these limited major roadways on each island are critical for the movement of people, goods, and emergency responders throughout each island after a severe event.

Any poles targeted for hardening through this initiative will be designed to meet or exceed NESC Extreme Wind Loading requirements. Hardening these poles may include one or more measures such as replacing a critical pole with a stronger pole, installing additional guying, or strengthening a critical pole with steel trussing. The company proposes to harden ~56 critical poles on Oʻahu, ~26 poles on Hawaiʻi Island, and ~18 poles in Maui County. Through this project, HE will be able to execute significantly more hardening along these critical lifelines than it would have been able to fund otherwise.

Project Sub-Initiative Description: Wildfire Mitigation

HE's wildfire prevention and mitigation initiative, informed by industry best practices, incorporates a multi-pronged approach including system hardening and situational awareness investments. Examples of system hardening activities planned in high wildfire risk areas include:

- Deployment of intelligent switches to minimize sparks caused by line contact.
- Proactive pole and hardware upgrades to prevent failures and address clearance issues with overhead conductors. Examples may include pole hardening or changing horizontal conductor configurations to reduce the probability of swing shorts.
- Proactive replacement of higher failure risk single-strand copper conductors with aluminum.

Examples of situational awareness investments planned under the Project include:

- Strategically installing weather stations to monitor wind speed and relative humidity.
- Installing video cameras in strategic locations to help dispatchers respond to fires and provide authorities with critical information about wildfire situations.
- Installing secondary line monitors with outage notification and smoke detection. This is an emerging technology for fire mitigation that HE is among the first to implement.
- Installing fault current indicators with communications, enabling dispatchers with better knowledge of fault locations and the ability to more effectively dispatch trouble persons.

HE used a combination of ignition density maps developed by the Pacific Fire Exchange, a state fire science and information communication program, along with historical experience and stakeholder input to identify initial wildfire risk areas. Then, the company conducted drone and field inspections of utility facilities and surrounding vegetation to evaluate risk and identify appropriate interventions. The following qualitative criteria were then used to prioritize areas for which to develop prevention and mitigation plans:

- Type of vegetation
- Proximity to residents
- Accessibility issues for fire response
- Other lessons learned from California experiences

HE has identified initial wildfire priority areas on all of the islands in its service territory. These priority areas are considered a starting point and other areas may be added as circumstances warrant. Two-thirds of these priority areas contain disadvantaged communities which will directly benefit from the reduction in wildfire risk. While the prioritization of projects may be adjusted with new information and stakeholder input, HE commits to ensure that a similar percentage of spend will be allocated to projects that reduce wildfire risk for disadvantaged communities. This initiative is a transformation of the initial wildfire mitigation efforts that Hawaiian Electric recently completed, as detailed in the Report on Resilience Investments, to reach across the entirety of the service territory and leverage significantly more innovative and comprehensive risk mitigation solutions.

Project Sub-Initiative Description: Hazard Tree Removal

This aspect of the project is the removal of high-risk hazard trees along critical transmission, sub-transmission, and distribution lines. Hazard trees are trees that are (1) not in the trim zone, (2) dead, diseased, or structurally compromised, and (3) tall enough to fall into power lines. HE's current vegetation management programs do not include the removal of trees that are outside the normal trim zone, so this initiative represents a significant and transformative increase in vegetation management beyond existing planned investments. Hawaiian Electric estimates that a total of 22,000 hazard trees will be removed in each of its service territories over the five-year period.

HE's prioritization of transmission and distribution circuits is informed by a combination of circuit resilience criticality and density of fall-in-risk trees identified through LiDAR surveys on each island.

For the same reasons as Critical Transmission Line Hardening and Critical Customer Circuit Hardening, this effort will be prioritized to benefit the entirety of each island, including the disadvantaged communities therein.

Project Sub-Initiative Description: Lateral Undergrounding

Undergrounding distribution lateral lines will be conducted to reduce the amount of damage that needs to be repaired to significantly reduce the total length of restoration in severe events. During these types of events, many damage locations typically occur on overhead distribution lateral lines in forested locations. Stakeholders have also repeatedly requested that the company considers undergrounding as a solution for resilience, particularly in areas with a high density of vegetation. Two miles of circuit will be identified by ranking all single-phase laterals on O'ahu based on vegetation-related failures on a failures-per-circuit-mile basis (using five to ten years of historical data). This will identify the overhead laterals that would be likely to have the most damage in a severe event.

The identified laterals will be further prioritized based on cost factors such as customer density, the presence of third-party attachments, accessibility, and disadvantaged community status. The prioritization process will result in the selection of two circuit miles of distribution laterals on O'ahu for undergrounding to improve storm resilience. This initiative would be a major new step for the company as this would be HE's first project at undergrounding distribution lines for the purpose of resilience. Historically, distribution undergrounding has only been done when needed for other projects or when requested by customers.

Project Sub-Initiative Description: Control Center Resiliency

Since the electric grids on each island are not interconnected, each island is essentially its own control area and each island has its own system operation control center. Given each island's grid operations dependency on a sole control center facility, there is a heightened need to ensure that these facilities remain resilient as infrastructure continues to age and the risk of tsunamis grows due to climate change. There are two components of this sub initiative: 1) development of a backup control center on the O'ahu grid, 2) relocation of the Maui control center.

O'ahu currently only has one system operation control center located at the Ward Baseyard in Honolulu. The proposed backup control center on O'ahu will be at HE's Waiau Power Plant (PP) utilizing available space in a concrete building to improve system operation resiliency on HE's largest grid. The power plant was identified as the most optimal site situated by the shore of Pearl Harbor where the harbor provides shelter from storms and tsunamis. The power plant itself is already secured, constantly manned, and has black start capability. Waiau is also a major telecommunication hub providing access to the utility's telecommunications network and is situated adjacent to a major DOD facility, Joint-Base Pearl Harbor-Hickam.

The backup control center will be equipped for a full system operator staff and will have enough equipped space for additional system operations support and incident management staffs. An adjacent concrete room will be converted into a computer and communications server room connecting to existing HE data center and telecommunications hub located elsewhere in the same building.

The Maui System Operation Control Center is located at the Kahului Baseyard on Maui. The baseyard itself and the building that houses the control center is currently located in Maui's Tsunami Evacuation Zone and a low-lying area that is prone to flooding. This portion of the initiative is the relocation of the Maui Control Center to the second floor of the HE administration building, a sturdier concrete structure in an area less prone to flooding. While the administration building is also located at the baseyard, the relocation of the control center, associated computer servers, and telecommunications equipment to the 2nd floor will better protect against flooding, allowing for speedier restoration of the control center to operations following a severe storm or other natural disaster. The new control center will be designed to allow for additional communications and incident management personnel to effectively manage the system operation response with the community and civil defense agencies during major system disturbances. The building will be hardened by having windows permanently filled and an emergency generator installed. The Kahului Baseyard is manned 24/7 and has both manned and electronic physical security.

2.2 Technical Feasibility

HE has executed work of a similar scope and magnitude such as transmission structure upgrades, highway crossing upgrades, pole replacements, and wildfire mitigation activities as part of its core work in recent years. For example, from 2019-2021, HE upgraded 69 transmission structures, totaling $36.9M. HE is also currently executing over $200M of electrical utility relocation work on the island of O'ahu to support the Honolulu Authority for Rapid Transit's rail transit project. This work is of a similar scale and complexity to the proposed

project, including design, permitting, land rights acquisition, procurement, construction, and testing, with timely execution required to allow for construction of the above ground railway. Further examples of similar types of projects can be found in the "Resilience Investments" attachment in this application.

2.3 Alignment with State and Community Goals

At the national level, the project will bolster the reliability and resilience of the electric grid for the Department of Defense's military and civilian operations. For instance, the US Indo-Pacific Command (USINDOPACOM), which is the nation's oldest and largest combatant command, is based in Oʻahu and served exclusively by HE.

At the state level, the project supports Hawaiʻi's Renewable Portfolio Standard (RPS)[3] which mandates that each electric utility (including HE) "shall establish a renewable portfolio standard of . . . [o]ne hundred per cent of its net electricity generation by December 31, 2045."[4] The project accomplishes this by hardening high-priority transmission restoration paths that will also have synergies with renewable energy zones ("REZ") contemplated in the IGP process.[5] The REZ were identified with the goal of developing additional transmission capacity to enable further integration of grid-scale renewable energy in Hawaiʻi.

Hawaiʻi has made commitments to take action on climate change, and in 2021 Hawaiʻi was the first state to declare a climate emergency. Since 2015, the state's governor has issued at least 15 weather-related emergency proclamations for events including hurricanes, tropical storms, flooding, landsides, wildfire, and lava eruptions, among others. The project is in-line with state policy and has been developed utilizing significant stakeholder input and the priorities of the Hawaiʻi Public Utilities Commission. In developing the project, Hawaiian Electric leveraged the work of the statewide Resilience Working Group (RWG). As stated above, the RWG members represent a broad range of state and national agencies, commercial and industrial customers, and not-for-profit interest groups whose collective goals are to support the development of resilience planning inputs for Hawaiʻi's power system.

At the local level, the project is supported by and aligned with the action items identified as part of the City and County of Honolulu's Office of Climate Change, Sustainability and Resiliency's Oʻahu Resilience Strategy (published in 2019).[6] Particularly, the Oʻahu Resilience Strategy identifies development of a long-term recovery plan to "provide a framework for large-scale redevelopment, rezoning, and re-positioning of critical infrastructure . . . including rebuilding damaged structures/infrastructure to be more resilient, [and] targeting new investment to safer areas"[7] as part of Action No. 19 (Develop and Implement a Long-Term Disaster Recovery Plan for Oʻahu).

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[3] Hawaii Revised Statutes (HRS) Section 269-92.
[4] Id.,
[5] Transmission Renewable Energy Zone Study, HE, filed as part of Grid Needs Assessment Methodology Review Point on November 5, 2021, in Docket No. 2018-0165.
[6] Oahu Resilience Strategy 2019, City and County of Honolulu's Office of Climate Change, Sustainability and Resiliency, https://www.resilientoahu.org/resilience-strategy
[7] Id. at pp68-69.

2.4 Innovation and Impacts

This project is designed to go beyond traditional hardening of utility infrastructure to fully transform its grid according to industry-leading practices and enablement of new grid services. For example, wildfire mitigation practices are relatively new in the electrical utility industry. HE's plans leverage state-of-the-art approaches gleaned from the California utilities' plans and adapted to Hawai'i's specific environment and risks. The resulting plans combine industry state-of-the-art hardening approaches with recent innovations in remote sensing devices and operational procedures. For example, HE is among the first utilities to deploy secondary line monitoring devices equipped to detect loss of power, heat, smoke, humidity, and temperature to alert system operators of potential fires. HE also plans to pair strategic deployment of weather stations with new operating procedures to remotely block reclosing in targeted areas when weather stations detect high-wildfire-risk conditions. HE's storm hardening programs (i.e., Critical Transmission Line Hardening, Critical Customer Circuit Hardening, Critical Pole Hardening, Lateral Undergrounding, and Hazard Tree Removal) combine state-of-the-art methods with lessons learned from utilities in Florida, Texas, Virginia, and the Northeast. For example, several utilities have implemented distribution hardening programs focused on either critical structures (whose failure would disproportionately impact restoration) or circuits serving critical customers. HE's innovation is to combine these approaches and harden critical structures on critical circuits (as described in Critical Customer Circuit Hardening), as a more targeted way to reduce restoration times for both critical infrastructure and the wider grid.

2.5 Market Enablement

In addition to building resiliency against these direct threats, these investments will also lay the foundation for future renewable energy and microgrid development in certain regions. As part of its Integrated Grid Planning process, HE identified renewable energy zones (REZs) where grid-scale renewable energy should be planned and determined which zones will require transmission system upgrades. Several of the critical transmission lines that will be hardened through this project are needed to support existing REZs and the development of future REZs. These proactive investments will reduce future interconnection costs of grid-scale renewable energy, thus further incentivizing development of new renewable projects. In addition to incentivizing new grid-scale generation, the project will also incentivize developers to work with Hawai'i stakeholders to explore the build out of distribution scale microgrids. HE is currently undertaking several initiatives with local communities to identify potential options for microgrid deployments which may overlap with planned sections of critical customer distribution hardening. By laying the foundation of the necessary investments needed for microgrid development, Hawaiian Electric can better work with local communities to identify sites where future microgrid deployment can be most beneficial. HE's efforts towards developing microgrids and enabling future microgrids in conjunction with local communities is detailed further in the Report on Resilience Investments.

Project Workplan

3.1 Project Objectives

The central objective is to transform Hawaiian Electric's grid resilience strategy through significant investments that drive system-wide benefits while ensuring commensurate benefits are realized in the state's disadvantaged communities. This will be driven by adapting the current utility infrastructure, which is facing evolving threats due to climate change, to meet the following goals:

- Decreased likelihood of outages to critical customer facilities and community lifelines
- Decreased restoration times, resulting in fewer customers being out of power for extended periods of time, allowing for a faster economic and quality of life recovery
- Decreased risk of wildfire events caused by electric power lines and faster response times and mitigations if an event were to occur
- Increased grid operations resilience during both severe events and blue-sky conditions

3.2 Technical Scope Summary

Budget Period 1

The initial year will include the establishment of a Grant Management Office and an IIJA Executive Steering Committee within HE, and assignment of dedicated PMs for different sub-initiatives within the project.

For the control center initiatives, the initial year will primarily consist of design work on the facilities (e.g. floorplans), and design / requirements gathering for the telecom, substation, and IT portions of each center.

For the remaining initiatives, the focus of the initial year will be on laying out the foundations for the construction work that will be occurring over the remaining budget periods. During this period, HE will also gather community and stakeholder input as part of its scope refinement process to ensure it provides optimal climate resilience to its customers. In addition, the first 1,600 hazard trees will be removed along high priority transmission lines, which will reduce the expected damage to transmission lines under major storm events, thereby benefiting large swaths of each island's customers.

Budget Period 2

In Budget Period 2, 10 transmission structures along Maui's critical Māʻalaea-Kuihelani and Kuihelani-Kanahā lines will be hardened. If a major storm were to strike, this line would be expected to incur less damage, reducing the amount of time to repair this critical transmission line that serves the largest load center on Maui, which also includes the island's DACs. 60 critical poles along distribution circuits serving major hospitals on Oʻahu, Hawaiʻi Island, and Maui County will be hardened, reducing the time to restore power after a major storm to these critical community lifeline facilities providing life-saving services that benefit whole islands. 8 major highway crossings (16 poles) will be hardened across Oʻahu and Hawaiʻi Island, which will safeguard the flow of traffic (including goods and emergency vehicles) along these critical major roadways in the aftermath of a major storm. Approximately 4 wildfire projects will be completed, which will help to prevent the ignition of fires and enable quicker fire response in these areas. An estimated 0.5 miles of distribution line will be undergrounded, avoiding the risk

of major storm damage in these locations. 6,400 hazard trees will be removed along priority transmission and distribution lines, preventing fall-in tree damage during storms.

For the control center initiatives, the second year will be dedicated to the procurement of various types of computer, telecom, and overall facilities materials and contractors in preparation for construction and installation in the upcoming year.

Budget Period 3

In Budget Period 3, 35 transmission structures will be hardened on high priority transmission lines on O‘ahu and Maui, reducing damage and time to restore these critical transmission network components on each island after a major storm. 320 critical poles on distribution circuits serving major hospitals and other community lifeline facilities will be hardened, reducing the time to restore power to these essential services after a major storm. 25 highway crossings (50 poles) will be hardened across O‘ahu, Maui County, and Hawai‘i Island, benefiting travel along critical routes after a major storm. An estimated 4 wildfire projects will be completed, which will help to prevent wildfires and enable quicker fire response. 0.5 miles of distribution lines will be undergrounded, avoiding the risk of major storm damage in these locations. 6,400 hazard trees will be removed along transmission and distribution lines, preventing fall-in tree damage in a major storm.

For the control center initiatives, the primary construction for both projects will be completed in this budget period, enabling the preliminary grid operations resilience benefits that will be provided through the project.

Budget Period 4

In Budget Period 4, an additional 122 transmission structures will be hardened on high priority transmission lines on O‘ahu and Maui, reducing damage and time to restore these critical transmission network components on each island after a major storm. 1.5 miles of critical double circuit transmission line on Maui will be split into 2 separate lines, reducing risk to Maui’s transmission system in a storm while also benefiting day-to-day maintenance. 17 highway crossings (34 poles) will be hardened, benefiting travel along critical routes after a major storm. An estimated 3 wildfire projects will be completed, which will help to prevent wildfires and enable quicker fire response. 0.5 miles of distribution lines will be undergrounded, avoiding the risk of major storm damage in these locations. 6,400 hazard trees will be removed along transmission and distribution lines, preventing fall-in tree damage in a major storm.

The control center initiatives will be completed this period following completion of testing of all of the individual subsystems and overall control centers, ensuring the backup O‘ahu control center and the relocated Maui control center are fully operational.

Budget Period 5

In Budget Period 5, 30 transmission structures will be hardened in-place and 3-miles of line will be reconductored on the 6200 Line on Hawai‘i Island, reducing damage and time to restore this critical transmission network component after a major storm. In addition, a 7-mile portion of Hawai‘i Island’s 6200 Line will be relocated out of a critical habitat area to the road and hardened, enabling much quicker repair if the line is damaged in a major storm. About 400 critical poles on distribution circuits serving community lifeline facilities will be hardened, reducing the time to restore power to these essential services after a major storm. An estimated 5 wildfire projects will be completed, which will help to prevent wildfires and enable

quicker fire response. An additional 1,600 hazard trees will be removed along transmission and distribution lines, preventing fall-in tree damage in a major storm.

Cumulatively, by the end of Budget Period 5, about 200 critical transmission structures will be hardened in-place, 3-miles of transmission line will be reconductored in-place, about 8.5 miles of transmission line will have been relocated and hardened, about 800 critical poles on distribution circuits serving critical infrastructure will be hardened, about 50 highway crossings (100 poles) will be hardened, 10-20 wildfire projects will have been completed, 2 miles of distribution lines will be undergrounded, and about 22,000 hazard trees will be removed.

3.3 Work Breakdown Structure (WBS)

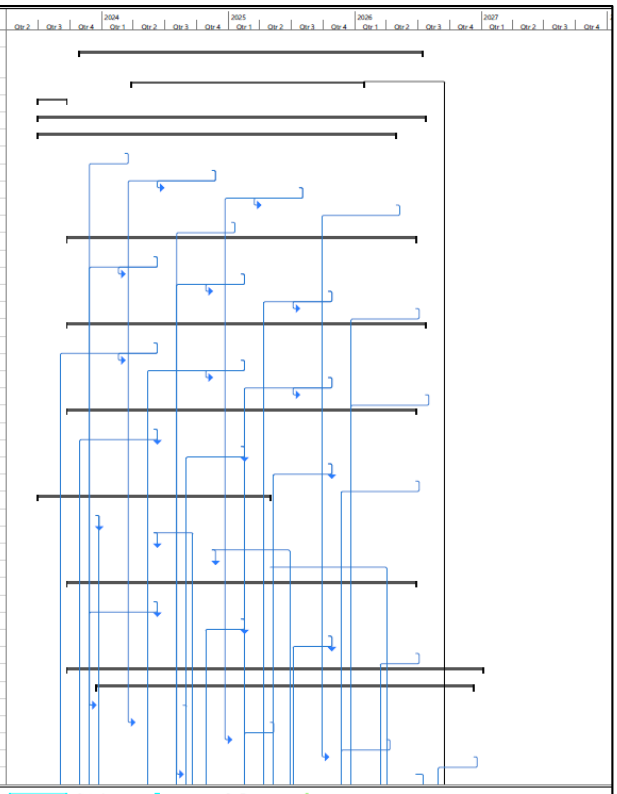
For the following section, the term "T&D Resilience" encompasses the transmission, circuit, and pole hardening, wildfire mitigation, hazard tree removal, and lateral undergrounding initiatives.

Year	WBS #	Task / Subtask
1	1	Assign Project Manager and establish core project team
1	1.2	Planning for Year 1 T&D resilience work plan
1	2	Design for Year 1 T&D resilience work plan
1	3	Procurement for Year 1 T&D resilience work plan
1	4	Construction for Year 1 T&D resilience work plan
1	5	Control center project design requirements
1	5.1	Architect to draw floorplan
1	5.2	Design for telecom and substation equipment and requirements gathering
1	5.3	Design for IT network and design equipment
1	6	Obtain necessary permits (e.g., City Hall approval, Special Management Area Permit)
1	7	Planning for Year 2 T&D resilience work plan
2	8	Design for Year 2 T&D resilience work plan
2	9	Procurement for Year 2 T&D resilience work plan
2	10	Construction for Year 2 T&D resilience work plan
2	11	Planning for Year 3 T&D resilience work plan
2	12	Procure control center equipment (e.g., servers, workstations, furniture, racks)
3	13	Design for Year 3 T&D resilience work plan
3	14	Procurement for Year 3 T&D resilience work plan
3	15	Construction for Year 3 T&D resilience work plan
3	16	Planning for Year 4 T&D resilience work plan
3	17	O'ahu backup control center and Maui control center construction
4	18	Design for Year 4 T&D resilience work plan
4	19	Procurement for Year 4 T&D resilience work plan
4	20	Construction for Year 4 T&D resilience work plan
4	21	Planning for Year 5 T&D resilience work plan
4	22	Control center testing
4	22.1	Test subsystems (telecom, RTUs, workstations, network)
4	22.2	Test overall integrated center
5	23	Design for Year 5 T&D resilience work plan
5	24	Procurement for Year 5 T&D resilience work plan
5	25	Construction for Year 5 T&D resilience work plan

3.4 Project Schedule

T&D Resilience:

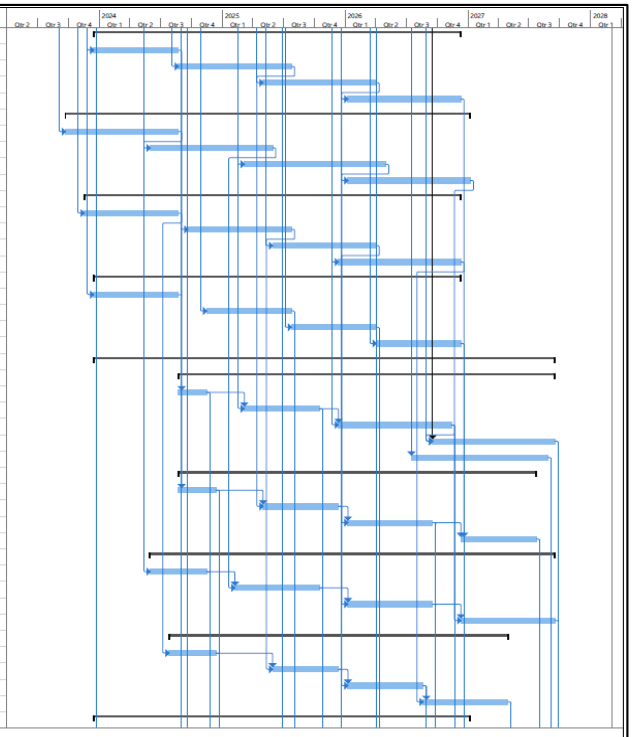
ID	Task Mode	Task Name	Duration	Start	Finish
1		**Resiliency Program - Oahu**			
22		**Hawaii Island T- Line Hardening (6200 line) permits/approvals**	**711 days**	**Thu 10/26/23**	**Thu 7/16/26**
25		**Maui T-Line Hardening permits/approvals**	**480 days**	**Wed 3/27/24**	**Tue 1/27/26**
31		**RFP for EPC**	**60 days**	**Fri 6/30/23**	**Thu 9/21/23**
39		**Engineering**	**800 days**	**Fri 6/30/23**	**Thu 7/23/26**
40		**T-line hardening**	**740 days**	**Fri 6/30/23**	**Thu 4/30/26**
41		Design for 2024 In-service	6 mons	Fri 9/22/23	Thu 3/7/24
42		Design for 2025 In-service	15 mons	Fri 9/22/23	Thu 11/14/24
43		Design for 2026 In-service	14 mons	Fri 6/28/24	Thu 7/24/25
44		Design for 2027 In-service	14 mons	Fri 4/4/25	Thu 4/30/26
45		Design for Critical T-Line Hardening (6200 line)	20 mons	Fri 6/30/23	Thu 1/9/25
46		**Highway Crossings**	**720 days**	**Fri 9/22/23**	**Thu 6/25/26**
47		Design for 2024 In-service	9 mons	Fri 9/22/23	Thu 5/30/24
48		Design for 2025 In-service	12 mons	Fri 3/8/24	Thu 2/6/25
49		Design for 2026 In-service	12 mons	Fri 11/15/24	Thu 10/16/25
50		Design for 2027 In-service	12 mons	Fri 7/25/25	Thu 6/25/26
51		**Critical Circuit Hardening**	**740 days**	**Fri 9/22/23**	**Thu 7/23/26**
52		Design for 2024 In-service	9 mons	Fri 9/22/23	Thu 5/30/24
53		Design for 2025 In-service	12 mons	Fri 3/8/24	Thu 2/6/25
54		Design for 2026 In-service	12 mons	Fri 11/15/24	Thu 10/16/25
55		Design for 2027 In-service	13 mons	Fri 7/25/25	Thu 7/23/26
56		**Wildfire Mitigation**	**720 days**	**Fri 9/22/23**	**Thu 6/25/26**
57		Design for 2024 In-service	9 mons	Fri 9/22/23	Thu 5/30/24
58		Design for 2025 In-service	9 mons	Fri 5/31/24	Thu 2/6/25
59		Design for 2026 In-service	9 mons	Fri 2/7/25	Thu 10/16/25
60		Design for 2027 In-service	9 mons	Fri 10/17/25	Thu 6/25/26
61		**Hazard Tree Removal**	**480 days**	**Fri 6/30/23**	**Thu 5/1/25**
62		Refine Plan for 2024	6 mons	Fri 6/30/23	Thu 12/14/23
63		Refine Plan for 2025	6 mons	Fri 12/15/23	Thu 5/30/24
64		Refine Plan for 2026	6 mons	Fri 5/31/24	Thu 11/14/24
65		Refine Plan for 2027	6 mons	Fri 11/15/24	Thu 5/1/25
66		**Lateral Undergrounding**	**720 days**	**Fri 9/22/23**	**Thu 6/25/26**
67		Design for 2024	9 mons	Fri 9/22/23	Thu 5/30/24
68		Design for 2025	9 mons	Fri 5/31/24	Thu 2/6/25
69		Design for 2026	9 mons	Fri 2/7/25	Thu 10/16/25
70		Design for 2027	9 mons	Fri 10/17/25	Thu 6/25/26
71		**Procurement**	**860 days**	**Fri 9/22/23**	**Thu 1/7/27**
72		**T-line hardening**	**780 days**	**Fri 12/15/23**	**Thu 12/10/26**
73		Procurement for 2024 In-service	9 mons	Fri 12/15/23	Thu 8/22/24
74		Procurement for 2025 In-service	14 mons	Fri 4/5/24	Thu 5/1/25
75		Procurement for 2026 In-service	16 mons	Fri 1/10/25	Thu 4/2/26
76		Procurement for 2027 In-service	15 mons	Fri 10/17/25	Thu 12/10/26
77		Critical T-Line Hardening (6200 line)	24 mons	Fri 8/23/24	Thu 6/25/26



Project: Resiliency Program - O
Date: Thu 1/26/23

Task | Split | Milestone | Summary | Project Summary | Inactive Task | Inactive Milestone | Inactive Summary | Manual Task | Duration-only | Manual Summary Rollup | Manual Summary | Start-only | Finish-only | External Tasks | External Milestone | Deadline | Progress | Manual Progress

ID	Task Name	Duration	Start	Finish
78	**Highway Crossings**	**780 days**	**Fri 12/15/23**	**Thu 12/10/26**
79	Procurement for 2024 In-service	9 mons	Fri 12/15/23	Thu 8/22/24
80	Procurement for 2025 In-service	12 mons	Fri 8/23/24	Thu 7/24/25
81	Procurement for 2026 In-service	12 mons	Fri 5/2/25	Thu 4/2/26
82	Procurement for 2027 In-service	12 mons	Fri 1/9/26	Thu 12/10/26
83	**Critical Circuit Hardening**	**860 days**	**Fri 9/22/23**	**Thu 1/7/27**
84	Procurement for 2024 In-service	12 mons	Fri 9/22/23	Thu 8/22/24
85	Procurement for 2025 In-service	13 mons	Fri 5/31/24	Thu 5/29/25
86	Procurement for 2026 In-service	15 mons	Fri 3/7/25	Thu 4/30/26
87	Procurement for 2027 In-service	13 mons	Fri 1/9/26	Thu 1/7/27
88	**Wildfire Mitigation**	**800 days**	**Fri 11/17/23**	**Thu 12/10/26**
89	Procurement for 2024 In-service	10 mons	Fri 11/17/23	Thu 8/22/24
90	Procurement for 2025 In-service	11 mons	Fri 9/20/24	Thu 7/24/25
91	Procurement for 2026 In-service	11 mons	Fri 5/30/25	Thu 4/2/26
92	Procurement for 2027 In-service	13 mons	Fri 12/12/25	Thu 12/10/26
93	**Lateral Undergrounding**	**780 days**	**Fri 12/15/23**	**Thu 12/10/26**
94	Procurement for 2024	9 mons	Fri 12/15/23	Thu 8/22/24
95	Procurement for 2025	9 mons	Fri 11/15/24	Thu 7/24/25
96	Procurement for 2026	9 mons	Fri 7/25/25	Thu 4/2/26
97	Procurement for 2027	9 mons	Fri 4/3/26	Thu 12/10/26
98	**Construction**	**980 days**	**Fri 12/15/23**	**Thu 9/16/27**
99	**T-line hardening**	**800 days**	**Fri 8/23/24**	**Thu 9/16/27**
100	Construction for 2024 In-service	3 mons	Fri 8/23/24	Thu 11/14/24
101	Construction for 2025 In-service	8 mons	Fri 3/7/25	Thu 10/16/25
102	Construction for 2026 In-service	12 mons	Fri 12/12/25	Thu 11/12/26
103	Construction for 2027 In-service	13 mons	Fri 9/18/26	Thu 9/16/27
104	Critical T-Line Hardening (6200 line)	14.5 mons	Fri 7/17/26	Thu 8/26/27
105	**Highway Crossings**	**760 days**	**Fri 8/23/24**	**Thu 7/22/27**
106	Construction for 2024 In-service	4 mons	Fri 8/23/24	Thu 12/12/24
107	Construction for 2025 In-service	8 mons	Fri 5/2/25	Thu 12/11/25
108	Construction for 2026 In-service	9 mons	Fri 1/9/26	Thu 9/17/26
109	Construction for 2027 In-service	8 mons	Fri 12/11/26	Thu 7/22/27
110	**Critical Circuit Hardening**	**860 days**	**Fri 5/31/24**	**Thu 9/16/27**
111	Construction for 2024 In-service	6 mons	Fri 5/31/24	Thu 11/14/24
112	Construction for 2025 In-service	9 mons	Fri 2/7/25	Thu 10/16/25
113	Construction for 2026 In-service	9 mons	Fri 1/9/26	Thu 9/17/26
114	Construction for 2027 In-service	10 mons	Fri 12/11/26	Thu 9/16/27
115	**Wildfire Mitigation**	**720 days**	**Fri 7/26/24**	**Thu 4/29/27**
116	Construction for 2024 In-service	5 mons	Fri 7/26/24	Thu 12/12/24
117	Construction for 2025 In-service	7 mons	Fri 5/30/25	Thu 12/11/25
118	Construction for 2026 In-service	8 mons	Fri 1/9/26	Thu 8/20/26
119	Construction for 2027 In-service	9 mons	Fri 8/21/26	Thu 4/29/27
120	**Hazard Tree Removal**	**800 days**	**Fri 12/15/23**	**Thu 1/7/27**

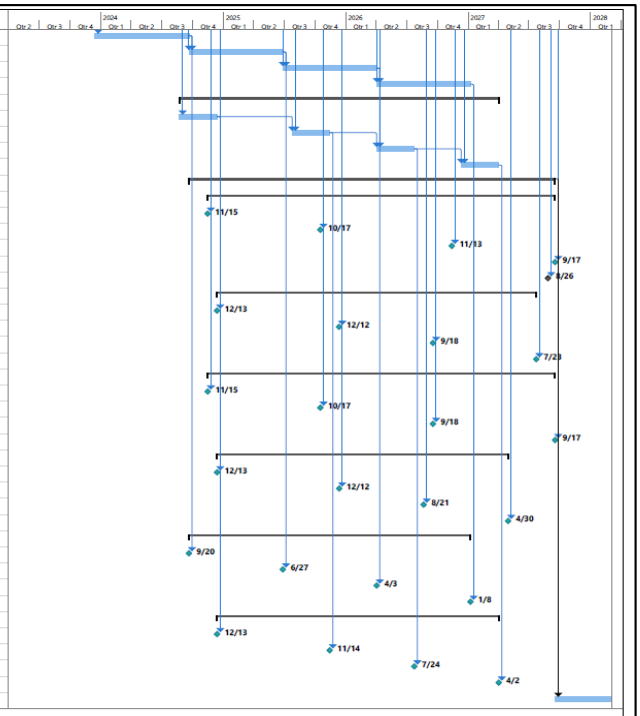


Project: Resiliency Program - O
Date: Thu 1/26/23

Task | Split | Milestone | Summary | Project Summary | Inactive Task | Inactive Milestone | Inactive Summary | Manual Task | Duration-only | Manual Summary Rollup | Manual Summary | Start-only | Finish-only | External Tasks | External Milestone | Deadline | Progress | Manual Progress

Page 2

ID	Task Name	Duration	Start	Finish
121	Construction for 2024	10 mons	Fri 12/15/23	Thu 9/19/24
122	Construction for 2025	10 mons	Fri 9/20/24	Thu 6/26/25
123	Construction for 2026	10 mons	Fri 6/27/25	Thu 4/2/26
124	Construction for 2027	10 mons	Fri 4/3/26	Thu 1/7/27
125	**Lateral Undergrounding**	**680 days**	**Fri 8/23/24**	**Thu 4/1/27**
126	Construction for 2024	4 mons	Fri 8/23/24	Thu 12/12/24
127	Construction for 2025	4 mons	Fri 7/25/25	Thu 11/13/25
128	Construction for 2026	4 mons	Fri 4/3/26	Thu 7/23/26
129	Construction for 2027	4 mons	Fri 12/11/26	Thu 4/1/27
130	**In-Service**	**780 days**	**Fri 9/20/24**	**Fri 9/17/27**
131	**T-line hardening**	**740 days**	**Fri 11/15/24**	**Fri 9/17/27**
132	2024 In-service	0 days	Fri 11/15/24	Fri 11/15/24
133	2025 In-service	0 days	Fri 10/17/25	Fri 10/17/25
134	2025 In-service	0 days	Fri 11/13/26	Fri 11/13/26
135	2027 In-service	0 days	Fri 9/17/27	Fri 9/17/27
136	Critical T-Line Hardening (6200 line)	0 mons	Thu 8/26/27	Thu 8/26/27
137	**Highway Crossings**	**680 days**	**Fri 12/13/24**	**Fri 7/23/27**
138	2024 In-service	0 days	Fri 12/13/24	Fri 12/13/24
139	2025 In-service	0 days	Fri 12/12/25	Fri 12/12/25
140	2025 In-service	0 days	Fri 9/18/26	Fri 9/18/26
141	2027 In-service	0 days	Fri 7/23/27	Fri 7/23/27
142	**Critical Circuit Hardening**	**740 days**	**Fri 11/15/24**	**Fri 9/17/27**
143	2024 In-service	0 days	Fri 11/15/24	Fri 11/15/24
144	2025 In-service	0 days	Fri 10/17/25	Fri 10/17/25
145	2025 In-service	0 days	Fri 9/18/26	Fri 9/18/26
146	2027 In-service	0 days	Fri 9/17/27	Fri 9/17/27
147	**Wildfire Mitigation**	**620 days**	**Fri 12/13/24**	**Fri 4/30/27**
148	2024 In-service	0 days	Fri 12/13/24	Fri 12/13/24
149	2025 In-service	0 days	Fri 12/12/25	Fri 12/12/25
150	2025 In-service	0 days	Fri 8/21/26	Fri 8/21/26
151	2027 In-service	0 days	Fri 4/30/27	Fri 4/30/27
152	**Hazard Tree Removal**	**600 days**	**Fri 9/20/24**	**Fri 1/8/27**
153	2024 In-service	0 days	Fri 9/20/24	Fri 9/20/24
154	2025 In-service	0 days	Fri 6/27/25	Fri 6/27/25
155	2025 In-service	0 days	Fri 4/3/26	Fri 4/3/26
156	2027 In-service	0 days	Fri 1/8/27	Fri 1/8/27
157	**Lateral Undergrounding**	**600 days**	**Fri 12/13/24**	**Fri 4/2/27**
158	2024 In-service	0 days	Fri 12/13/24	Fri 12/13/24
159	2025 In-service	0 days	Fri 11/14/25	Fri 11/14/25
160	2025 In-service	0 days	Fri 7/24/26	Fri 7/24/26
161	2027 In-service	0 days	Fri 4/2/27	Fri 4/2/27
162	Project Close	6 mons	Fri 9/17/27	Thu 3/2/28



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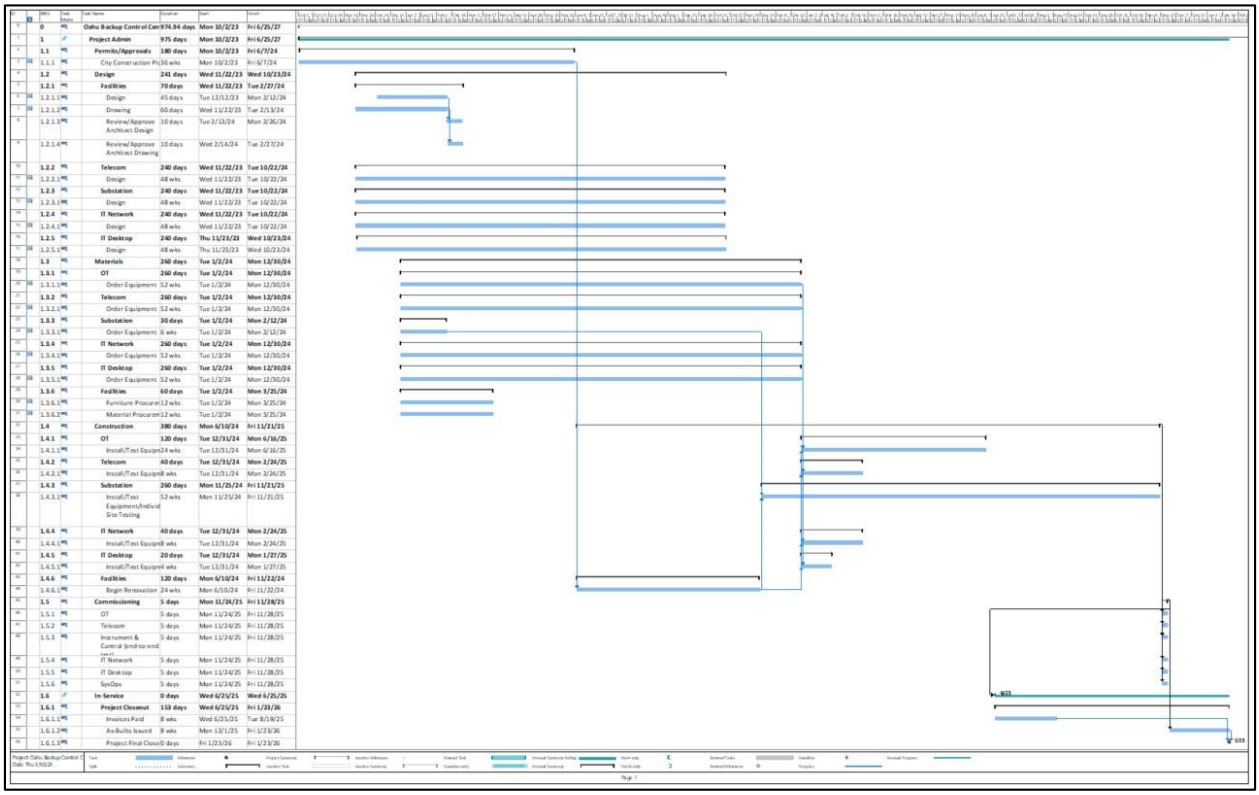
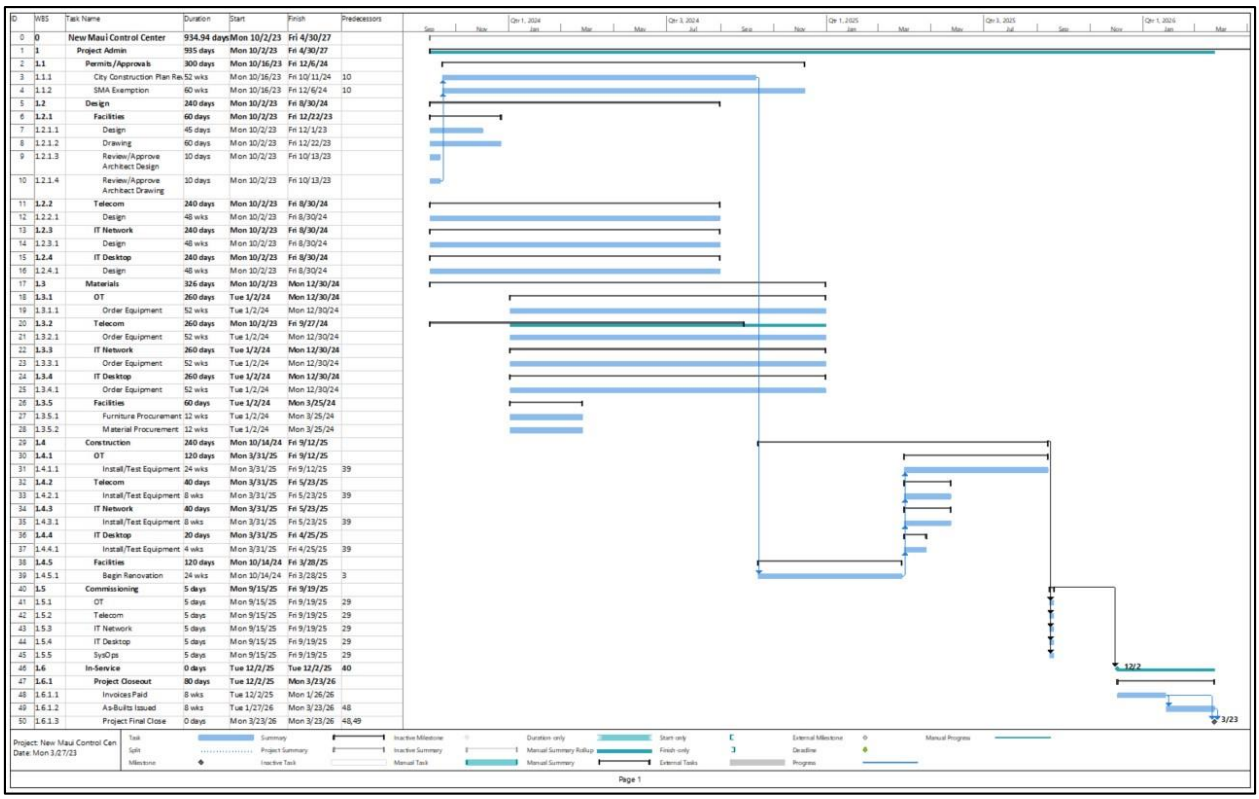
Page 3

O'ahu Backup Control Center:



New Maui Control Center:



ID	WBS	Task Name	Duration	Start	Finish	Predecessors
0	0	New Maui Control Center	934.94 days	Mon 10/2/23	Fri 4/30/27	
1	1	Project Admin	995 days	Mon 10/2/23	Fri 4/30/27	
2	1.1	Permits/Approvals	300 days	Mon 10/16/23	Fri 12/6/24	
3	1.1.1	City Construction Plan Rev	52 wks	Mon 10/16/23	Fri 10/11/24	10
4	1.1.2	SMA Exemption	60 wks	Mon 10/16/23	Fri 12/6/24	10
5	1.2	Design	240 days	Mon 10/2/23	Fri 8/30/24	
6	1.2.1	Facilities	60 days	Mon 10/2/23	Fri 12/22/23	
7	1.2.1.1	Design	45 days	Mon 10/2/23	Fri 12/1/23	
8	1.2.1.2	Drawing	60 days	Mon 10/2/23	Fri 12/22/23	
9	1.2.1.3	Review/Approve Architect Design	10 days	Mon 10/2/23	Fri 10/13/23	
10	1.2.1.4	Review/Approve Architect Drawing	10 days	Mon 10/2/23	Fri 10/13/23	
11	1.2.2	Telecom	240 days	Mon 10/2/23	Fri 8/30/24	
12	1.2.2.1	Design	48 wks	Mon 10/2/23	Fri 8/30/24	
13	1.2.3	IT Network	240 days	Mon 10/2/23	Fri 8/30/24	
14	1.2.3.1	Design	48 wks	Mon 10/2/23	Fri 8/30/24	
15	1.2.4	IT Desktop	240 days	Mon 10/2/23	Fri 8/30/24	
16	1.2.4.1	Design	48 wks	Mon 10/2/23	Fri 8/30/24	
17	1.3	Materials	326 days	Mon 10/2/23	Mon 12/30/24	
18	1.3.1	OT	260 days	Tue 1/2/24	Mon 12/30/24	
19	1.3.1.1	Order Equipment	52 wks	Tue 1/2/24	Mon 12/30/24	
20	1.3.2	Telecom	260 days	Mon 10/2/23	Fri 9/27/24	
21	1.3.2.1	Order Equipment	52 wks	Tue 1/2/24	Mon 12/30/24	
22	1.3.3	IT Network	260 days	Tue 1/2/24	Mon 12/30/24	
23	1.3.3.1	Order Equipment	52 wks	Tue 1/2/24	Mon 12/30/24	
24	1.3.4	IT Desktop	260 days	Tue 1/2/24	Mon 12/30/24	
25	1.3.4.1	Order Equipment	52 wks	Tue 1/2/24	Mon 12/30/24	
26	1.3.5	Facilities	60 days	Tue 1/2/24	Mon 3/25/24	
27	1.3.5.1	Furniture Procurement	12 wks	Tue 1/2/24	Mon 3/25/24	
28	1.3.5.2	Material Procurement	12 wks	Tue 1/2/24	Mon 3/25/24	
29	1.4	Construction	240 days	Mon 10/14/24	Fri 9/12/25	
30	1.4.1	OT	120 days	Mon 3/31/25	Fri 9/12/25	
31	1.4.1.1	Install/Test Equipment	24 wks	Mon 3/31/25	Fri 9/12/25	39
32	1.4.2	Telecom	40 days	Mon 3/31/25	Fri 5/23/25	
33	1.4.2.1	Install/Test Equipment	8 wks	Mon 3/31/25	Fri 5/23/25	39
34	1.4.3	IT Network	40 days	Mon 3/31/25	Fri 5/23/25	
35	1.4.3.1	Install/Test Equipment	8 wks	Mon 3/31/25	Fri 5/23/25	39
36	1.4.4	IT Desktop	20 days	Mon 3/31/25	Fri 4/25/25	
37	1.4.4.1	Install/Test Equipment	4 wks	Mon 3/31/25	Fri 4/25/25	39
38	1.4.5	Facilities	120 days	Mon 10/14/24	Fri 3/28/25	
39	1.4.5.1	Begin Renovation	24 wks	Mon 10/14/24	Fri 3/28/25	3
40	1.5	Commissioning	5 days	Mon 9/15/25	Fri 9/19/25	
41	1.5.1	OT	5 days	Mon 9/15/25	Fri 9/19/25	29
42	1.5.2	Telecom	5 days	Mon 9/15/25	Fri 9/19/25	29
43	1.5.3	IT Network	5 days	Mon 9/15/25	Fri 9/19/25	29
44	1.5.4	IT Desktop	5 days	Mon 9/15/25	Fri 9/19/25	29
45	1.5.5	SysOps	5 days	Mon 9/15/25	Fri 9/19/25	29
46	1.6	In-Service	0 days	Tue 12/2/25	Tue 12/2/25	40
47	1.6.1	Project Closeout	80 days	Tue 12/2/25	Mon 3/23/26	
48	1.6.1.1	Invoices Paid	8 wks	Tue 12/2/25	Mon 1/26/26	
49	1.6.1.2	As-Builts Issued	8 wks	Tue 1/27/26	Mon 3/23/26	48
50	1.6.1.3	Project Final Close	0 days	Mon 3/23/26	Mon 3/23/26	48,49

3.5 Project Milestone Overview

Date	Milestone	Milestone Type	Method of Verification
BP 1 – Q1	• Commence design work for 2024 commissioning • Contracts executed for design work	Task	• Documented meeting minutes
BP 1 – Q2	• Engineering package issued for construction ("IFC") ○ 2024 Transmission-Line Hardening	Task	• Documented engineering plans and single line diagrams
BP 1 – Q2	• Control center architectural design complete	SMART	• Receive drawings from architect
BP 1 – Q3	• Engineering package IFC ○ 2024 Highway Crossings, Customer Circuits, Wildfire Mitigation, Lateral Undergrounding	Task	• Documented meeting minutes
BP 1 – Q4	• Procurement complete ○ 2024 Transmission-Line Hardening, Highway Crossings, Customer Circuits Wildfire Mitigation, Lateral Undergrounding • Construction complete ○ 2024 Hazard Tree Removal (1,600 trees)	Task; SMART	• Purchase orders and confirmation of delivery • Completed construction orders
BP 2 – Q1	• Engineering package IFC ○ 2025 Transmission-Line Hardening • Construction complete ○ 2024 Transmission -Line Hardening: (10 structures), Highway Crossings (16 poles), Customer Circuits (60 poles), Wildfire Mitigation (reconductoring, smart fuses, weather cameras/stations), Lateral Undergrounding (0.5 miles)	Task; SMART	• Documented engineering plans and single line diagrams • Completed construction orders
BP 2 – Q1	• Procurement initiated for control center initiatives	SMART	• Purchase orders and confirmation of delivery
BP 2 – Q2	• Engineering package IFC ○ Transmission-Line Hardening (6200 line), 2025 Highway Crossings, Customer Circuits, Wildfire Mitigation, Lateral Undergrounding	Task; SMART	• Documented engineering plans and single line diagrams
BP 2 – Q3	• Procurement complete ○ 2025 Transmission-Line Hardening, Customer Circuits	Task	• Purchase orders and confirmation of delivery • Completed construction orders
BP 2 – Q3	• Control center initiatives construction initiated	Task	• Documented construction orders
BP 2 – Q4	• Engineering package IFC ○ 2026 Transmission-Line Hardening • Procurement complete ○ 2025 Highway Crossings, Wildfire Mitigation, Lateral Undergrounding • Construction complete ○ 2025 Hazard Tree Removal (6,400 trees)	Task	• Documented engineering plans and single line diagrams • Purchase orders and confirmation of delivery
BP 3 – Q1	• Construction complete ○ 2025 Transmission-Line Hardening (35 structures), Highway Crossings (22 poles),	SMART	• Completed construction orders

	Customer Circuits (120 poles), Wildfire Mitigation (structures, smart fuses, weather cameras and station), Lateral Undergrounding (0.5 miles)		
BP 3 – Q2	○ Engineering package IFC ○ 2026 Highway Crossings, Customer Circuits, Wildfire Mitigation, Lateral Undergrounding	Task	• Documented engineering plans and single line diagrams
BP 3 – Q2	• Control center equipment installed • Control center equipment testing completed	SMART	• Confirmation of equipment installation, testing documentation and confirmation of operations
BP 3 – Q3	• Engineering package IFC ○ 2027 Highway Crossings, Transmission-Line Hardening, Wildfire Mitigation, Lateral Undergrounding • Procurement complete ○ Transmission-Line Hardening (6200 line); 2026 Transmission-Line Hardening, Highway Crossings, Customer Circuits, Wildfire Mitigation, Lateral Undergrounding	SMART	• Documented engineering plans and single line diagrams • Purchase orders and confirmation of delivery • Completed construction orders
BP 3 – Q3	• O'ahu backup control center initiative close out • Maui control center initiative close out	SMART	• As-builts received, invoices paid, project closed
BP 3 – Q4	• Engineering package IFC ○ 2027 Customer Circuits, • Construction Complete ○ 2026 Highway Crossings (28 poles), Customer Circuits (200 poles), Wildfire Mitigation (structures, treewire, cameras), Lateral Undergrounding (0.5 miles), Hazard Tree Removal (6,400 trees)	Task; SMART	• Documented engineering plans and single line diagrams • Completed construction orders
BP 4 – Q1	• Procurement complete ○ 2027 Transmission-Line Hardening, Highway Crossings, Wildfire Mitigation, Lateral Undergrounding • Construction complete ○ 2026 Transmission-Line Hardening (56 structures)	Task	• Purchase orders and confirmation of delivery • Completed construction orders
BP 4 – Q2	• Procurement complete ○ 2027 Customer Circuits	Task	• Purchase orders and confirmation of delivery • Completed construction orders
BP 4 – Q3	• Construction complete ○ 2027 Wildfire Mitigation (could include reconductoring, weather cameras/stations, smart fuses), Lateral Undergrounding (0.5 miles)	SMART	• Completed construction orders
BP 4 – Q4	• Construction complete ○ 2027 Transmission-Line Hardening (66 structures, 1.5 miles of new line), Highway	SMART	• Completed construction orders

	Crossings (34 poles), Hazard Tree Removal (6,400 trees)		
BP5-Q1	• Construction complete ○ 6200 line (30 structures, 3 miles reconductoring, 7 miles of new line), 2027 Customer Circuits (414 poles)	SMART	• Completed construction orders

3.6 Go / No – Go Decision Points

Go/No-Go Decision	Date	Method of Evaluation
All milestones have been achieved in BP 1 and provide the identified technical benefits. If any milestones have not been achieved, or have been altered, an explanation and risk mitigation plan will be provided.	EOY BP1	Each milestone will be verified using the identified method identified in the milestone table.
All milestones have been achieved in BP 2 and provide the identified technical benefits. If any milestones have not been achieved, or have been altered, an explanation and risk mitigation plan will be provided.	EOY BP2	Each milestone will be verified using the identified method identified in the milestone table.
All milestones have been achieved in BP 3 and provide the identified technical benefits. If any milestones have not been achieved, or have been altered, an explanation and risk mitigation plan will be provided.	EOY BP3	Each milestone will be verified using the identified method identified in the milestone table.
All milestones have been achieved in BP 4 and provide the identified technical benefits. If any milestones have not been achieved, or have been altered, an explanation and risk mitigation plan will be provided.	EOY BP4	Each milestone will be verified using the identified method identified in the milestone table.
All milestones have been achieved in BP 5 and provide the identified technical benefits. If any milestones have not been achieved, or have been altered, an explanation and risk mitigation plan will be provided.	EOY BP5	Each milestone will be verified using the identified method identified in the milestone table.

3.7 End of Project Goal

The key components of the project's end goal are:

- Decreased likelihood of outages to critical customer facilities and community lifelines
- Decreased restoration times, resulting in fewer customers being out of power for extended periods of time, allowing for a faster economic and quality of life recovery
- Decreased risk of wildfire events caused by power lines and faster response times and mitigations if an event were to occur
- Increased grid operations resilience during both severe events and blue-sky conditions

Since the true value of resilience investments can only be estimated following severe events, HE plans to measure success towards the project goal per the geographic reach of the project and expert-based analysis of the decreased likelihood and effects of severe events causing outages and potential wildfires.

3.8 Project Management Plan

HE will oversee and manage all the work that will be executed in the project. While the key personnel identified in the cover page will be responsible for overseeing the planning and

execution of the project, HE will also establish a Grant Management Office to manage compliance reporting. Project managers will be assigned for all the initiatives from the HE's existing project management offices. These project managers will manage the day-to-day execution of each initiative throughout the performance period. These project managers will execute the project per established internal project management standards and procedures. The key personnel overseeing the project will continually stay aligned to ensure that overall benefits are being realized and that they are being reported on a continuous basis.

Contractors are planned to be utilized partially for engineering design, and construction. This will be done through a formal request for proposal (RFP) process. All work done internal to the HE will follow employee/union labor laws. A user agreement with Local 1260 ensures all contractors for high-voltage work are signatories with the union, thus ensuring these contractors are union members. HE conforms to Project Management Institute (PMI) standards, including establishing a formal Stakeholders Register, Communications Plan, Risk Register, Earned Value Management tracking, Requirements Traceability Matrix, Project Change Request process, regular project status reporting and other project management tools to ensure success of the projects. To manage risk throughout the project, there will be a centralized project risk register to monitor risk, track developments, and mitigation strategies. Several key risks and mitigation strategies have been identified in the following section of the technical volume.

Project changes will go through an internal change management plan which will include assessing benefits, risks, and issues of the change. Additional internal approvals will then need to be obtained for the project changes to be implemented.

Quality Assurance will be controlled via utilizing check sheets and expert judgement. Project deliverables will be measured against the Cost of Quality, where we will use prior reviews and engineer experience, experts, lessons learned, and quality metric templates to assess inspectional compliance.

3.9 Risk Identification & Mitigation Strategies

As part of its risk evaluation process, HE has identified several potential risks that may cause delays in the project and has identified respective mitigation plans.

Risk	Mitigation Strategy
Supply Chain Delays	There are several types of hardware that need to be purchased, namely the field devices. Since this is specialized equipment, there is a risk of supply chain delays throughout the performance period. To mitigate this risk, HE will work closely with vendors to identify any potential delays and order equipment prior to the deployment year, wherever possible. In case of significant delays, HE will seek alternate vendors.
Inflation / Increased Field Devices Cost	Currently, HE plans to purchase equipment on an annual basis. In case of any unexpected increases in costs, HE will look towards alternate vendors. If that is not possible, the workplan will be adjusted to reflect potential reductions in scope.

Technical Qualifications and Resources

4.1 Team Qualifications & Project Commitment

The key personnel who will be overseeing the project all have experience deploying similar projects at HE, experience with other DOE-funded grant projects, and have the expertise to manage the projects going forward. The deployment of the project will be a top priority for all of the key personnel and project managers and they will be heavily involved in the planning

and execution of the project throughout the performance period. The grant management office to manage IIJA compliance and reporting will be working near full-time on the project. The success of the project is critical for the stability of HE's grid and the company will dedicate resources accordingly to ensure the project is successfully completed and that the project objectives are met.

4.2 Existing Equipment and Facilities

HE already possesses the necessary equipment (e.g., bucket trucks) to safely execute the construction work on T&D infrastructure (e.g., pole replacements, field device installation). Vegetation management contractor equipment will be used to conduct the hazard tree removal. For the control center initiative, the existing power plant will be the site of the backup control center and the initiative will include a modification of the facilities.

4.3 Prior Experience with Similar Projects

Since 2016, HE has collaborated on projects that have leveraged about $11 million in federal funding and $3 million in industry cost share. In addition, HE has accepted to participate in 26 of 55 grant proposals from external entities, 6 of which have been awarded federal awards. A few recent examples of external collaboration include:

- A joint project with EPRI on a USDOE project ($1.8 million in federal grant funds) entitled 'Integrated Operations Using Enhanced Probabilistic Solar Forecasting,' which would apply probabilistic solar and wind forecasting data to develop new automation and tools to optimize operating reserve requirements.
- Partnering with Siemens Corporation (Corporate Technology) on a USDOE ARPA-e OPEN grant to enhance power system models for Hawai'i Electric Light.

While current efforts continue to build on projects initiated under prior grant funds received by HE, new initiatives are being proactively pursued and undertaken based on anticipation of need or through development of new partnerships and grant opportunities.

Other projects with federal partners:

- East O'ahu Switching Project (DOE grant)
- Schofield Generating Station (Army)
- Army Privatization (Army)

The experience and successes in working with federal, state, and local agencies will enable HE to work with the DOE to properly leverage grant funding. Internally, HE has significant experience working on projects of this scale that will help it achieve its project objectives as described in the "Technical Feasibility" section of the Technical Volume.